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OUR BETTER ORDERING AND PRESERVATION[1]

By Dr. ISAIAH BOWMAN

PRESIDENT OF THE JOHNS HOPKINS UNIVERSITY

THE title of my address is a phrase from one of the earliest documents of American social history, the compact made on board the *Mayflower* before she reached Plymouth harbor. Since the patent under which the company sailed from home was drawn for Virginia and not for New England, whither storms had deflected the ship, it was deemed necessary to have a form of government adapted to the new situation and to frame "laws for the general good"—to prevent a few asocial men in the company from imperiling the enterprise. Before they set foot on the new land of hope and liberty they drew up a document constraining and defining each man's liberty. It was the good of the whole they sought, which implied recognition of the harm that might result from the wayward course of the individual. To "combine ourselves together into a civil body politic, for our better ordering and preservation," was the first requirement. Whatever the new land was to give or to deny, the first problem was the choice of a social and moral order under which they were to live.

It is significant that the text of the compact is brief. They did not know what kind of land it was, whether rich or poor. The winter's privations were before them. They shared the land with unpredictable savages. They did not know how the members of the company would get on together. In short, they had to go forward from day to day, and meet problems as they arose. The important thing, after dedication of self-government to the general good, was *how to agree* on what to do, whatever it was that they would find it good to do. That is the core of the document. If laws were to be for the general good, men were to obey

[1] Dedication address, Natural Resources Building, Urbana, Illinois, November 15, 1940.

column decreases or increases the amount of light falling on the phototube, and this in turn, through the electrical circuit described below, controls the amount of current flowing through the heating unit.

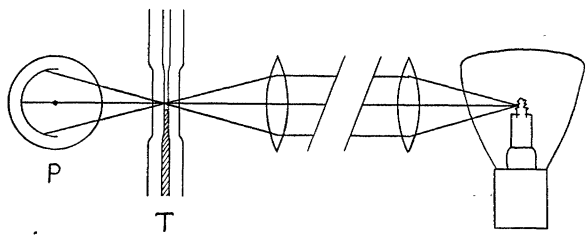

FIG. 1. P—phototube, T—upper part of thermoregulator.

The electrical circuit is shown in Fig. 2. It was taken from Nottingham[2] and is essentially the same as the scheme given by Hull[3] for photoelectric control of a thyratron by the phase-shift method. The circuit was not applied by these authors to temperature control, however. T is the thyratron tube, General Electric Type FG-57, P is the phototube, Type PJ-23,

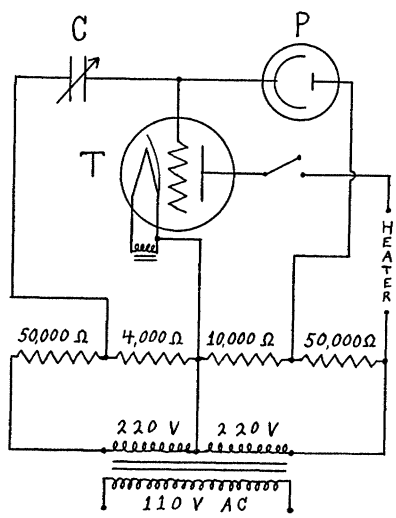

FIG. 2

and C is a variable condenser of 100μμf capacity. It will be seen that alternating voltage is applied to the grid. When this voltage is in phase with the anode voltage the maximum current will flow in the anode circuit. But as the grid voltage is gradually retarded in phase through 180°, the average anode current decreases continuously to zero. This phase shift in the grid voltage is brought about by increase in the resistance of the phototube resulting from decrease in the intensity of light falling upon it.

Thus the heater operates continuously, with very little variation, at a level just sufficient to balance the loss of heat through the walls of the water bath. This continuous control of heat input has the advantage of reducing periodic fluctuations in temperature to an almost infinitesimal value, but it carries with it a potential source of error in that changes in the ambient temperature will be reflected, on a greatly reduced scale, in the bath temperature. However, except perhaps in cases of extreme variation in the room temperature, good insulation of the bath together with adjustments of the system making for maximum sensitivity will keep this variation within very narrow limits. In a laboratory where the room temperature does not vary widely, the bath temperature has been observed to remain constant to ± .001° C for periods of 48 hours and nearly as constant over much longer periods.

A few practical suggestions based on my experience with the apparatus may be added. As a light source a 32 candle power headlight bulb operated from a 6.3 volt transformer has proved satisfactory. The capillary of the thermoregulator (2 mm inside diameter) is compressed so that the cavity becomes a flat oval in cross section, thus minimizing spreading of the light beam as it passes through, and at the same time increasing sensitivity by decreasing the area of cross section of the capillary. The capillary is painted on the outside with black glass-marking ink, except for a slit on each side through which the beam passes. I have had the bulb of the thermoregulator made in the form of a helix, so as to combine large volume with small diameter.

The parts for constructing this apparatus, exclusive of stirrer and heater, can be purchased for about thirty dollars.

ALFRED D. COMPTON, JR.

YALE UNIVERSITY

[2] W. B. Nottingham, *Jour. Franklin Inst.*, 211: 271, 1931.

[3] A. W. Hull, *Gen. Elec. Rev.*, 32: 213 and 390, 1929.

BOOKS RECEIVED

American Institute of Physics. *Temperature, Its Measurement and Control in Science and Industry.* Papers Presented at a Symposium held at New York City, November, 1939. Pp. xiii + 1362. Illustrated. Reinhold. $11.00.

CARLSON, ANTON J. and VICTOR JOHNSON. *The Machinery of the Body.* Revised edition. Pp. xix + 620. 213 figures. University of Chicago Press. $4.00.

CLARK, JOHN A., FREDERICK L. FITZPATRICK and EDITH L. SMITH. *Science on the March.* Pp. xiii + 571 + xi. 437 figures. Houghton Mifflin. $1.72.

DE RUDDER, B. and F. LINKE. *Biologie der GroBstadt. Frankfurter Konferenz für medizinisch-naturwissenschaftliche Zusammenarbeit am 9. und 10. Mai 1940.* Pp. xi + 210. Illustrated. Theodor Steinkopff, Dresden.

Fisheries Research Board of Canada. *Bulletin No. LIX: The Chemistry and Technology of Marine Animal Oils with Particular Reference to Those of Canada.* BROCKLESBY, H. N., Editor. Pp. 442. 73 figures. The Board, Toronto. $2.95.

TARSKI, ALFRED. *Introduction to Logic and to the Methodology of Deductive Sciences.* Revised edition. Pp. xviii + 239. Oxford University Press. $2.75.