atmosphere in the furnace than Babcock[1] found for the same iron lines in the arc. The value of the mean ratio for the pressure shift of lines common to the two lists is 2.3 with an average deviation of 0.3. The second paper reports pressure shifts for λ2537 of mercury in absorption at room temperature. These results indicate that molecular density, while not the ultimate cause, is probably the controlling factor in pressure shift.

An increase in pressure at constant temperature indicates an increased density of molecules. This change usually causes an increase in wave-length. A decrease in temperature at constant pressure might be expected to operate similarly.

The core of an iron arc of the Pfund type with cathode below is surrounded by a rather thick envelope of iron vapor and iron oxide dust. In an effort to establish the existence of a temperature shift a layer of this envelope was used by the author as a low temperature source of iron lines, while the central section of the arc with polarity reversed was used as a high temperature source. Two of the three lines selected for this test showed a shift in the direction indicated above, and of the right order of magnitude.

In order to check these results plates were taken of λ5890 of sodium. Shifts measured between four different types of sources gave results qualitatively in agreement with that indicated by the previous paragraph. It is considered that neither line asymmetry nor fine structure, as reported by Minkowski[4] and Schüler[5] respectively, can account for all the experimental data as easily as the hypothesis here suggested.

[4] Minkowski, Zeits. f. Physik **55**, 16 (1929).
[5] Schüler, Naturwiss. **16**, 512 (1928).

It therefore seems possible to measure, by means of this phenomenon, effective flame, arc, and furnace temperatures when the pressure is known. Assuming that the wave-length of a line is a linear function of the number of molecules per unit volume, that ionic fields of high value were absent from the sources of Babcock and King, and that the effective temperature of King's furnace was 2000°C, the calculated temperature of the effective emission point of Babcock's iron arc for the lines common to both lists is 5000°C ±700°C.

St. John and Babcock[6] found that a 6 mm iron arc was practically free from pole effect at pressures below 10 cm. However, an anomalous behavior of the yellow sodium lines has been reported by Kiess.[7] Both lines showed a shift of 0.004A between absorption in a low pressure tube and emission in a vacuum arc at 6 cm pressure. This indicates either that the pressure shift is non-linear at low pressures or that a positive pole effect existed in the arc used. Two sets of plates of λ5890 taken by the author showed a positive pole effect of 0.005A and 0.006A respectively in a carbon arc operated at about 10 cm pressure. Therefore it is suggested that care be used in applying this result of St. John and Babcock to any conditions other than those investigated by them.

All plates were taken at Yale University.

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[6] St. John and Babcock, Astrophys. J. **42**, 231 (1915).
[7] Kiess, J.O.S.A. and R.S.I. **18**, 169 (1929).

Emission of Positive Ions From Thoriated Tungsten

In an earlier note, it was reported that tungsten when heated gave off positively charged tungsten ions. The emission from thoriated tungsten has been investigated and in addition to tungsten ions of mass 184, thorium ions of mass 232 and an ion of mass 247 ± 2 have been obtained. This latter ion may be thorium monoxide, although all attempts to reduce it with H_2 have failed. It appears at an estimated temperature of about 2300°C. The alternative explanation is that it is some other extremely stable compound or an element. An x-ray investigation of various thorium sources is under way to settle this last possibility.

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