SIR,—Whilst thanking Professor Bryan for his criticisms, I would like to state, in mitigation of sentence, that I was abroad when the paper was printed and so was unable to read the proofs.*

(1) Correct: This appears fairly evident from the context.

(2) Error on page 204:

$$f\left(\frac{1}{V}\right) \quad \text{should be} \quad \frac{1}{f\,(V)}.$$

I have not my manuscript so do not know if this is my fault or that of the printer.

(3) I am inclined to agree with this: as, however, we know next to nothing about the form these functions take, no misunderstanding is likely to arise from the omission of suffixes.

(4) I suppose I must cry *peccavi* for the "sign of multiplication": a comma, in place of this, would have expressed the meaning I intended to convey. Professor Bryan's

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

would appear even more elegant.

Page 206: This phrase is badly worded and the objection is quite sound. What I meant was that the *effect* was more *apparent*, or *noticeable*, at high velocities.

I regret that a few other errors have crept in.

Page 194, line 7: "Lights" should be "Sights" (see the "eyes" on Plate II.).

Page 197. Expt. IV.: Angle 8° 30′ should be 18° 30′.

Page 199. Expt. IV.: Angle 28° 38′ should be 20° 38′.

Page 201. Expt. I. (in Air): Angle 15° 33′ should be 15° 33″. (As Avanzini was not able to measure to seconds, this may be either (1) an error in the original or (2) the mean of a large number of experiments.)

Page 202. Expt. IV.: Angle 9° 30′ should be 9° 30″. (Same remarks.)

It may be interesting to know that Colonel Duchemin (*Les lois de la résistance des fluides*), in referring to Avanzini's work on page 224 of his book falls into an error:—

"4° En faisant varier les dimensions de la plaque, sans changer ni la vitesse ni l'intervalle *ce*, on observe qu'avec *l'augmentation de la longueur ab* l'angle *bcd* devient *moins aigu*." This is obviously an oversight, for he concludes the paragraph, "D'ou l'on conclut que le centre de résistance s'approche d'autant plus *du centre de figure* que la plaque *est plus longue*."

R. DE VILLAMIL.

## MILITARY AERONAUTICS.

*September*, 1912.

SIR,—Having read with very great interest in the July number of the JOURNAL the lecture given by Brigadier-General D. Henderson, C.B., D.S.O., on "The Design of the Military Scouting Aeroplane," also the very interesting discussion which ensued, I cannot resist the temptation to offer a few remarks in the hope that they may be of service.

While all due weight must be given to lessons derived from military experience in the past, I think that much additional help may be derived from careful observation of those who are accustomed to go about their business at high speeds, viz.:—the birds and fishes. For instance, the question of invisibility has been settled, as a rule with very few exceptions, for those birds and fishes that live on or close under the surface of the sea and are liable to attack both from above and below. They require to be as inconspicuous as possible and their undersurfaces are *pure snow-white*, while the upper surface is a darkish brown or gray. The reason for this arrangement of colour is obvious.

Then again in fighting tactics something may be learnt from the crows. When they get a "wireless" they proceed to the spot indicated each "on his own" and when they have completed their task, or if they are attacked meanwhile they *disperse* and return.

* It should be said that the proofs of his paper were read for Col. de Villamil by a gentleman selected by him.—EDITOR.

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No longer will a general march sword-in-hand at the head of his serried ranks. He will sit in his office and the weather being suitable, perhaps an hour before dawn, he will send out a wireless to his men something like this :—" At 7.10 a.m. (say 10 minutes after daybreak) you must arrive at No. .. locality (on map of enemy's country, it may be 50 miles beyond the frontier) and participate in destruction of ..... railway station. Then disperse, return and report." When the aviator arrives at his destination he finds that he is only one of a hundred approaching from different directions who have all come on the same errand.

ALAN OWSTON.

Yokohama.

## SOARING FLIGHT

SIR,—Referring to Dr. Hankin's paper on " The Soaring Flight of Birds " in the April number of the JOURNAL, I would like to put forward a theory, for whatever it may be worth only, as it is not supported by any exact experiments.

One very hot summer day I was walking along a shingly beach very greatly oppressed by the heat. I took refuge in a tea-house, standing back maybe a hundred yards from the sea. From the upper verandah of this tea-house a bamboo sun-shade extended for some fifteen or twenty feet, and to my great surprise and relief I found there was a marvellous cool breeze blowing in. On the sea there was just a light air but when this reached the shore it was driven straight up by the currents rising from the heated shingle. The phenomenon is of course common enough, but this instance was so marked as to create a lasting impression. It was like extracting a cool breeze from a furnace. Now, may not the cooling of the air in the shade beneath the outspread bird cause a draught of wind to blow after it ? This would certainly agree with Dr. Hankin's statement (page 84) that " the air under the wing is more compressed than the air over the wings." The effect of such a draught might possibly be cumulative up to a certain point and it seems to be generally admitted that very little force is required to propel the bird. In the case cited above it is easy to conceive that if the tea-house had been mounted on wheels it might have been moved by the wind induced by itself. The conditions appear to be generally the same as those required for the formation of a waterspout, only on a miniature scale ; viz. : a column of dense shade. It may be noted that soaring birds are generally well provided with shade feathers, viz. : large thick secondaries, and I have noticed the very sharply-defined shadow birds throw on the ground when soaring.

Sailing-flight I take to be quite a different affair from sun-soaring, although at times the two may be used in combination. Birds equipped specially for sailing flight such as the albatross and gannet are poorly provided with secondaries.

If one might do a little soaring oneself into the realms of speculation, might it not be possible that the vulture soaring at great height is assisted in finding his food in calm weather by a column of air blowing directly to him from a definite spot, or line on the ground ?

To sum up—the theory I suggest is that the power required to support and propel a bird when soaring is derived from the difference between the temperature in the direct rays of the sun and in the shadow of the bird. The exact working of the principle is doubtless well-known to designers of hot-air engines.

ALAN OWSTON.

Yokohama.

## A.B.C. OF HYDRODYNAMICS

SIR,—Your reviewer complains that I made no mention of Bernouilli in my book ; I certainly thought it superfluous and quite unnecessary.

Your reviewer's reference to him is, moreover, inaccurate. Bernouilli was not an Italian, and he did not publish his book in Italian. He was a Swiss and a Professor at Bâle. His *Hydrodinamica* is published in Latin.

Venturi was an Italian, but his *Recherches Expérimentales* was published in Paris and in French. The date (1860) given by your reviewer is not correct ; a reference to the title page where the author is called " le Citoyen J. B. Venturi " would make one suspect that the date was about that of the Battle of Marengo, or earlier—the exact date was year VI. (1797).

An English translation was published in London in 1799.

R. DE VILLAMIL.