worry over the danger to which they were exposed, played the most significant rôle, as the percentage of female admissions was almost as large in 1919, when hostilities had ceased, as in 1918. The rise in female alcoholic admissions to 17.9 per cent. in 1934 and 1935 is too brief an experience from which a significant change in the trend may be predicted.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE USE OF POLARIZED LIGHT IN THE SIMULTANEOUS COMPARISON OF RETINALLY AND CORTICALLY FUSED COLORS

THE importance of the study of the binocular fusion of colors to present theories of color vision makes the phenomenological study of such cortical mixtures a matter of vital interest.[1] The writers have long been interested in the phenomenological comparison of the "cortical yellow" reported by Hecht and the usual, monocularly mixed yellow. Such a study is best carried out under conditions permitting a simultaneous comparison of the colors. The problem of presenting two adjacent stimulus fields, one of which will be presenting red to one eye and green to the other, while the other field is presenting *both* colors to *each* eye, is a difficult one for the laboratory lacking elaborate equipment. The method outlined below is inexpensive, easily set up and adaptable to other visual demonstrations.

Two light sources are used, one containing a red filter, the other a green filter. The light from each of these sources is projected through a polarizing lens upon a directional screen, which maintains the polarization of the light while reflecting it. Aluminized oil cloth makes an excellent screen, although any material covered with aluminum paint will serve. The polarizing lenses are those furnished by the Polaroid Corporation of Boston, and consist of a plain glass lens containing a polarizing material. If the two polarizing lenses are oriented at right angles to each other the directional screen will be reflecting polarized red light oriented in one direction and polarized green light oriented in the opposite direction. To the observer, the screen will appear as a yellow surface. If, however, the observer will place two more polarizing lenses one before each eye (they may be fitted into a spectacle frame for convenience), one oriented to admit the red light but exclude the green, the other to admit the green but exclude the red, the result will be retinal rivalry, since each eye will be stimulated by a different color. Under the correct conditions, cortical fusion will take place and the "cortical yellow" of Hecht will be observed. Preliminary work seems to indicate that this fusion may be helped by reducing the area of the stimulus field. This may be done by surrounding the screen with a black border of variable width.

In order to get simultaneous comparison of cortically and retinally fused colors, one can place a piece of white paper upon the aluminum screen. For small areas white adhesive tape will serve. The light striking this material will not maintain its orientation but will be depolarized and hence neither the red nor green light from this area will be stopped by the polarizing lens worn by the observer. As a result, the screen presents two adjacent fields of stimulation to the eyes, one field supplying red to one eye and green to the other, the other field supplying both red and green to each eye. The observer is thus able to simultaneously observe both retinal and cortical fusion. Intensity values of the two fields may be adjusted by rotating the screen upon a pivot. Since the light is reflected directly ahead from the aluminized portion of the screen, but reflected at all angles from the paper, rotation will cause a relatively greater loss in intensity for the aluminized part as compared with the paper. The same effect may be obtained by varying the angle from which the observer views the screen.

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[1] S. Hecht, *Proc. Nat. Acad. Sci.*, 14: 237–240.

A PRECISION APPARATUS FOR MIXING GASES IN VARIOUS PROPORTIONS

IN a previous communication[1] we have shown how broken automatic pipettes can be utilized in the construction of some useful laboratory apparatus. The present note describes another appliance of considerable scientific importance also constructed out of two 50 cc automatic pipettes, which were rendered useless because of the breakage of the oval caps, and some other glass apparatus easily obtainable in any laboratory. The recent researches of Blackman,[2] Kidd and West,[3] and Singh[4] on the physiology of higher plants and of Warburg[5] and Keilin[6] on the respiratory enzymes have established that some of the fundamental

[1] Singh and Mathur, SCIENCE, 82: 2139, 626, December 27, 1935.
[2] Blackman, *Proc. Roy. Soc.* (*Lond.*), 103B: 491, 1928.
[3] Kidd and West, *Proc. Roy. Soc.* (*Lond.*), 106B: 93, 1930.
[4] Singh, Malaviya Commemoration Volume (Allahabad), 1932.
[5] Warburg, *Biochem. Zeitschr.*, 177: 471, 1926.
[6] Keilin, *Proc. Roy. Soc.* (*Lond.*), 104B: 206, 1929.

problems connected with the chemistry of respiration and the mechanism of enzyme action can best be solved by a study of oxidative gaseous exchange of plant material under various gaseous mixtures. A precision apparatus for mixing gases in various proportions is therefore needed in all physiological and biochemical laboratories.

The two gases are stored in two gas holders, preferably of the same dimensions, inside which they are maintained throughout at the atmospheric pressure.[7] With the aid of suction applied by means of a single mercury leveling bulb the gases are drawn into two 50 cc pipettes. The same leveling bulb is employed for forcing simultaneously both the gases through a common exit, which results in the formation of a highly satisfactory gas mixture. In the construction of the apparatus, two broken 50 cc automatic pipettes A and B are joined together with two Y-tubes G and H (Fig. 1). The free end of the lower Y-tube is connected

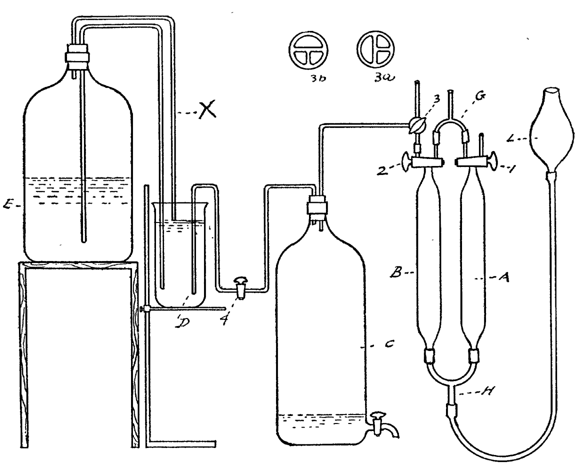

Fig. 1. Apparatus for mixing gases in various proportions.

with a mercury leveling bulb (capacity about 130 cc) through a piece of half-pressure rubber tubing, and that of the upper Y-tube serves as an exit for the gas mixture. The water reservoir E is connected by a siphon to a beaker D, in which the water is maintained at a constant level by means of another twice-bent tube X, which is so placed that the water reservoir E ceases to communicate with the external air the moment the water in the beaker attains a certain level and closes the orifice of the tube X. As a result of this the further draining of water into the beaker is stopped. The beaker D communicates through a glass tubing, which carries a tap as well, with the gas holder C. A three-way stopcock connects the gas holder with the pipette B (Fig. 1). The pipette A is connected to a similar equipment (not shown in the figure) for holding the gas at the atmospheric pressure throughout the experimental period.

[7] Magness and Diehl, *Jour. Agr. Res.*, 27: 1, 1924.

The manipulation is easy. The taps 1 and 2 are turned so that the pipettes communicate with the gas holders. The three-way stopcock 3 is turned in the position 3a and the other stopcock connected with the pipette A (not shown in the figure) is also turned in a similar position. Now the mercury leveling bulb L is raised until the mercury stands just above the stopcock 3, when it should also stand at a similar position in the stopcock connected with the pipette A. Subsequent to this tap 4 is opened and the stopcock 3 is turned in the position 3b and the gases from the two gas holders (one not shown in the figure) are drawn into the pipettes and immediately expelled out of them through the free end of the Y-tube G. This serves to wash the connecting tubes between the gas holders and the pipettes with pure gases. Again the taps 1 and 2 are turned and the gases drawn into the pipettes. The pipettes are once more put in communication with the Y-tube G and as the leveling bulb L is raised a gas mixture issues through the exit which may be directly introduced into the respiration apparatus or stored in a gas holder.

Due to the fact that a double pressure control is exercised—the gases inside the gas holders are maintained at the same pressure and withdrawn therefrom with suction of same magnitude—the results, as tested by means of Haldane's gas-analysis apparatus, are invariably found to be satisfactory. One of the main advantages of this device is that the gas mixtures so prepared need not be analyzed afterwards and may be directly used for experimentation. But it is advisable in all cases to allow the gas mixture directly into the respiration apparatus as the storage of gas mixtures may cause errors due to the different solubilities of the two gases. If two pure gases are used a mixture containing 50 per cent. of each is obtained. This mixture may be stored in one gas holder, while the other may be filled with the pure gas. The mixture obtained under such conditions will be 75 per cent. of one gas and 25 per cent. of the other. By repeating the process a great variety of gas mixtures of varying proportions is easily obtainable.

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