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ASTRONOMY DURING THE EARLY YEARS OF THE AMERICAN PHILOSOPHICAL SOCIETY[1]

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"IT was not without being sensible how very unequal I am to the undertaking that I first consented to comply with the request of several gentlemen for whom I have the highest esteem, and to solicit your attention to a subject which an able hand might indeed render both entertaining and instructive. I mean astronomy." These words are not my own but rather they were spoken by David Rittenhouse in an "Oration" delivered on February 24, 1775, before the American Philosophical Society. According to the minutes of the society, the oration was delivered in the college "to a crowded audience, consisting of his Honor the Governor of the Province, the Assembly, and a great number of gentlemen of the first distinction, besides the members of the Society." Moreover, the oration was dedicated "To the delegates of the Thirteen Colonies, assembled in Congress at Philadelphia, to whom the future liberties, and consequently the virtue, improvement in science and happiness in America are intrusted."

Again to quote the words of Rittenhouse:

Astronomy, like the Christian religion, if you will allow me the comparison, has a much greater influence on our knowledge in general, and perhaps on our manners, too,

[1] Address at the mid-winter meeting devoted to the Early History of Science and Learning in America with especial reference to the part played by the American Philosophical Society, Philadelphia, February 13 and 14, 1942.

If, however, the changing capacitance be used to frequency modulate an oscillator tuned to the sharply sloping portion of the selectivity curve of an intermediate frequency amplifier, and the amplifier output rectified by a diode, the rectified voltage will be in effect a directly coupled function of the voltage. This method was tried and worked quite well, but was abandoned because of mechanical difficulties in making a condenser microphone small enough to go into the heart. The principle has been used in a myograph, which will be described in a later article.

The method finally used is shown in the diagram (Fig. 1). The various parts are mounted on a tri-

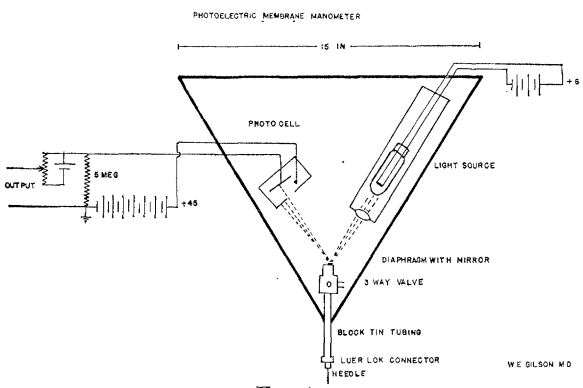

FIG. 1.

angular piece of one-half inch steel. The light source is a 75-watt exciter lamp of the type used in sound-on-film motion picture projectors. A single lens is used to focus the light on the mirror, which reflects a cone of light toward the photocell, an RCA 921 or 922. The apparatus is so adjusted that with zero pressure a small part of the light falls on the photocell. As the pressure applied to the diaphragm increases, the mirror is deflected and more light falls on the photocell. This produces an electrical change which is amplified by a push-pull direct coupled amplifier[2] and causes a deflection of the cathode ray spot, the amplitude of which is controlled by varying the gain of the amplifier.

The entire pressure system is filled with citrate solution. The three-way valve provides for connection between the diaphragm chamber and the side arm, for calibration against a mercury column, between the diaphragm chamber and the needle for record taking, and between the side arm and the needle for washing out the pressure system.

The output is linear over a wide range, as determined by accurate calibration. The device is easily adjusted and very flexible. It may be used to record the 160 mm Hg pressure change in the dog ventricle or the 1 mm Hg change in the turtle auricle. To my knowledge the latter has not been accurately recorded previously.

The frequency response is good, and entirely dependent on the mechanical design of the membrane manometer. This design is discussed by Wiggers.[1] The first part of his book would be of value to any one interested in using an instrument of this type.

The results and records obtained may be seen in papers by Eyster, Meek and Goldberg.[3, 4]

The photoelectric membrane manometer is not restricted in its application to cardiovascular research, but should be of value in a wide variety of physical and engineering problems.

In summary, its advantages over optical projection are:

1. Greater sensitivity.
2. Variable sensitivity. Pressure changes of any magnitude may be represented by any desired deflection of the cathode ray spot, simply by changing the amplifier gain.
3. Electrical changes may easily be recorded simultaneously.
4. Insertion of the needle is easy, because the entire device may be moved as a unit to any position desired.
5. It is not necessary to work in a room twenty feet in length.

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[2] H. Goldberg, "Electrical Engineering," January, 1940, Trans. p. 60.

[3] H. Goldberg and J. A. E. Eyster, *Am. Jour. Physiol.*, 131: 416, 1940.

[4] J. A. E. Eyster, Walter J. Meek and Harold Goldberg, *Am. Jour. Physiol.*, 131: 760, 1941.

BOOKS RECEIVED

BELDING, DAVID L. *Textbook of Clinical Parasitology.* Illustrated. Pp. 888. D. Appleton-Century Company, Inc.

BELL, R. P. *Acid-Base Catalysis.* Pp. 211. Oxford. $3.50.

COLEMAN, LAURENCE VAIL. *College and University Museums.* Illustrated. Pp. 73. Waverly Press, Inc. $1.25.

ENGELBRETH-HOLM, JULIUS. *Leukaemia in Animals.* Pp. 245. Oliver and Boyd.

HACK, JOHN T. *The Changing Physical Environment of the Hopi Indians of Arizona.* Illustrated. Pp. 85. Cambridge.

HACK, JOHN T. *Prehistoric Coal Mining in the Jeddito Valley, Arizona.* Illustrated. Pp. 24. Cambridge.

NICHOLS, JOHN T. *Representative North American Fresh-Water Fishes.* Illustrated. Pp. 128. The Macmillan Company. $1.25.

Respiratory Enzymes. A symposium. OTTO MEYERHOF and others. Pp. 281. The University of Wisconsin Press. $3.00.

RICE, VICTOR ARTHUR. *Breeding and Improvement of Farm Animals.* Third edition. Illustrated. Pp. 750. McGraw-Hill Book Company, Inc. $5.00.

Science, Philosophy and Religion. A symposium. Edited by LYMAN BRYSON and LOUIS FINKELSTEIN. Pp. 559. Conference on Science, Philosophy and Religion in Their Relation to the Democratic Way of Life, Inc.

SWINGLE, D. B. *Plant Life.* Illustrated. Pp. 457. D. Van Nostrand Company, Inc. $3.00.

The American Philosophical Society. *Year Book 1941.* Pp. 423. Lancaster Press, Inc.