

tended discussion of problems in hydraulics (flow in pipes and channels) is given (in which references to quite recent work are made). Then follows a good account of the Prandtl boundary layer theory and a discussion of resistance (Stokes' theory, Karman vortices, etc.). The theory of airfoils is amply treated (it being pleasant to see the credit given to Lanchester's pioneer work). The book closes with a chapter on experimental methods and apparatus and an appendix containing some sixty-eight photographs made by the author of various types of flow.

We strongly recommend this work to any student of practical hydrodynamics. As in the case of the companion volume, one interested mainly in the mathematical theory will have to look elsewhere.

F. D. MURNAGHAN

*Les Calculs Formels des Séries de Factorielles.* By J. Ser. Paris, Gauthier-Villars, 1933. vii+98 pp.

This book has to do with series, such as

$$f_0 - \sum_{n=1}^{\infty} f_n \frac{x(1-x) \cdots (n-1-x)}{1 \cdot 2 \cdots n},$$

arising in connection with the table of successive differences of the values of a function  $f(x)$  for equally spaced values of  $x$ . A large number of transformations of these series, and of expansions of particular functions in the series, are given. The treatment is entirely formal, there being only a few passing remarks about questions of convergence. Nothing in the way of a theory is developed; the contents consist chiefly of a collection of special calculations.

Even when due allowance is made for the restrictions that have been imposed intentionally on the subject matter, the book remains rather unsatisfactory. As there is no index, and as the subdivisions of the chapters have no titles, it is difficult to use the book for reference purposes. In many places, because of the lack of full explanations, the meaning is obscure. There are no references to the literature, and there are many typographical errors.

L. A. MACCOLL

*Le Mystère et le Paradoxe du Vol Animal.* By Émile Batault. Paris, Gauthier-Villars, 1933. 14+236 pp.

*Sur l'Excédent de Puissance des Oiseaux.* By A. Magnan and A. Planiol. Paris, Hermann, 1933. 25 pp.

*Sur l'Excédent de Puissance des Insectes.* By A. Magnan and A. Planiol. Paris, Hermann, 1933. 26 pp.

It must have been from the flight of birds that man first conceived the ambition to fly. And it was natural to believe that the solution of the problem lay in the study and imitation of animal flight. The student of the history of science is familiar with the drawings that Leonardo da Vinci made of wing-like appliances for man's use. The difficulty in the problem was that of power. The perfection of the gasoline motor and the screw propeller gave an entirely new approach to the question. As a result the flight of airplanes and the flight of birds differ in fundamental ways, and in consequence the latter has lost some of its interest. As a natural phenomenon, however, the flight of birds is still