# The Effect of Pressure on a Cadimum Cell.

By R. R. Ramsey.

This work is an extension of some work done in 1901 (Phys. Rev., Vol. 13, July, 1901), in which the pressure was raised to 300 atmospheres. In 1909 there appeared the work of Cohen and Swinge (Zeit. Phys. Chem. 67, 5 pp. 513. Sept., 1909), in which the cell was placed under a pressure

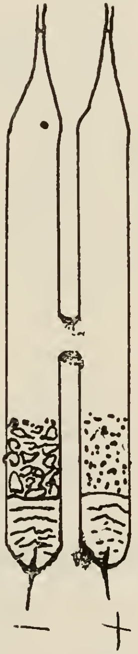


Fig. I.

of 750 atmospheres. Within the past year the Department of Physics has secured a compression pump extending to 1,000 kilograms per square centimeter (1 atmosphere=1,033 kilogram per square centimeter) and inasmuch as Cohen and Swinge's results were not in exact accord with my former results I thought it well to repeat and extend the work.

The apparatus and plan of the experiment was practically the same as in my former work. The pump was a Ducretet compression pump fitted with a gauge recording pressure up to 1,000 kilograms per square centimeter. The cell is made in the *H* form with very short connecting tube (Fig. I), so that it will go inside the piezometer (Fig. II), whose inside

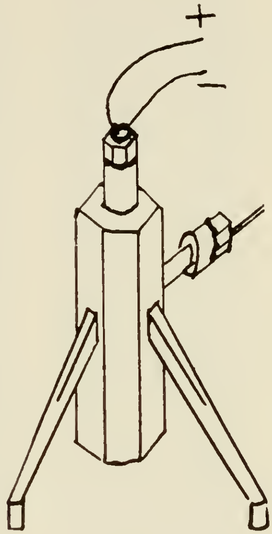


Fig. II

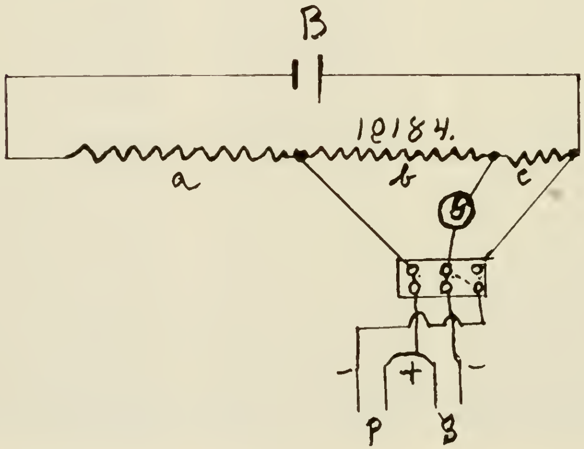


Fig III.

diameter is three centimeters. The top of the cell is drawn to a capillary after the electrodes and cadimium sulphate crystals are placed inside. The cell is then immersed in kerosene inside the piezometer. A special cap was made for the piezometer. This cap has two insulated connections leading through it so that the cell can be connected to a potentiometer. The piezometer is connected to the pump with a copper tube of small inside diameter. The potentiometer (Fig. III), is so arranged that the cell can be compared with a standard Weston cell and also so that the difference between the cell under pressure and a second cell can be measured. This second cell is immersed in a quantity of kerosene and placed as close as possible to the piezometer. In this way any fluctuations due to change of room temperature will be avoided.

The results are given in Table I.

TABLE I.

| Pressure in Killograms per Square Centimeter. | Change of E. M. F. in Volts. | Average $\frac{de}{dp}$. |
|---|---|---|
| 100 | $7.\times10^{-[illegible]}$ Volts. | $7.\times10^{-6}$ |
| 200 | 13.3 | 6.65 |
| 300 | 19.3 | 6.23 |
| 400 | 26 | 6.5 |
| 500 | 32.4 | 6.28 |
| 600 | 38.7 | 6.45 |
| 700 | 44.6 | 6.37 |
| 800 | 50.7 | 6.33 |
| 900 | ...... | ...... |
| 1000 | 64.7 | 6.47 |
| | | Mean, 6.47 |

The results are also shown in a curve (Fig. IV). The average value of $\frac{de}{dp}$ is $6.47\times10^{-6}$ volts per kilogram per square centimeter.

In the previous work a cell was made of heavy glass tubing and subjected to pressure up to 75 atmospheres, at which pressure the cell burst. The result for this method was $6.02\times10^{-5}$ volts per atmosphere.

The result for the piezometer method obtained at that time was $7.6\times10^{-6}$ volts per atmosphere. Cohen and Swinge have found the value $6.28\times10^{-6}$ volts per atmosphere for a pressure up to 750 atmospheres. The E. M. F.

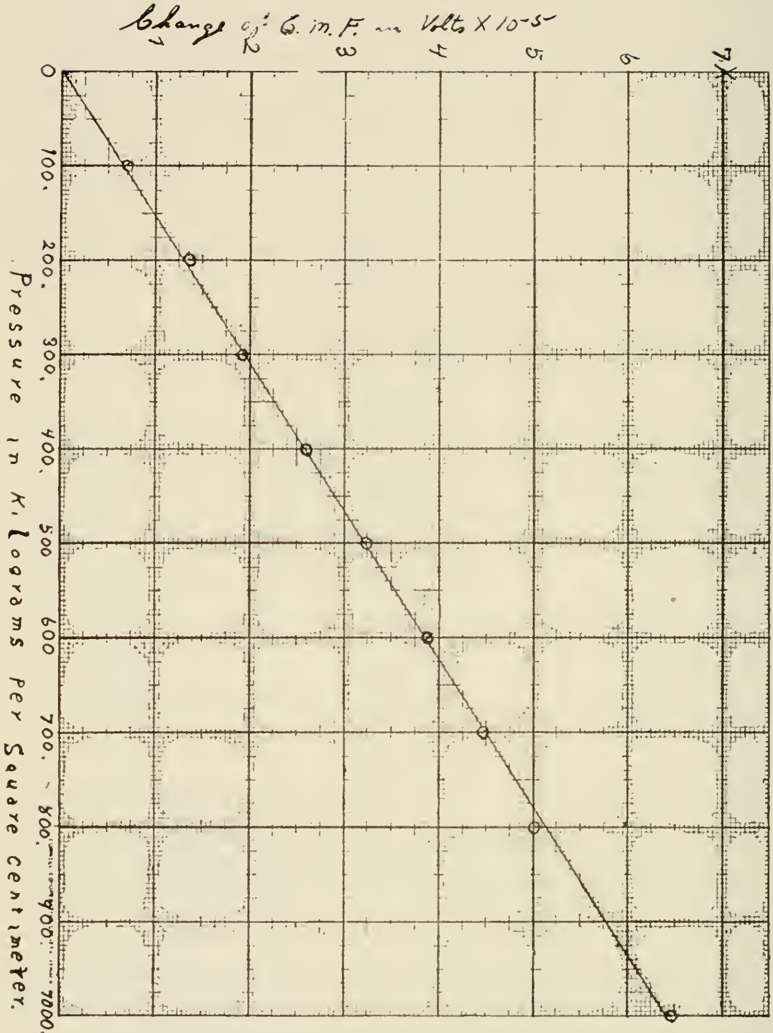
Change of E. m. F. in Volts × 10⁻⁵
1
2
3
4
5
6
7
0
100.
200.
300.
400.
500
600
700.
800.
900.
1000.
Pressure in Kilograms per Square Centimeter.

Fig. IV.

when first placed under pressure is increased more than the value given above. The pressure caused an increase of the temperature of the oil and a decrease of the temperature of the electrolyte in the neighborhood of the crystals. This has been shown by means of a thermo-junction. The exact results will be reserved for further investigation.

Both these temperature changes affect the E. M. F. of the cell. After a time, a half hour say, the cell reaches a constant E. M. F. When the cell was first placed under a pressure of 1,000 the E. M. F. was changed $78 \times 10^{-4}$ volts. The final change after thirty minutes was $6.4^{-7} \times 10^{-4}$ volts.

*Indiana University, February 2, 1912*