A Bristol Fighter was fitted in succession with two sets of auxiliary leading aerofoils chosen as the result of tests carried out by Messrs. Handley Page in their wind tunnel on a model monoplane. The main wing section, to the rear of the front spar, was standard, and the front portion and leading aerofoils were shaped so that if the slot were closed a good high-speed section would be formed. No experiments were carried out with slot closed, the object of the test being to determine scale effect on lift and drag in the neighbourhood of the maximum lift.

In the case of the small leading aerofoil the full-scale and model maximum lift coefficients are in agreement at 0·74. With the large leading aerofoil, however, the full-scale reaches 0·85, as compared with 0·77 for the model. The model drag coefficient is about 0·007 higher than the full scale in both cases.

The experiments are being extended to compare the centre of pressure and downwash in the case of the large leading aerofoil. These data are required for the calculation of tail settings.

EXPERIMENTS ON THE FLOW BEHIND A ROTATING CYLINDER IN THE WATER CHANNEL.

By E. F. Relf, A.R.C.Sc., and T. Lavender.

R. & M. No. 1009.—(Ae. 215). (2 pages and 11 diagrams.) May, 1925. Price 9*d.* net.

The Flettner Rotor Ship has brought before the public one practical method of using the special properties of a rotating cylinder in a wind, these properties have been studied in various laboratories to find the aerodynamic efficiency of the cylinder. The present report describes a visual study in water and gives a number of photographs which show clearly the development of an increasing circulation as the rotational speed of the cylinder increases. Owing to the small scale of the available apparatus, no conclusions could be drawn as to the behaviour of the flow from the experiments at the higher rotational speeds.

ON THE DRAG OF AN AEROFOIL FOR TWO-DIMENSIONAL FLOW.

By A. Fage, A.R.C.Sc., and L. J. Jones.

R. & M. No. 1015.—(Ae. 218). (14 pages and 3 diagrams.) November, 1925. Price 7*d.* net.

According to modern aerofoil theory, the drag of an aerofoil of finite span is compounded of two parts, one a profile drag associated with the shape and attitude of the section, and the other an induced drag connected with the variation of lift along the span. The magnitude of this induced drag can be determined when the forces acting on the aerofoil are known. As the span increases, the profile drag per unit length approaches a limiting value, whereas the induced drag becomes relatively smaller, because of the more uniform distribution of lift, and would disappear completely if the span were infinite. The present paper deals exclusively with the profile drag of an aerofoil of infinite span, or, in other words, the drag for two-dimensional flow.

The experiments were made on an aerofoil of 0·5 ft. chord mounted in a 4-ft. wind tunnel, with small clearances between the tips and the tunnel walls (0·15 in.). Preliminary observations of total head showed that the wake was uniform along the span, except in the neighbourhood of the walls, where it opened out appreciably.

Observations of the normal components of the pressure around the median section of the aerofoil have been made, and it has been estimated that in the neighbourhood of minimum drag they account for about 80 per cent. of the total drag. For this particular aerofoil, therefore, the surface tractions contribute about 20 per cent. of the total drag.

Included in the paper is a comparison between the drag for two-dimensional flow predicted by the Prandtl theory from force measurements on an aerofoil of rectangular plan form, the ratio of span to chord being 6 : 1, and that estimated from the total-head losses in the wake ; the agreement is close, except at large incidences, where the discrepancy is of the order of 10 per cent.

Finally, observations of pressure and velocity taken in the wake at some distance behind the aerofoil (0·68 chord), show that most of the total head losses can be accounted for by a decrease of velocity, and that the pressure does not differ appreciably from that measured in the surrounding stream.

REPORT ON DOPES AND DETONATION.

By Professor H. L. Callendar, C.B.E., F.R.S., Assisted by Captain R. O. King and Flying Officer C. J. Sims. Communicated by the Director of Scientific Research.

R. & M. No. 1013.—(E. 18). (54 pages, 15 figures.) November, 1925. Price 2*s.* net.

The investigations forming the basis of this report were undertaken at the Air Ministry Laboratory by request of Mr. H. E. Wimperis, then Acting Director of Scientific Research, who arranged for the experimental work to be directed by Professor Callendar and allocated suitable engine equipment to the Laboratory, following the submission by Professor Callendar of the nuclear theory of detonation.

The primary object of the investigation was the determination of the physical actions that delay or prevent detonation in an engine cylinder.

Such laboratory and engine experiments as were considered necessary to test the nuclear theory of detonation have been carried out, and, in addition, previous work bearing on the phenomena of detonation in engine cylinders has been reviewed.

The nuclear theory of detonation explains generally the action of dopes in delaying detonation, certainly to the extent that it may be taken as a guide in searching for anti-detonating substances free from the objectionable characteristics of the metallic dopes, and not subject to limitation of supply in time of emergency.

It is suggested that trials of metallic dopes should be made at higher engine compression pressures, and that the investigation of non-metallic dopes might be continued with the object of finding effective anti-detonating substances other than benzene derivatives. These trials will shortly be put in hand.

AN EXPERIMENT TO DETERMINE IF SLIP CAN BE DETECTED DURING THE UNLOADING PORTION OF A CYCLE OF REPEATED TENSILE STRESSES.

By H. J. Gough, M.B.E., B.Sc., S. J. Wright, B.A., and D. Hanson, D.Sc.

Work Performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. & M. No. 1022.—(M. 38). (6 pages and 6 figures.) December, 1925. Price 6*d.* net.

The object of the present experiment was to determine whether any plastic deformation could be detected as the result of the unloading part of a cycle of repeated tensile loading.*

An apparatus was designed by means of which a test piece could be stressed in tension, and could be examined and repolished while under load. The load being then released, a further examination could be made. Any changes in microstructure due to the unloading could thus be isolated from those occurring in the remaining portion of a complete cycle.

No change in microstructure could be detected as a result of one unloading of a single crystal of aluminium from a stress of 1·78 tons/sq. in. On the other hand, no change could be detected when the specimen was *re-loaded* to the same stress, although a multitude of slip bands resulted from 100,000 further cycles. Consequently, the results of the experiment prove only that the amount of plastic strain which occurs in any one cycle after the first, at the range of stress used, is not sufficient to be detected under the microscope.

It is proposed to repeat the present experiment on further specimens using a much higher maximum stress. Similar work will also be performed on crystalline aggregates.

* The more general investigation has been published under the title, "Behaviour of Single Crystals of Aluminium under Static and Repeated Stresses."—Gough, Hanson and Wright. Phil. Trans., Roy. Soc., Series A, Vol. 226, pp. 1–30, 1926, and R. & M. 995.