

# SCIENCE

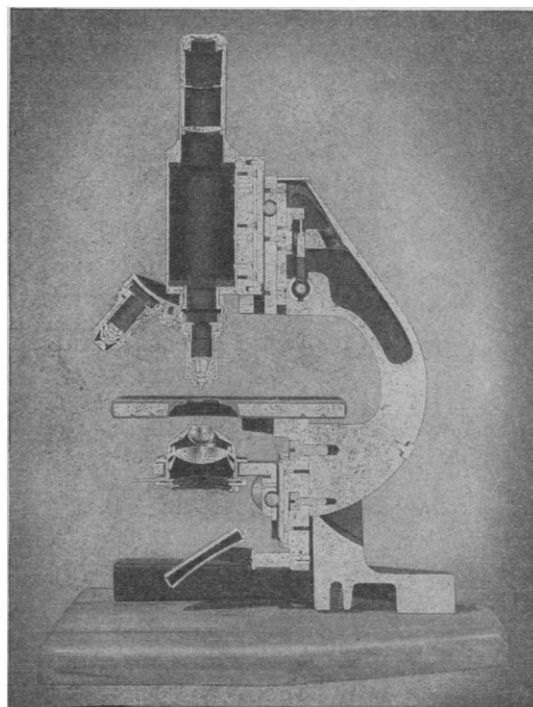
NEW SERIES  
VOL. 93, No. 2408

FRIDAY, FEBRUARY 21, 1941

SUBSCRIPTION, \$6.00  
SINGLE COPIES, .15

*Performance*

**AND DURABILITY**



**BASED ON PRECISION . . . .**

Precision, more than any other one factor, determines the quality and performance of an optical system. Likewise, precision determines the durability and continuous smooth functioning of the mechanical parts of any optical instrument. Because Bausch & Lomb Instruments are characterized by precision, optically and mechanically, they are used by leading scientists, research workers and technical experts in scientific and industrial laboratories throughout the world.

Bausch & Lomb high precision standards are backed by 88 years of optical experience, skilled workers who have made optics their life work, a competent technical staff, a glass plant which is the only one of its kind in America and rigid manufacturing and inspection control.

Make certain that your next optical instrument bears the B&L trademark—the symbol of Performance and Durability. Bausch & Lomb Optical Co., 642 St. Paul Street, Rochester, N. Y.

**B A U S C H   &   L O M B  
O P T I C A L   C O M P A N Y**

EST.  1853

**FOR YOUR EYES, INSIST ON BAUSCH & LOMB EYEWEAR, MADE FROM BAUSCH  
& LOMB GLASS TO BAUSCH & LOMB HIGH STANDARDS OF PRECISION**

*Science: published weekly by The Science Press, Lancaster, Pa.*

*Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.*



# ANNOUNCEMENT

## GOLD SEAL MICRO COVER GLASSES MADE IN U.S.A. of AMERICAN GLASS

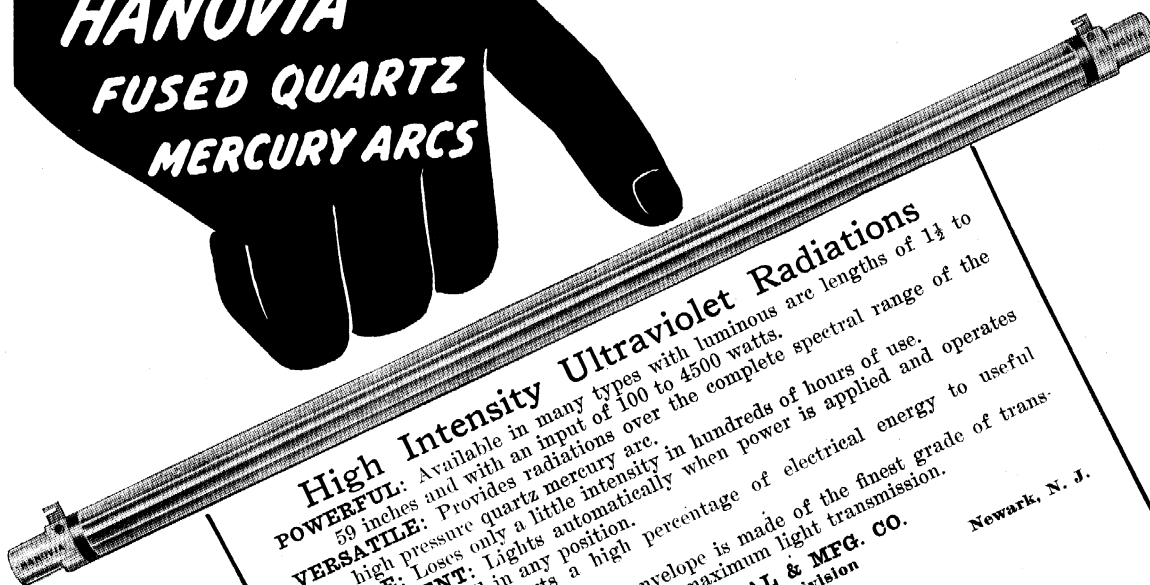
GOLD SEAL MICRO COVER GLASSES, made as previously in our New York City workrooms, are now available made of American glass. Careful laboratory tests have shown the glass to be equal in quality to the glass formerly imported.

Write for current price list and delivery schedule, stating your requirements.

**CLAY-ADAMS** CO., 44 East 23rd St.  
Inc. New York, N. Y.



**HANOVIA**  
**FUSED QUARTZ**  
**MERCURY ARCS**

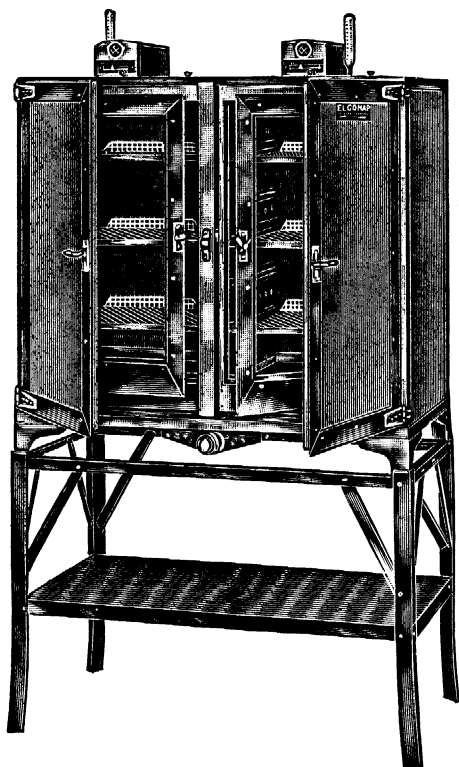


### High Intensity Ultraviolet Radiations

**POWERFUL:** Available in many types with luminous are lengths of 1½ to 59 inches and with an input of 100 to 4500 watts.  
**VERSATILE:** Provides radiations over the complete spectral range of the high pressure quartz mercury arc.  
**STABLE:** Loses only a little intensity in hundreds of hours of use.  
**CONVENIENT:** Lights automatically when power is applied and operates equally well in any position.  
**EFFICIENT:** Converts a high percentage of electrical energy to useful ultraviolet radiations.  
**ECONOMICAL:** The burner envelope is made of the finest grade of transparent fused quartz insuring maximum light transmission.

**HANOVIA CHEMICAL & MFG. CO.**  
Research Apparatus Division

Newark, N. J.



## Elconap Research Type INCUBATORS

Ruggedly constructed of asbestos transite with glass wool insulation between double walls, and stainless steel trim.

Temperatures between 20° and 70° C. can be set in advance by turning a regulator knob until the indicator points to the desired setting where it will be maintained automatically. The thermostat is of the indirect Make-and-Break type and has an operating sensitivity of 0.25° C. All contacts are outside the chamber and designed to eliminate arcing.

A patented ventilation system insures unobstructed temperature distribution throughout the chamber. Below the flood of the working space is a specially constructed water reservoir with a funnel and draincock for filling from the outside. This feature insures adequate humidity conditions.

Research Type "Elconap" Incubators offer durability of construction combined with simplicity and economy for continuous unattended operation. They are guaranteed for FIVE YEARS against defects.

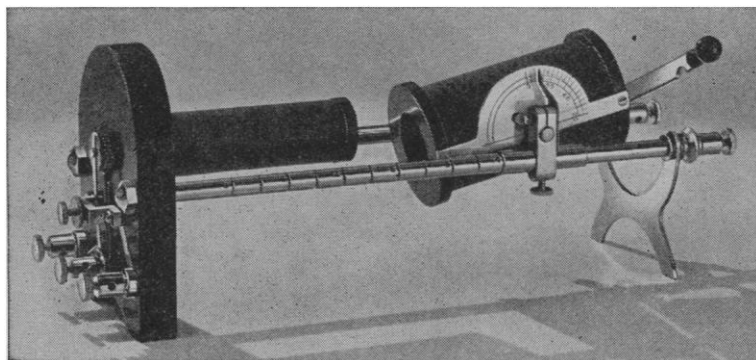
*Pages 498 to 510 of our Catalog 5 show all standard types and sizes of Incubators*

# WILL CORPORATION, ROCHESTER, NEW YORK

*Offices and Warehouses*

BUFFALO APPARATUS CORP., Buffalo, N. Y. • WILL CORPORATION, 596 Broadway, New York City

LABORATORY APPARATUS AND CHEMICALS

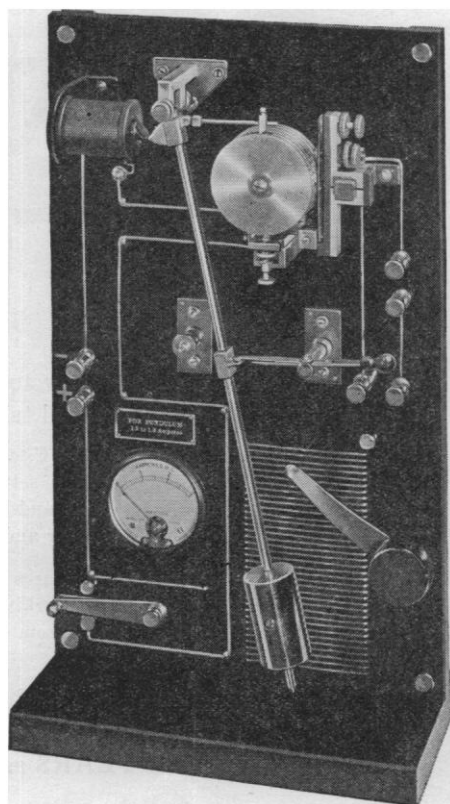


## INDUCTORIUM AND ELECTRICAL CLOCK

Two devices for the Physiological Laboratory that maintain their usefulness among the teeming demands of changing times.

These instruments, through their qualities of strength, simplicity and careful workmanship, have stood the test of long use in many lands.

Our revised Catalogue describes many other pieces of value in teaching and investigation.



*The* HARVARD APPARATUS COMPANY, *Incorporated*

Dover, Massachusetts

(Organized on a non-profit basis for the advancement of teaching and investigation in physiology and the allied sciences)

# SCIENCE

VOL. 93

FRIDAY, FEBRUARY 21, 1941

No. 2408

<i>Ions in Gases</i> : PROFESSOR JOHN ZELENY .....	167
<i>Botanical Research by Unfashionable Technics</i> : PROFESSOR NEIL E. STEVENS .....	172

## Scientific Events:

*The Research Section of the Rochester Academy of Science; Conference of Radio Engineers at the Ohio State University; Symposia at the St. Louis Meeting of the American Chemical Society; Symposium at Union College; Nominations of Officers of the American Institute of Electrical Engineers; Appointment of Dr. James Bryant Conant as Head of a Scientific Mission; Recent Deaths* ..... 176

<i>Scientific Notes and News</i> .....	179
--	-----

## Discussion:

*An Important Factor in Evolution*: DR. MELVILLE H. HATCH. *Linnæus on the Natural History of Man*: FRANCIS H. ALLEN. *The Soybean in China*: PROFESSOR L. CARRINGTON GOODRICH. *Our Science Meetings Again*: DR. WILLIAM SEIFRIZ. *The Presentation of Scientific Papers*: PROFESSOR J. VAN OVERBEEK ..... 182

## Scientific Books:

*The Design of High Pressure Plant*: PROFESSOR P. W. BRIDGMAN. *Abstract Algebra*: PROFESSOR GARRETT BIRKHOFF ..... 185

## Special Articles:

*On Lubimenko Extracts of Chlorophyll-Protein*: DR. M. L. ANSON. *The H-ion Concentration and the Origin of the Heart Beat*: DR. C. R. SPEALMAN. *Susceptibility to Disease in Relation to Plant Nutrition*: DR. WALTER THOMAS and DR. WARREN B. MACK ..... 186

## Scientific Apparatus and Laboratory Methods:

*Histological Sectioning of Hard Tissues by a New Technique*: ALEXANDER RANDALL, IV and PROFESSOR ALAN W. C. MENZIES. *The Staining of Acid-fast Tubercle Bacteria*: DR. OSCAR W. RICHARDS ..... 189

<i>Science News</i> .....	6
---------------------------	---

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKEEN CATTELL and published every Friday by

## THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal

Annual Subscription, \$6.00

Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

## IONS IN GASES<sup>1</sup>

By Professor JOHN ZELENY

YALE UNIVERSITY

The problem of size and that of mass, which is usually connected with it, has been one of great perplexity. This problem presented itself at the very outset of the study of these ions, and has remained with us ever since.

Forty-four years have passed since Thomson and Rutherford<sup>2</sup> adopted the ionization theory to explain the conductivity imparted to gases by x-rays. At the time, the electron had not been isolated, and the process of ionization of a diatomic molecule was regarded as consisting in the pulling apart of its two atoms.

However, when Thomson and Rutherford obtained a rough estimate of the speeds with which the ions migrate in an electric field, they found that the mobility was much smaller than an ion of atomic size should have according to the kinetic theory of gases.

<sup>2</sup> J. J. Thomson and E. Rutherford, *Phil. Mag.*, 42: 392, 1896.

WHAT I propose to do in this paper is to outline briefly some of the difficulties which have been met in our attempts to get a better understanding of gaseous ions, and to indicate the present state of our knowledge about these ions. And then lastly, I shall go somewhat afield to say something about the theories that have been proposed to account for lightning.

To begin, then, what is there that we should like to know about ions in gases? We should like to know their mass, size, composition and structure. We should like to know the amount of charge that each carries. And we should like to know how they differ and what part each plays in the various electrical discharges. For obvious reasons, I shall not attempt to discuss all these various aspects of the subject.

<sup>1</sup> Address of the retiring president of the American Physical Society given in Philadelphia, December 27, 1940.

---

---

## Outstanding Books in Physics

---

---

### Electromagnetic Theory

By J. A. STRATTON, Massachusetts Institute of Technology. *International Series in Physics*. 615 pages, 6 x 9. \$6.00

Postulating Maxwell's equations from the outset, the author of this new book emphasizes dynamic rather than static field theory. A mathematical formation of the general theory is followed by a comprehensive investigation of energy and stress relations. The properties of static fields are then discussed and the rest of the book is devoted to the propagation of plane, cylindrical, and spherical waves, the theory of radiation, and boundary value problems.

### The Modern Theory of Solids

By FREDERICK SEITZ, University of Pennsylvania. *International Series in Physics*. 698 pages, 6 x 9. \$7.00

In this important book the author presents a survey of the theory of the properties of all types of crystalline solids. While the book deals largely with recent developments in the field, it includes a coordinated treatment of those parts of the older theoretical work which are still valid. The book is unique in that it covers the theory of all types of solids from a common viewpoint. Besides dealing with the theory of metals, the author treats the properties of salts and other insulators as well, showing the factors which account for differences and similarities in all these materials.

### Physics of the Air. *New third edition*

By W. J. HUMPHREYS, United States Weather Bureau (Retired). 676 pages, 6 x 9. \$6.00

The revision of this well-known standard treatise on atmospheric phenomena retains the orderly arrangement of material and the clear, explicit explanations of facts and theories which were outstanding features of earlier editions. Humidity is discussed more fully than before; the discussion of vertical distribution of temperature is amplified and revised in accordance with the latest observations; the treatment of evaporation is expanded; and many other changes have been made to cover recent advances.

### Weather Analysis and Forecasting

By SVERRE PETTERSEN, Massachusetts Institute of Technology. 505 pages, 6 x 9. \$5.00

Unique in scope, this distinctive book presents a complete, authoritative treatment of modern methods of weather analysis and forecasting. The author discusses in detail the underlying theories and their application to weather charts and upper air charts and offers numerous examples of correct analysis and forecasts. Recent results in the fields of air-mass analysis, frontal analysis, and isentropic analysis are included.

### Applied X-rays. *New third edition*

By GEORGE L. CLARK, University of Illinois. *International Series in Physics*. 674 pages, 6 x 9. \$6.00

Presenting X-ray as a practical research tool, especially in industry, this book covers the entire science of X-rays, integrating physics, chemistry, crystallography, genetics, biology, medicine, and industries of every kind. The present edition contains chapters on interpretation of X-rays diffraction patterns; measurement of intensity, measurement of quality; photochemistry, biological effects of X-rays; etc.

### Introduction to Electricity and Optics

By NATHANIEL H. FRANK, Massachusetts Institute of Technology. 398 pages, 6 x 9. \$3.50

This textbook, together with the second edition of the author's *Introduction to Mechanics and Heat*, constitutes a two-volume series in physics for the introductory technical course. *Introduction to Electricity and Optics* gives a logical exposition of the fundamental principles, emphasizing field theory and the elementary application of these principles to circuits and to the electrical, magnetic, and optical properties of matter. The treatment is quantitative throughout and modern atomic ideas are stressed along with the more classical modes of presentation.

*Send for copies on approval*

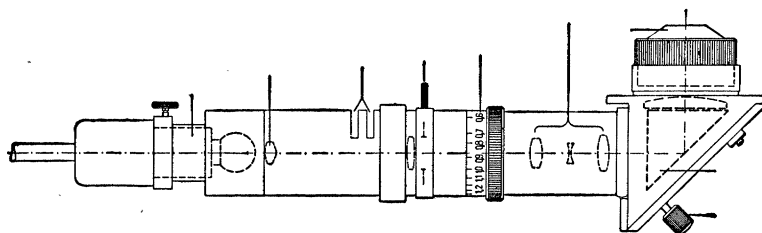
---

## McGRAW-HILL BOOK COMPANY, INC.

330 West 42nd Street, New York, N. Y.

Aldwych House, London, W.C.2

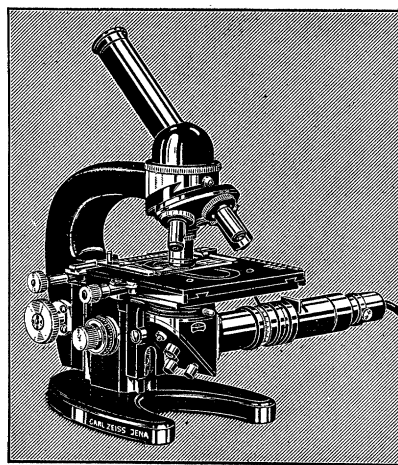
## *A New Illumination Device for MICROSCOPES*



# ZEISS

## PANCRATIC CONDENSER

The Zeiss Pancratic Condenser is a complete illumination system embodying the Kohler principle of illumination. Source of light and condenser are contained in a single tube attachable to any make of microscope forming an ideal compact unit for microscopic work in transmitted light at different magnifications. With the Pancratic Condenser it is possible for the first time to synchronize instantaneously the numerical aperture of the condenser with the numerical aperture of the respective objective within a range from N.A. 0.16 to N.A. 1.40. In practice this provides a smooth transition from illumination as needed for low power work to the correct illumination for medium and high powers. The Pancratic Condenser may further be used for Dark Field illumination with objectives of numerical apertures up to 1.0. Color as well as polarising filters are also available.



*Modern Stand LgOG and Pancratic  
Condenser—an ideal combination*

*Literature and Prices on Application*

CARL ZEISS, INC.

485 Fifth Avenue  
NEW YORK

728 So Hill Street  
LOS ANGELES



## LaMotte Universal pH Outfit



Compact and readily portable. Covers a wide pH range. Can be supplied with any 3, 4, 5, 6, 7 or 8 sets of LaMotte Permanent Color Standards and will therefore cover any desired part of pH range, 0.2-13.6. Applicable to all types of research and industrial pH work. Accurate to 0.1 pH. Excellent for use with highly colored or turbid solutions. Price, \$35.00 to \$60.00 f.o.b. Baltimore.

**LaMotte Chemical Products Co.**  
Dept. "H"                      Towson, Baltimore, Md.

## NEW



**VERTICAL ATTENUATOR.** A radically improved construction. Has tremendous advantages over rotary type. Front cleaning. Knob indicates level directly. Write for Bulletin No. 372.

Also complete line of attenuators, tap switches, decade resistances, stop watches, etc. Catalog on request.

**TECH LABORATORIES**  
7 LINCOLN STREET                      JERSEY CITY, N. J.

## Wertheim Textbook of Organic Chemistry

This successful text presents material for a two-semester beginning course in organic chemistry. It is intended for students who will major in chemistry or specialize in organic chemistry, and for those who are enrolled in pre-medical or chemical engineering courses.

Salient facts are stated in a definite manner . . . important relationships between compounds and reactions are emphasized by cross references . . . charts and summaries aid in the initial study and facilitate review . . . detailed flow sheets illustrate industrial processes . . . portraits with biographical sketches are included.

By E. WERTHEIM, PH.D., Univ. of Arkansas  
110 Illus. 830 Pages \$4.00

By Same Author  
**Laboratory Guide for  
Organic Chemistry—2nd Edition**

Widely adopted, this book presents experimental material for a year's course in elementary organic chemistry.

Detailed instructions are given for all work . . . experiments can be performed with the simplest apparatus . . . removable report sheets are provided . . . lists of reagents and amounts required are given . . . a time table for each experiment is included.

24 Illus. 560 Pages \$2.00

**THE BLAKISTON COMPANY, Philadelphia**

## MANUAL OF THE SOUTHEASTERN FLORA

ILLUSTRATED

Being Descriptions of the Seed-Plants growing naturally in North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee and Eastern Louisiana

By

JOHN KUNKEL SMALL

**THIS** Manual replaces the author's Flora of the Southeastern United States, published in 1903 (second edition 1913), for the Southern States east of the Mississippi River. It embodies the results of continued exploration and study, thus bringing up to date our knowledge of this floral region.

The Manual is the only complete illustrated work on the flora of the Southeast by a recognized authority.

In addition to analytical keys to the various plant groups, and descriptions of the orders, families, genera and species, regional or altitudinal and geographic distribution, there are xxii + 1554 pages and over 1500 illustrations, one illustration of a species of each genus.

Price \$10.50 Postpaid

**THE SCIENCE PRESS PRINTING COMPANY**  
LANCASTER, PENNSYLVANIA