afloat, although even with that the only part that did keep above water was the tail and elevator. F. B. FOWLER.

Natural Stability.

[1469] May I be allowed to point out to Mr. C. W. Beckmann that my invention is for "improvements in aeroplanes" and not for *kites*. There is a vast difference between the two.

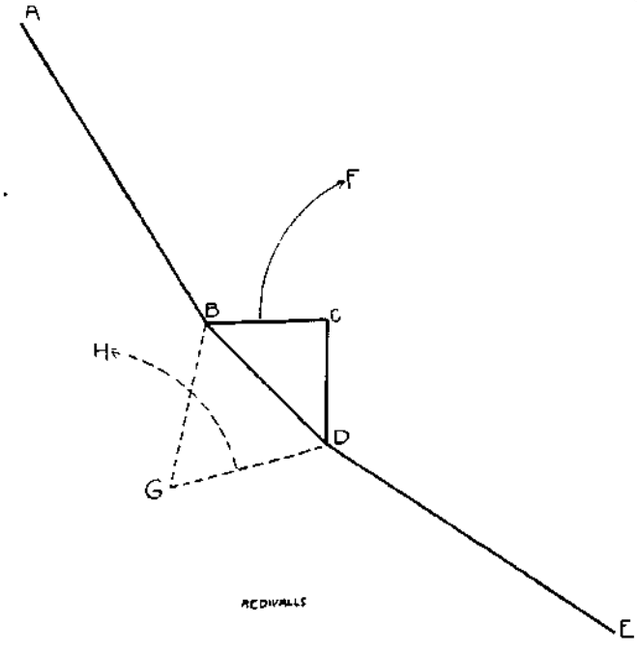
As Mr. W. Le Maitre has drawn our attention to his invention I presume he invites criticism, and I therefore propose to show that, although I have no doubt his monoplane would certainly right itself, still it has two objections from my point of view.

First: I do not agree with a low centre of gravity because I am afraid it would result in a lateral pendulum motion.

Secondly: Long before taking out my patent I tried a "triangular duct arrangement" although unaware of his invention. I, too, found that a low c.g. was essential. The reason is obvious. In the illustration we see a monoplane of this design "banking" in presumably circling. It will be apparent that the panel, B C, is now exerting a lift whilst panel C D is not. Unless you use a low c.g. the lifting effect of plane A B, plus panel B C, being much greater than that of plane D E, it will certainly cant the monoplane further in the direction of F in horizontal flight.

On the contrary, one of the chief points of my invention is that the panel, D G (dotted lines), more than counteracts the effects of panel, B C, by virtue of its greater area by exerting a greater lift in the direction of H.

Scientifically, too, if you place a "triangular duct" *over* the plane you must also place one *under* the plane. Otherwise a side wind would cant the monoplane over. The pendulum action of a low c.g.



would be more apparent, as it would be continually righting the monoplane. I will anticipate further correspondence by stating that I have also tried my monoplane without panels, B C and C D, and without a low c.g., taking out a provisional patent, and subsequently abandoning it.

I found that a side wind caused a rocking motion, and that in a vertical fall the resistance of panel, G D, prevented it righting from vertical to horizontal. I am quite aware that this panel in theory somewhat counteracts the effect of panel, D C, in a vertical fall, but the increased lift and the dihedral-angled planes in combination completely overcome it.

Of course, a bird has in its body a counterpart of my irregular diamond. It is obvious that it presents an extra lifting surface, G D, when canted over, and that it has no counteracting lift at B C, owing to being an *enclosed* body. In fact, the resistance at B C is a *downward* one, thereby accelerating stability. Therefore, if you close my irregular diamond panels in stream-line form, you have a perfect *natural self-righting* monoplane. But you must not forget the extra *resistance* which our experts so very much impress upon us. How they are going to obtain natural lateral stability without extra resistance I do not know, if my invention does not supply it.

Eccles. WILL H. BOOTH (Redivalls).

"Ergaer."

[1470] Independent testimony may be of value in testing previously recorded observations. Hence, perhaps, it may be of interest to your readers to have the results of an unprejudiced observer, albeit his qualifications in no way compare with those of the able writer of the articles you have been publishing on "Bird Flight."

A fortunate chance gave me the welcome opportunity of going to Agra, and making Dr. Hankin's acquaintance.

The neighbourhood of Agra is a splendid field for making observations on the soaring flight of birds. Five miles out are extensive meat-curing establishments, where carrion birds abound. Of these there are seven varieties, gradually increasing in size from the common cheel to the weighty adjutant bird.

At this time of the year the nights are still and cold, the days bright and cloudless, with little or no wind, ideal conditions for verifying observations on soaring flight.

On December 3rd Dr. Hankin motored me out to Jharna Nullah. On arrival, about 9.14 a.m., immense numbers of birds were standing about, the ubiquitous cheels were flapping in the air. Occasionally some other bird would make a short flight and re-settle.

As the sun got higher and the air warmer, the cheels commenced soaring, the heavier birds would rise flapping and attempt short glides only to come down again. The analogy of a skater venturing on to doubtful ice and retiring, instantly occurred to one.

Gradually and in strict succession, each variety of bird took wing and remained soaring. Finally in an hour's time all the varieties were in the air, except the adjutant birds, the order of starting being in accordance with their respective weights. First the cheels, then the scavengers, eagles, common vultures, and black vultures. Unfortunately we had to leave before the adjutant birds got up. The following is a verbatim transcript of the notes I made independently on the spot. The notes would have been more valuable had my power of observation been better trained. Many details escaped recognition simply from this cause.

9.25.—Cheels circling, bright sunshine, faint air from W. Slight haze, low lying.

9.30.—Cheel gliding just overhead, tail twisting.

9.31.—Scavenger flap gliding. Dip of right wing turning to right.

9.33.—Cheels slow flex gliding up wind.

9.34.—Cheel circling in small circles 30 feet up, slight movements of wing tips visible, also tail twisting.

9.36.—Black vulture flap gliding in circles.

9.37.—Scavenger suddenly checked speed overhead and dropped legs momentarily, then continued flight (Note i).

9.40.—Cheel circling to right, forward thrust of inner wing for a moment (Note ii).

9.41.—Loose downy feather gradually descending amid circling cheels above and below.

9.43.—Vultures still all on the ground.

9.47.—Scavenger flap circling.

9.48.—Same bird settled.

9.53.—Cheel slow flex gliding up wind without loss of height for 200 yards.

9.57.—Common vulture flap gliding up wind.

10.0.—Breeze increasing, 8 to 10 miles an hour.

10.3.—Scavenger circling.

10.5.—Vultures flap gliding up wind.

10.7.—Adjutant flap gliding.

10.8.—Several vultures up, flap circling. Dip movements for steering, drifting to leeward.

10.11.—Vultures circling, occasional flaps.

10.13.—Vultures circling, no flapping.

10.14.—Cheel tail jolting (Note iii), many vultures up.

10.25.—Black vultures circling.

Note i.—Apparently to avoid a collision.

Note ii.—To check over-banking.

Note iii.—Dr. Hankin had observed this several times before I could discern the movement.

The observation recorded at 9.41 is particularly important. It is conceivable that the column of circling cheels could have been supported only by an ascending current of air, which failed to support a loose bit of downy feather. The birds were passing above and below the bit of white down, without loss of height or change of course, which shows that the feather was not in the descending centre of an ascending hollow column of air.

I regret that it was not possible to wait and observe when the adjutants finally begin to soar.

Certain facts at once obtrude themselves on consideration. Birds do not soar at all times. The lighter birds commence soaring before the heavier ones. Birds may be seen flap gliding for short flights, apparently testing the soarability of the air. Finally, under the influence of the sun's rays the air becomes soarable. This soarability is not due to ascending local currents, witness the incident of the falling feather.

I omitted to mention the fact that on December 3rd birds could be seen soaring in all directions over a very wide stretch of country, both over the low lying huts of the meat-curing establishment and over the surrounding flat, bare country intersected with nullahs and ravines.