spectral emission was observable during Period A (*i.e.*, through opening *a*), there was no detectable emission during Period C. Since it is known from various lines of evidence that spectral emission is not appreciably the result of recombination of ions and electrons, but is the result of excitation, this proves conclusively that the post-arc currents are due to the neutralization of negative space charge by the persisting positive ions, and not to the ionization of excited atoms.

Furthermore, Kannenstine's results using a Braun tube were reproduced in all essential details, in very pure helium, in helium of ordinary purity (no impurity visible spectroscopically) and also in helium containing large amounts of mercury vapor. No quantitative difference greater than the limit of reproductibility under the same conditions was found.

Many of the peculiarities of the Braun tube figures were found to be produced by the resistance of the potentiometer and other elements of the circuit.

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THE SUCCESSIVE STIMULATION OF THE ARC LINES OF HELIUM BELOW THE IONIZATION POTENTIAL

RECENT experiments made in the research section of this laboratory have demonstrated photographically the successive stimulation of the arc lines of helium under increasing potential of electron bombardment between the resonance and ionization points.

The potentials necessary for the stimulation of the lines of the visible spectrum were calculated from the established term values of these lines and from a term value for the normal atom based on the assumption that the correct ionization point is 24.5 volts. The photographs show a concordance of observation with calculation to better than one tenth of a volt. The voltmeter corrections were made from ionization point curves taken under the same conditions in the same apparatus assuming the correct point to be at 24.5 volts. This correction amounted to 1.1 volts, a value also calculable by the usual methods by application of contact difference of potential and other corrections. A large Hilger quartz spectrograph was used with a plate setting to cover from about 5000A to 3000A. With this setting the spectrum at 22.9 volts consists of a single line, 3889A. This is the second line of the coplanar principal series, m = 2. The calculated voltage necessary to stimulate this line is 22.9 volts. At 23.5 volts three lines are found 5016 (calculated 23.00 volts), 4713 (23.51) and 3889. At 23.9 volts nine lines occur, 5048 (23.56), 5016, 4922 (23.65), 4713, 4472 (23.65), 4121 (23.88), 3965 (23.65), 3889 and 3188 (23.62). At 25 volts the full spectrum is obtained.

When viewed visually the lines appear and extinguish sharply in order. The disappearance of the line 5048 leaving 5016 adjacent to it furnishes a convenient method for establishing instrumental corrections if the calculated value for the appearance of the line is accepted as correct.

The experiments are an extension of work reported to the American Physical Society at its Washington meeting in April, 1924. The apparatus described at that time has been altered by the introduction of an equipotential lime cathode of a type similar to that suggested by G. Hertz (*Zeit. für Phys.*, 22, 24, 1924), but of a different shape, sharply peaked at its narrowed center to permit closer approach to the grid. The distance of electron acceleration did not exceed one half of a millimeter. Under these conditions both voltage and current were remarkably steady. No "kicks" or "hysteresis loops" were found in the current-voltage curves nor were there any evidences of oscillatory disturbances.

These results are a confirmation of the early observations of Rau (*Sitz. Ber. d. Phys. Med. Ges.*, Wurzburg, 1914) and of Richardson and Bazzoni (*Nature*, 98, 5, 1916) and of the recent publications of G. Hertz (*l. c.*).

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THE NATIONAL ACADEMY OF SCIENCES

ABSTRACTS OF PAPERS PRESENTED AT THE WASHINGTON MEETING, APRIL 25 AND 26

Measurement of the circulation in man: DR. YANDELL HENDERSON and HOWARD W. HAGGARD, Sheffield Scientific School, Yale University. Ever since Harvey showed that the blood circulates, the determination of the volume of flow per minute has remained the outstanding, unsolved problem of the circulation. It is not merely general knowledge that is needed, but rather the means of determining the functional efficiency of the circulation in individuals in all conditions; in other words, a simple and fairly accurate method for measuring the circulation in man. The method based on absorption of nitrous oxide from the lungs is inaccurate and of limited applicability.

Investigations in this laboratory have led to the formulation of the principles controlling the absorption of any gas whatever by mere solution from the lung air into the blood. These principles show that the rate of absorption of a very soluble gas, such as ether or alcohol vapor, is dependent mainly on the volume of air breathed, that is, the respiration; while the rate