PROBLEMS OF MODERN AERODYNAMICS (1)

BY PROF. ENG. E. PISTOLESI.

After mentioning the results of classical aerodynamics and pointing out their disagreement with those of experimental aerodynamics (paradox of d'Alembert, impossibility of creation of vortices etc) the author illustrates in brief the principal manners in which modern aerodynamics has attempted to approach reality, in an effort to bring together theory and practical tests. Beginning with the hypotheses which have taken as a basis the perfect fluid, the Helmholtz theory of the continuous wake, subsequently improved by Kirchoff, Levi-Civita etc. is mentioned, pointing out its great value and its serious deficiencies at the same time. The author then examines the theory of lift in plane motion, according to the views of Joukowski, subsequently improved by von Mises and others, and expresses the opinion that this theory does not disagree, as believed by others, with the theory of perfect fluids and in particular with the theorems of the conservation of vortices; the points of coincidence (very remarkable) and those

(1) Lecture held May 22 at the Pontifical Academy of the "Nuovi Lincei" and illustrated with lantern slides and moving pictures.
of divergency of the theory with results of practical tests are set forth in brief. The author then discusses the problem of a wing of finite span, solved in accordance with the principles of Lanchester and Prandtl, which were developed by Prandtl himself and his assistants at the laboratory of Göttingen.

The problem of resistance and its causes (induction, friction, profile drag) is also discussed by the author who examines also the Kármán theory of wakes.

The author then discusses viscosity, as an indispensable element for the creation of a modern theory of aerodynamic phenomena: he shows the influence of the Reynolds number: \( \frac{vL}{\nu} \) and mentions the existence of various types of flows. Particular attention is given to the Prandtl theory of the "boundary layer" (Grenzschicht), illustrating the very interesting consequences of same, particularly with respect to the detachment of the current from the walls of bodies surrounded by said current. The author illustrates the process which, at the beginning of motion, through the formation of "Anfahrwirbeln" leads to the formation of a normal flow around a cylinder, a wing profile, etc. The behaviour of wings at high incidence is also explained by the accumulation of dead fluid on the back of the wing; this phenomenon may be eliminated or delayed both with the Handley-Page slot wing and with the suction or blowing away of the adherent dead fluid.

The author illustrates with lantern slides and moving pictures (1) the surprising effects which may be obtained with the suction method on cylinders, on wing sections, on a current flowing though a canal the walls of which are strongly diverging, in order to prevent the detachment of the current at such points where it would normally take place. The "Magnus" phenomenon is also discussed and explained.

The lecture is ended by mentioning a number of other problems (Oseen theory, fluids the viscosity of which tends to zero etc) still under study.

(1) Moving pictures of the greatest interest, produced by the Aerodynamical Laboratory of Göttingen.
AERODYNAMIC FORCES ON AEROFOILS
IN THE PRESENCE OF SOURCES OR VORTICES

BY G. GRASSI.

The problem discussed by the Author is of particular importance for the study of bladed hydraulic machines (turbines and centrifugal pumps).

The Author limits himself to the plane problem and considers at first the dynamic action exercised by a source (rectilinear and indefinite) against a circular cylinder, both in the case of no circulation around the cylinder (Euler’s current) and in that of a circulation around the cylinder. In the first case the force is an aspiration towards the source, while in the second case to said aspiration is added a lift which is obtained by multiplying the density by the circulation and by the velocity induced by the source at the center of a circle in which the cylinder is cut by the plane xy. The lift is normal to the direction of the velocity induced at the center of the circle. The Author also studies, in particular, the behaviour of the velocity and of the pressure around the circle, the behaviour of the lines of current etc.

The Author then passes to the study of the dynamic actions created by a vortex (rectilinear and indefinite) outside of the cylinder, with and without circulation around the cylinder. Also in this case there is an aspiration towards the vortex and, in the case of a circulation, there is also a lift fully analogous to that examined in the case of the source. In this case, however, the direction of the lift coincides with that of the aspiration, while in the preceding case it was normal to the aspiration.

The case in which the cylinder is in the presence of a source-vortex, that is, of a source and a vortex superposed is analogous to those discussed above.

The Author then passes from the case of the circle to the case of a wing profile (aerofoil) by making use of the conform representation and by calculating the aerodynamic forces and their relative moments with the Blasius formulae.

The Author then passes to the calculation of the circulation around the aerofoil in accordance with the principle of Joukow-
ski, that is, so that the velocity at the edge of the wing profile remains finite, which means that the velocity at the point of the circle corresponding to the edge of the wing profile must be zero.

The values determined for the circulation, either in the case of the source, or in that of the vortex, or again in the more difficult case of the source–vortex, are interpreted geometrically by the Author in a very elegant and satisfactory manner.

The Author finally shows that the results are much simpler under the hypothesis that the source or the vortex find themselves very far from the aerofoil, in which case the formulae coincide with those, well known, of the parallel current, provided however that the velocity induced by the source or by the vortex (or by the source–vortex) at the center of the wing profile be taken as the asymptotic velocity.

The researches herein described must be completed by the consideration of the rotation of the aerofoil about the source–vortex, and by extending the case of only one wing profile to the case of a system of equal profiles distributed regularly around the source–vortex.

THE VALLAURI PRIZE FOR PHYSICS WON BY TWO MEMBERS OF THE ITALIAN ASSOCIATION OF AEROTECHNICS

BY PROF. GIACOMELLI.

The two members of the Italian Association of Aerotechnics Prof. E. Pistolesi and Eng. A. Marchetti have won the prize of the Royal Academy of Science of Turin for the most important works of theoretical and applied physics made in the four years 1923–1926. The author describes the work of the two scientists, discusses their merit and reproduces the decision of the Commission which examined their work, in assigning the prize.

THE HARRY GUGGENHEIM PRIZE FOR THE FLYING MODEL COMPETITION

BY PROF. R. GIACOMELLI.

Mr. Harry Guggenheim, wishing to demonstrate to Gen. Balbo his appreciation of Italian Aviation, sent to him a cheque of
10,000 lire, asking him to establish a new prize for the flying model competition which will take place in the Littorio Airport.

The gift is a purely personal matter of Mr. Harry Guggenheim, because the Fund does not extend to these competitions.