the reacting substances themselves would be subjected to new decompositions, and the realization of the phenomenon would be excluded.

**8.** *Conclusions.*

At the present state of our knowledge of the gas equilibria every gas reaction may be represented by the two-constant formula $\log K = \frac{a}{T} + b$. There are no reasons to add more terms with $T$ to this expression in the second member, as the experimental errors are always greater than the change that can be effected by these $T$-terms in the formula. If the addition of these terms is necessary, and if they, therefore, bring about an appreciable modification in the curve, we have to do either with a wrong interpretation or with errors of observation.

In contradiction with what is recorded in the literature, the transition case of $\frac{d\log K}{dT} = 0$ has not been found with any certainty for a single reaction, and it will not be easy to realize either in my opinion. This case might be found for a reaction that has a very small heat of conversion over a very great range of temperature; an example of this is, however, not known.

**Physics.** — *"Comparison of the Utrecht Pressure Balance of the* VAN 'T HOFF *Laboratory with those of the* VAN DER WAALS *Fund at Amsterdam."* By Mrs. E. I. HOOGENBOOM—SMID. VAN DER WAALS fund researches N°. 9. (Communicated by Prof. P. ZEEMAN).

(Communicated in the meeting of Sept. 30 1916).

*Introduction.* In the former half of 1915 a comparison was made of the small Amsterdam pressure balance with the open standard manometer at Leiden from 20 to 100 atmospheres [1]). The result of this was that the effective area appeared to be not equal to the real area; a constant value was not even found, but a value dependent on the pressure.

To be able to make accurate determinations of the pressure in spite of this it is required to study the theory of the instrument.

[1]) See C. A. CROMMELIN and Miss E. I. SMID, Comparison of the pressure balance of S. and B. etc. These Proceedings XVIII, p. 472.

For this purpose it was interesting to investigate whether the deviations of the effective area from the real area presented the same course for different pressure balances. We might obtain some idea of this by comparing the pressure balance of Prof. COHEN at Utrecht with the small and the large pressure balance belonging to the apparatus of the VAN DER WAALS fund, which comparison took place at Amsterdam from October to December 1915.

*Investigation.* The Utrecht pressure balance looks entirely the same as the small Amsterdam one, only the real area is not 1, but $\frac{1}{4}$ cm$^2$, so that its range of measurements reaches to 1000 atmospheres. The comparison of the effective area of the two apparatus was carried out by using a measuring tube filled with hydrogen, as it has been described by WALSTRA in his Thesis for the Doctorate[1]), as indicator. Then the measuring tube was successively brought in connection with the two pressure balances that were to be compared, the temperature of the gas being kept constant as well as possible at 25°. The results of the measurements at different pressures for different fillings in different measuring tubes on the given data are recorded in the following two tables.

TABLE I.

Ratio effective area Amst small and Utrecht press. bal.

| Charge in kg. | 14 Oct. | 15 Oct. | 16 Oct. | 19 Oct. | 20 Oct. | 27 Oct. | 16 Nov. | 18 Nov. |
|---|---|---|---|---|---|---|---|---|
| 88 | | | | | | 3.993 | | |
| 109 | 3.993 | | 3.993 | | | | | |
| 147 | | | | | | | 3.993 | |
| 151 | 3 993 | 3 992 | 3.993 | | | | | 3.992 |
| 167 | | | | | | 3.991 | | |
| 195 | 3 993 | 3.991 | 3.991 | | | | | |
| 204 | | | | | | | 3.991 | |
| 223 | | | | | | | | 3.992 |
| 242 | 3 990 | 3.991 | 3.991 | 3.991 | 3.990 | | | |

[1]) K. W. WALSTRA, Dissertatie Amsterdam 1914. Cf. These Proc Vol. 16, (1913) p 754 and 822, Vol. 17, (1914) p. 203.

TABLE II

Ratio effective area Amst. large and Utr. press. bal.

| Charge in kg. | 19 Oct | 20 Oct. | 21 Oct | 23 Oct. | 25 Oct | 29 Oct. | 6 Nov. | 8 Nov | 9 Nov | 10 Nov. | 12 Nov. | 13 Nov. | 18 Nov | 19 Nov. | 20 Nov. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 223 | | | | | | | | | | | | | | | 3.993 |
| 238 | | | | | | | | | | 3.993 | | | | | |
| 242 | 3.996 | 3 993 | | | | | | | | | | | | | |
| 268 | | | | | | 3.994 | | | | | | | | | |
| 297 | 3 997 | 3.996 | 3.993 | | | | | | | | | | | | |
| 316 | | | | | | | | | | | | | 3.993 | | 3.994 |
| 322 | | | | | | | | | 3.994 | 3.994 | | | | | |
| 351 | | | | | | | | | | | 3.994 | | | | |
| 357 | | | 3.994 | | 3.992 | | | | | | | | | | |
| 398 | | | | | | 3.992 | | | | | | | | | |
| 406 | | | | | | | | | | | 3.994 | | | | |
| 420 | | | | | | | | 3.994 | 3.994 | 3.994 | | | | | |
| 422 | | | | 3.993 | | | | | | | | | | | |
| 440 | | | | | | | | | | | | | | 3 993 | 3.994 |
| 471 | | | | 3.993 | 3.993 | | | | | | | | | | |
| 472 | | | | | | | | | | | 3 994 | | | | |
| 533 | | | | | | | | | | | | 3.994 | | | |
| 555 | | | | | | 3.993 | 3.994 | | | | | | | | |
| 566 | | | | | | | | | | | | | | 3.993 | 3.994 |
| 592 | | | | | | | | | | | | 3.994 | | | |
| 655 | | | | | | | | | | | | 3 994 | | | |
| 668 | | | | | | | | | | | | | | 3.994 | 3 994 |
| 701 | | | | | | | | 3.993 | 3 994 | | | | | | |
| 709 | | | | | | | | | | | | 3.994 | | | |
| 751 | | | | | | | | | | | | 3.993 | | | |
| 754 | | | | | | | 3.993 | | | | | | | | |
| 796 | | | | | | | | | | | | | | 3.994 | 3.993 |
| 894 | | | | | | | | | 3.994 | | | | | | |
| 918 | | | | | | | | | | | | | | 3 993 | |

*Remarks.*

1. The height of the piston appears to have an appreciable influence on the pressure. This influence was not observed at Leiden in experiments made expressly for the purpose.

2. The rotatory velocity has an appreciable influence on the pressure.

3. The direction of rotation has a great influence on the pressure with the Utrecht pressure balance. The difference amounts to about 60 grams for a charge of 60 kg. When the charge is very slight, the Utrecht balance can only be rotated in one direction. Hence only the charge for righthand rotation is always taken into account on comparison with the small Amsterdam balance. On comparison with the large balance on Oct. 19 and 20 the Utrecht balance was either rotated to the left or to the right, because then the phenomenon had not yet been observed. Afterwards always the mean has been taken of the charge for lefthanded and righthanded rotation.

*Result.* The ratio of the effective areas appears to be pretty well constant, taking into consideration the inaccuracy which is the consequence of the phenomena mentioned in the above remarks. On comparison of the Utrecht pressure balance with the small Amsterdam balance, however, the ratio values seem to present a slight systematic course.

It is the intention to continue the investigation of the pressure balance in the Amsterdam laboratory, first of all in this direction that the value of the effective area will be determined for very different values of the charge. The apparatus required for this will, however, most likely not be obtainable during the war.

In conclusion I must express my indebtedness to Prof. KOHNSTAMM, under whose superintendence I have been allowed to carry out this investigation.

*Deventer*, September 1916.