

by placing the chamber in a magnetic field, which would aid greatly in the interpretation of each track. E.W.C.

A Large Cloud Chamber Using Rear Illumination. By E. W. Cowan. *Rev. Sci. Inst.* 20: 492, July, 1949.

Hearing Thunder

Thunder is seldom heard at distances greater than about twenty-five kilometers from the point of origin. Lightning without thunder is often referred to as "heat" or "sheet" lightning, although the physical characteristics of heat lightning and lightning accompanied by thunder seem to be identical. The relatively short range of audibility may be explained by the refraction of sound rays to be expected within and near mature thunderstorms. Calculations, based on theory due to Rayleigh, show that the normal vertical temperature gradient in the neighborhood of thunderstorms results in bending the sound rays away from the earth so that thunder which originates at an elevation of four kilometers is audible at the ground only within a radius of twenty-five kilometers. Recent observations of wind velocity within and near Florida thunderstorms indicate that the vertical wind shear is directed toward a thunderstorm in its lower portion and calculations show this results in reducing further the range of audibility on all sides of the thunderstorm.

R.G.F.

The Audibility of Thunder. By Robert G. Fleagle. *J. Acous. Soc. Am.* 21: 411, July, 1949.

Visual Color Standard

Catesby and Edwards in the early 18th century, and others since then, have made serious attempts to describe and record colors, feeling that color holds important information for the biologist. The means they employed was not properly standardized and gradually came to be questioned. Ridgway considered the problem and in 1912 introduced his standards and nomenclature which were widely adopted and used for published descriptions by biologists in many parts of the world, particularly by those of the United States, Canada, and Great Britain. Unfortunately, these widely used standards must now be replaced, for it has been discovered that they can not be republished precisely as originally issued.

The failure of the Ridgway Color Standards to be permanent standards gave rise to two questions: could a key be devised which would enable individuals to translate Ridgway color names into some system of permanent reference? and, why had biologists preferred the Ridgway Standards rather than other color systems?

The first question has been answered by the publication of key to a single copy of the Ridgway Standards since it can not be assumed that all copies of these standards are completely alike. This means that whenever the key is used it must be kept in mind that the Ridgway Standards used may have differed or been illuminated in different ways; hence it will not be possible to obtain an exact description of the original color.

The second question is partly answered by answers given to a Canadian questionnaire on the subject and

by the commonly expressed preferences of biologists which indicate that they have found the Ridgway Standards and Nomenclature more useful than others. This is apparently due to two factors: the standards contained a very high proportion of colors wanted by biologists and also the colors were named in a way now widely adopted by other systems.

This paper, together with two papers published in *Science* on June 17 ("Robert Ridgway's Color Standards," by D. H. Hamly, and "Color Standards for Biologists," by W. E. K. Middleton), indicate that there is great need for a special series of permanent color standards so described that they can be reproduced at any time and be referred to by one of several different methods.

D.H.H.

The Ridgway Color Standards with a Munsell Notation Key. By D. H. Hamly. *J. Opt. Soc. Am.* 39: 594, July, 1949.

Molecular Symmetry Coordinates

In 1923 C. J. Brester showed, by elementary but cumbersome mathematical methods, that the normal vibrations of molecules or crystals can be classified in terms of their symmetry. Seven years later E. Wigner successfully applied group theory to the same problem. More recently E. Bright Wilson and others have developed techniques for calculating molecular vibration frequencies which still depend heavily upon the finding of suitable symmetry coordinates. No general method has been known for obtaining such coordinates, and except for the simplest molecules the process has usually involved considerable trial and error. The present paper describes a direct algebraic method for finding symmetry coordinates which is closely related to a procedure sometimes used in quantum mechanics for obtaining wave functions. The method is applied to a simple example both with Cartesian and internal initial coordinates.

J.R.N.

A General Method of Obtaining Molecular Symmetry Coordinates. By J. Rud Nielsen and L. H. Berryman. *J. Chem. Phys.* 17: 659, July, 1949.

Pulse Height Analyzer

In nuclear experiments where conditions may change rapidly it is desirable to obtain simultaneously a number of points on the pulse height distribution curve, which is a plot of the number of particles given off in the experiment versus their energy. Previous experimenters have developed multi-channel pulse amplitude discriminators to record several points on the distribution curve using ordinary vacuum tubes. Experience has shown that these analyzers must be recalibrated frequently, perhaps as often as twice a day. The use of a large number of tubes increases the probability that a tube failure will throw the whole system out of operation.

To overcome these limitations, a new method of multi-channel discrimination has long been sought. A beam deflection tube used for switching and multiplexing by the Federal Telecommunication Laboratories was suggested

Continued on page 37

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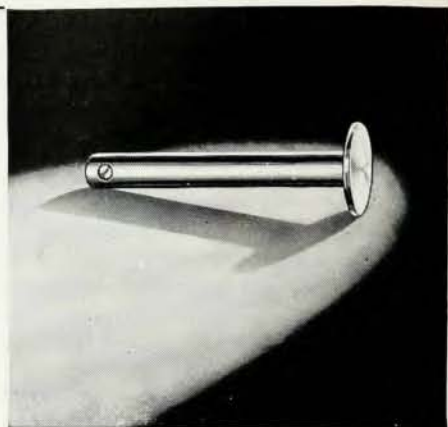
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in this connection and a ten-channel tube is now available around which an analyzer has been designed and built. The input pulse from a counter after amplification and shaping is applied to the vertical deflection plates of the cathode ray tube. In place of a fluorescent screen, ten "dynodes" are mounted one above the other. The beam is deflected upward a distance proportional to the amplitude of the input pulse and falls on one of the dynodes causing a voltage pulse which is amplified and recorded by a mechanical register. The analyzer provides one, five, and ten volt channels covering the range from zero to one hundred volts. Counting rates of up to two hundred and fifty counts per second are permissible with less than one percent loss. The analyzer has required no recalibration since it was first put into operation several months ago. The use of several analyzers in parallel can provide up to one hundred channels at one volt intervals. Each analyzer occupies a short relay rack and includes a pulse amplifier and a pulse generator for calibration.

It is felt that this analyzer fills two definite needs in the field of nuclear research: its high degree of stability avoids the need for frequent recalibration, and a large number of output channels may be obtained by arranging several of the analyzers in parallel.

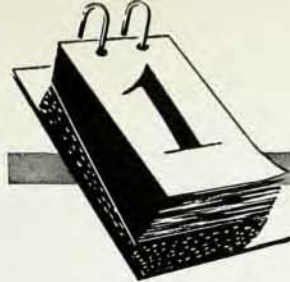
D.A.W.

The Ten Channel Electrostatic Pulse Analyzer. By Dean A. Watkins. *Rev. Sci. Inst.* 20: 495, July, 1949.

Frequency Band Designations

A subcommittee of the American Institute of Electrical Engineers has prepared a chart covering a frequency range from eleven and a half years, corresponding to the sun spot cycle, to less than one micromicron (in electromagnetic wave lengths), corresponding to the frequency of secondary cosmic rays. The primary object of the chart is to promote the use of integers to indicate frequency bands over the whole useful range of frequencies which occur in nature, thus giving a single coordinate system. The method proposed for designating band numbers is to use the exponent of ten corresponding to the lowest frequency (in cycles per second) of a given band. Thus the frequencies of particular interest to bridge designers and to designers of large rotating machines, for example, are given the band designation "minus one" corresponding to frequencies of from one-tenth to one cycle per second, while the frequencies of visible light within the range 10^{14} to 10^{15} cycles per second are contained in the band designated "fourteen." The chart has been scheduled for publication in the August issue of the magazine *Electrical Engineering*.

The AIEE Joint Subcommittee on Standard Frequency Bands and Designations, as the group is known, is headed by Thomas Spooner of the Westinghouse Electric Corporation and includes C. T. Burke, J. E. McCormack, G. B. Ransom, and F. B. Silsbee. The band designations chart supplements a previous brief report and abbreviated table which appeared in the May, 1947 issue of *Electrical Engineering*.



CALENDAR

of EVENTS

- | | |
|------------------------|---|
| August 22-27 | New England Association of Chemistry Teachers, Durham, New Hampshire |
| August 23-26 | American Institute of Electrical Engineers (Pacific General Meeting), San Francisco, California |
| August 29-30 | Mathematical Association of America (31st Summer Meeting), Boulder, Colorado |
| August 30-September 2 | American Mathematical Society, Boulder, Colorado |
| September 2, 3, 5 | International Colloquium on Macromolecules (sponsored by the Union Internationale de Chimie), Amsterdam, Holland |
| September 5-10 | Second Canadian Mathematical Congress, Vancouver, Canada |
| September 6-8 | American Institute of Chemical Engineers, Montreal, Canada |
| September 7-10 | Biological Photographic Association, Inc. (19th Annual Meeting), Cleveland, Ohio |
| September 9-12 | Instrument Society of America Clinic on Maintenance of Industrial Instruments, St. Louis, Mo. |
| September 12-16 | Instrument Society of America, St. Louis, Missouri |
| September 18-23 | American Chemical Society (Semiannual Meeting), Atlantic City, New Jersey |
| September 19-23 | Illuminating Engineering Society (National Technical Conference), French Lick, Indiana |
| September 25-28 | American Institute of Mining and Metallurgical Engineers (Regional Meeting), Columbus, Ohio |
| September 26-28 | National Electronics Conference, Chicago, Illinois |
| September 28-30 | American Society of Mechanical Engineers (Fall Meeting), Erie, Pennsylvania |
| October 3-4 | National Association of Corrosion Engineers (Annual Meeting of South Central Region), Dallas, Texas |
| October 10-14 | American Society for Testing Materials (West Coast Meeting), San Francisco, California |
| October 11-14 | American Standards Association, New York City |
| October 17-19 | American Institute of Mining and Metallurgical Engineers (Institute of Metals Division), Cleveland, Ohio |
| October 17-21 | American Institute of Electrical Engineers (Mid-West General Meeting), Cincinnati, Ohio |
| October 17-21 | American Society for Metals, Cleveland, Ohio |
| October 23-30 | International Congress of the Society of Industrial Chemistry, Barcelona, Spain |
| October 24-28 | Society of Motion Picture Engineers, Hollywood, California |
| October 27-29 | Optical Society of America, Buffalo, New York |
| October 29 | American Mathematical Society, New York City |
| October 31-November 2 | Radio Engineers (Fall Meeting, sponsored by Radio Manufacturing Association and Institute of Radio Engineers), Syracuse, New York |
| November 7-10 | American Institute of Chemical Engineers, Pittsburgh, Pa. |
| November 10-12 | Geological Society of America, El Paso, Texas |
| November 17-19 | Acoustical Society of America, St. Louis, Mo. |
| November 25-26 | American Physical Society, Chicago, Illinois |
| November 25-26 | American Mathematical Society, Chicago, Illinois |
| November 26 | American Mathematical Society, Pasadena, California |
| November 27-December 2 | American Society of Mechanical Engineers (Annual Meeting), New York City |