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A New Analysis of the Action of Amsler's Polar Planimeter

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A SIMPLE DERIVATION OF THE EQUATION FOR MEAN FREE PATH

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(ABSTRACT)

According to simple kinetic theory, in which all the gas molecules but one are considered stationary, the mean free path L is given by $L = \frac{1}{N \pi \sigma^2}$, where N is the number of molecules per cc. and σ is the molecular diameter. Clausius, considering all molecules to be moving with the mean relative velocity, finds $L = \frac{3}{4N \pi \sigma^2}$. Again, Maxwell, applying his law of velocity distribution, obtains the result $L = \frac{1}{\sqrt{2}N \pi \sigma^2}$. This value found by Maxwell is the one most generally accepted. If we consider it to be correct, then the value from simple kinetic theory is 41% too large, while that found by Clausius is 6% too large.

An approximate value of L, much more nearly correct than the first one given, may be derived very simply by considering the gas molecules to be vibrating in sheets. The result obtained is $L = \frac{1}{4 N \sigma^2}$. This value is 11% higher than that found by Maxwell, as compared to 41% for the first value given above. The mathematical difficulties encountered by Clausius and Maxwell in deriving their formulas are entirely avoided in this development.

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A NEW ANALYSIS OF THE ACTION OF AMSLER'S POLAR PLANIMETER

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(ABSTRACT)

The theory of Amsler's polar planimeter, as commonly given, leads to the expression $A = L\ h$, where A is the area circumscribed, L is the length of the tracer arm, and h is the net distance of translation of the tracer arm in a direction perpendicular to its length. However, it can be shown that the area may also be given by $A = L^2\theta$, where θ is the net angle through which the tracer arm has rotated about either of its ends. But as the tracer point passes around the area A, the tracer arm does not, in general,

rotate simply about one end. At any particular instant it rotates about some point which may be situated anywhere along its length. However, about whatever single point the arm may be rotating, such rotation can be resolved into two simultaneous rotations about the two ends. Therefore for purposes of analysis we may consider that the tracer arm rotates only about the ends, and we may express the area in terms of that rotation, as already stated.

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A COMPARISON OF POWER OUTPUT OF CONICAL, HYPERBOLIC AND EXPONENTIAL TRUMPETS

G. W. STEWART

(ABSTRACT)

These measurements are presented as illustrative of the advances that have been made in the measurement of acoustic power. They refer of course to single cases, but they are of interest in showing the actual fluctuations of both components of impedance and of the power output in the three types of trumpets stated in the title.

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THE THEORY OF THE TWO-WAY QUINCKE TUBE

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(ABSTRACT)

The long known Quincke two-way tube has been assumed to eliminate transmission by interference only at a frequency corresponding to a difference of path of one-half wave length. The author has derived the theory of the action and finds that the ratio of transmitted to incident energy is

$$[4 \sin (\alpha_2 + \alpha)/2 \times \cos (\alpha_2 - \alpha_3)/2]^2 \times [1 - 2 \cos (\alpha_2 + \alpha_3) + \cos (\alpha_2 - \alpha_3)]^2 + 4 \sin^2 (\alpha_2 + \alpha_3)]^{-1}$$

This shows that the conditions of zero transmission are $\alpha_2 - \alpha_3 = (2n + 1) \pi$, where n is an integer, which has long been known, and $(\alpha_2 + \alpha_3) = 2n \pi$, if $(\alpha_2 - \alpha_3) = 2n_1 \pi$ where n_1 is an integer. Since $(\alpha_2 + \alpha_3) > (\alpha_2 - \alpha_3)$, it is seen that, in general, these new minima of transmission are much more numerous than