CORRESPONDENCE

To the Editor of the AËRONAUTICAL JOURNAL

THE LAWS OF AVANZINI

SIR,—In Col. de Villamil's interesting paper there are a few errors to which attention should be directed.

(1) Presumably the sign for the arithmetical difference of two quantities is a misprint for the ordinary sign for variation.

(2) On page 192, θ is (assuming correction 1) stated to vary as $1/f(V)$, while on page 204 θ is stated to vary as $f(1/V)$. Of course the form of the function f may be so chosen so as to express the result in either form that is preferred, but the two statements are not equivalent and once the choice has been decided on it is incorrect to substitute one form for the other, since it is generally not true that $1/f(V) = f(1/V)$. Thus to take a simple illustration, let

$$f(V) = aV + bV^2$$

then

$$\frac{1}{f(V)} = \frac{1}{aV + bV^2}$$

while

$$f\left(\frac{1}{V}\right) = \frac{a}{V} + \frac{b}{V^2}$$

(3) In the statements of the five laws the same symbol f is used to denote different functions. It might add very much to clearness of explanation if the different functions had been denoted by different symbols or distinguished by suffixes. Probably no misunderstanding will arise on this score.

(4) Assuming that readers of the paper have mentally or otherwise made the necessary corrections in these cases a more fundamental error occurs in the inference deduced at the problem of page 209. It is incorrect to infer *without further justification* that

$$\theta \text{ varies as } \frac{f_1(b)}{f_2(\rho) \times f_3(L) \times f_4(V)}$$

or that by a different choice of functions we may write θ varying as

$$f_1(b) \times F_2\left(\frac{1}{\rho}\right) \times F_3\left(\frac{1}{L}\right) \times F_4\left(\frac{1}{V}\right)$$

The correct inference may be written in the form

$$\theta = F\left(b, \frac{1}{\rho}, \frac{1}{L}, \frac{1}{V}\right)$$

and involves *a single function of four independent variables, not a product of four functions each of one independent variable.*

Of course it *may* happen in such a case that the function assumes the form given in the paper, but this does not follow from elementary algebra and the statement can only be justified if it is based on experimental evidence. The statement on page 206 that the relation between θ and $1/L$ "is most marked at high velocities" seems contradictory to any such assumption. If (keeping the other variables constant) we assume (as Col. de Villamil does) that

$$\theta \text{ varies as } F_3\left(\frac{1}{L}\right) \times F_4\left(\frac{1}{V}\right)$$

the law of variation of θ when L varies and V is constant will be independent of the velocity and will be the same at high as at low velocities.

In view of Col. de Villamil's statement that the laws obtained by Avanzini are to be regarded as qualitative rather than quantitative the particular form of the relation between the five variables stated on page 209 appears to be without justification.

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