THURSDAY, MAY 14, 1896.

FLIGHT.

The Aeronautical Annual, 1896. Edited by James Means. Medium 8vo, pp. 158. (Boston: W. B. Clarke and Co. London: Wm. Wesley and Sons, 1896.)

Zur Mechanik des Vogelfluges. Von Dr. Fr. Ahlborn. Demy 4to, pp. 134. (Hamburg: L. Friedrichsen and Co., 1896.)

TILL quite recently, artificial flight was regarded in much the same light as perpetual motion, the philosopher's stone, and other insoluble problems. But, now that Maxim, Langley, and others have demonstrated the possibility of overcoming the purely mechanical difficulties of flight, a wide field has been thrown open for scientific research in investigating the laws underlying the flight of birds and their practical application to the flight of man. The present record of investigations performed and theories propounded during the past year, will prove of great value to all who are interested in the subject by indicating what work has been done and what still remains undone.

The "Annual" opens with a long account by Lilienthal of recent experiments performed with his new apparatus, in which two superposed wing surfaces are employed instead of one. A description of these experiments was given in NATURE for January 30; but it may be interesting to call attention to the diagram of the undulating path of Lilienthal's machine when raised by a sudden head-wind and again allowed to descend. The motion bears a striking resemblance to that of a model glider allowed to descend in still air, although in the latter case the undulatory course is not due to any wind beyond what the glider makes for itself in its descent.

After a short editorial note on the analogy between the development of the flying machine and that of the modern bicycle, we have a well-written article by Maxim on "Natural and Artificial Flight." Our interest naturally centres round the sections dealing with the author's experiments on the relative advantages and disadvantages of narrow and wide planes. These experiments fully confirm the theory that narrow superposed planes possess greater lifting power per square foot than a single wide plane, a principle which Maxim proposes to utilise most ingeniously in his next machine by constructing his condenser of aeroplanes capable of lifting their own weight + 1000 lb. additional. Maxim, however, doubts whether in an actual machine it may be safe to dispense with wide planes altogether, on account of the risk arising in case of a sudden breakdown. Possibly a suitable compromise may result from adopting the "cellular" principle, which has been introduced with such success in the Hargrave kite. A number of important experiments with this and other kites, notably the "Malay" kite, are described in subsequent articles of the "Annual."

That aerial navigation is regarded as a subject of national importance on the other side of the Atlantic, is evidenced by the Bill introduced into the Senate of Washington on December 4, 1895, to provide for the award of money prizes of 100,000 dols. and 25,000 dols., the first for the successful achievement of mechanical flight, and the second for improvements in soaring machines. The editor of the "Annual" evidently inclines to the view that the final solution of the problem will result from a successful combination of the ingenuity of Lilienthal and Maxim.

Passing now to the flight of birds, we find in the first part of Dr. Ahlborn's memoir a detailed account of the form and structure of birds' wings, and their action in active or "rowing" flight. Marey's observations, in particular, are discussed at some length and freely criticised. The second part deals with the so-called soaring of birds—that is, their power of sustaining themselves continuously in the air without flapping their wings; the term "sailing flight," lately adopted by American writers as a literal translation of the French "vol à voile," is a better name for this action. Unfortunately Dr. Ahlborn's suggested explanation will not bear close examination from a theoretical standpoint. We may take it as an axiomatic consequence of general dynamical principles that when a current of air is blowing uniformly, the relative motion of a bird flying freely is the same as if the current were reduced to rest by applying an equal and opposite velocity both to the air and bird. Starting from this fact, Lord Rayleigh, Prof. Langley, and other investigators have long realised the impossibility of a bird supporting itself without the expenditure of muscular action in a *uniform* horizontal wind, and they have therefore had to seek other sources of energy, either in the variability of the wind velocity, or in local upward convection or other air currents, of which birds have been supposed to take advantage. Dr. Ahlborn, however, seems to hold the opinion that these variations are rather a hindrance than a help to the sailing bird, and that the kinetic energy of the wind is the sole source from which the bird derives its energy. To support this view, the author considers the action of a side wind on a bird sailing round and round in a circle, and he derives his supposed gain of energy by arguments which, though ingenious, are not at all convincing.

The theory of sailing flight is examined from a somewhat more plausible standpoint in the "Annual." Maxim inclines to the view that upward currents of air are the chief cause of the phenomena. Prof. Pickering contributes an article first published in 1889, in which he advocates the theory that the action depends on pulsations or gusts of wind, thus agreeing substantially with the views enunciated subsequently by Prof. Langley in his paper on "The Internal Work of the Wind."[1] Mr. Octave Chanute contributes the first portion of a paper on the subject, but as yet he deals exclusively with observations on sailing birds, and gives no theoretical explanation of their action. We regret that this writer has had to defer till next year's "Annual" his mathematical calculations connected with this singular phenomenon.

With such literature as the "Annual" at hand, the aeronaut should have little difficulty in deciding what experiments will be the most likely to lead to the realisation of artificial flight. G. H. B.

[1] Proceedings of the Aeronautical Congress at Chicago, 1893.