THE EFFECT OF METALLIC SOLS IN DELAYING DETONATION IN INTERNAL COMBUSTION ENGINES.

By Flight-Lieut. C. J. SIMS, D.F.C., D.I.C., R.A.F., assisted by Dr. E. W. J. MARDLES, F.I.C.

Presented by the Director of Scientific Research. R. & M. No. 1021 (E. 19). 11 pages. May, 1926. Price 6*d*. net.

The experimental work with metallic sols was undertaken as part of the Air Ministry Laboratory investigation of the cause of detonation in carburettor engines. A more general investigation has been published in R. & M. 1013 under the title of "Reports on Dopes and Detonation" by Pofessor Callendar.

The investigation of the action of metallic sols as small additions to engine fuel has included trials of as many such sols as it has been found possible to prepare.

It has been found that colloidal solutions of iron, lead and nickel in petrol are as effective in delaying detonation as the organo compounds of these metals. Metallic iron seems to be more effective than its carbonyl compound.

It is proposed to continue experimental work with metallic sols with a view to obtaining evidence as to the manner in which they act in delaying detonation.

THE ANALYSIS OF EXPERIMENTAL RESULTS IN THE WINDMILL BRAKE AND VORTEX RING STATES OF AN AIRSCREW.

By H. GLAUERT, M.A.

R. & M. No. 1026 (Ae. 222) (8 pages and 2 diagrams). February, 1926. Price 3*d*. net.

The vortex theory of airscrews, as developed in reports R. & M. 786* and 869,† determines the behaviour of an air screw under ordinary working conditions, but breaks down in the vortex-ring state and in part of the windmill-brake state. The theory may be represented in the form of a characteristic curve connecting two non-dimensional parameters F and *f*.

An attempt to extend the theory empirically and by means of certain general theoretical arguments has been made in report R. & M. 1014,‡ and this discussion has revealed the general nature of the characteristic curve in the region where the vortex theory breaks down. The experimental data have been analysed in the present report to determine the form of the characteristic curve in the regions where the vortex theory is inapplicable or inaccurate.

An empirical form of the characteristic curve has been determined which fits the experimental data and joins on to the theoretical curves in the propeller and windmill-brake states. The exact form of the curve will remain somewhat uncertain until the tunnel interference is known accurately or until further experiments are available from an open jet tunnel.

* R. & M. 786.—An aerodynamic theory of the airscrew.—Glauert, R.A.E.

† R. & M. 869.—Notes on the vortex theory of airscrews.—Glauert, R.A.E.

‡ R. & M. 1014.—An extension of the vortex theory of airscrews with applications to airscrews of small pitch and including experimental results.—Lock, Bateman and Townend, N.P.L.

HYDROGEN AS AN AUXILIARY FUEL FOR A SOLID INJECTION OIL ENGINE.

BY G. F. MUCKLOW, M.SC. COMMUNICATED BY PROFESSOR A. H. GIBSON.

R. & M. No. 1029 (E. 20) (16 pages and 17 diagrams). April, 1926. Price 1*s*. net.

The report deals with experiments carried out in the Engineering Laboratories of the University of Manchester, on a Crossley solid-injection oil engine, in which small quantities of hydrogen and coal gas were introduced along with the air supply to the engine. The engine has a bore of 14 in., a stroke of 23 in., and a normal speed of 211 r.p.m. Its normal rating is 66 b.h.p.

References are made to the work of Dixon, Riedler, Wollers and Ehencke. Watson (Proc. Inst. Mech. Eng., May, 1912), and Fenning (R. & M. No. 979, May, 1924).

Three series of trials were run with hydrogen, each at a different load, viz., 53·4, 39·4 and 24·4 b.h.p. The maximum amount of hydrogen used was slightly more than 3 per cent. by volume of the air supply, corresponding, at the lightest load, to some 14 per cent. by weight of the oil fuel supply.

Three corresponding series of trials were run, using coal gas in place of hydrogen, the maximum volume of gas employed being 5 per cent. of the air supply. At the lightest load this corresponds to approximately 2·4 times the weight of fuel oil used.

Such quantities of hydrogen or coal gas can be used satisfactorily in the type of engine considered. No trouble was experienced due to pre-ignition or other causes, and the engine appeared to run more sweetly when gas was being used.

When running at constant load and speed, the admission of small quantities of gas appears to cause combustion to take place at a slower rate, giving a lower maximum pressure and more burning down the expansion stroke. The thermal efficiency is in consequence slightly reduced, while the heat losses to the exhaust are increased.

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THE ELEMENTS OF AEROFOIL AND AIRSCREW THEORY.

Very considerable strides have been made during the last few years in the development of a theory which would fit the observed phenomena connected with the action of a gas on a solid body such as an aerofoil, but it is rather strange that, although some of the earliest work on this subject was due to an Englishman, Mr. F. W. Lanchester, the development of the theory has been largely left to other nations, Germany in particular having contributed a great deal. Not only so, but it is to be feared that the work that has been going on abroad has not received at home the close and general attention which it deserved. Doubtless this is due in the main to the language difficulty. An excellent book on the subject of aerofoil theory was published in German some years ago,* but an English text-book on modern aerofoil theory has hitherto been lacking. It is therefore vastly more true of the new book by Mr. H. Glauert than is usually the case when the hackneyed phrase is used that it "fills a long-felt want." "The Elements of Aerofoil and Airscrew Theory," by H. Glauert, published by the Cambridge University Press at 14*s*. net, literally does "fill a long-felt want," and fills it in a manner wholly commendable. A very obstruse and learned exposition would have appealed to but a very few, but by writing it so as "to give an account of aerofoil and airscrew theory in a form suitable for students of aeronautical engineering who do not possess a previous knowledge of hydrodynamics," the author has rendered his book accessible to a vastly wider circle of readers.

Not that it should be assumed that Glauert's book is "easy reading." It is not, and the author does not profess to tell one all about aerofoil theory in "non-technical language." Had he claimed to do so, one would have looked upon the book with mistrust. As it is, complex mathematical analysis has been avoided as far as possible, and the book contains only the very minimum of "mathematics" necessary to the statement and explanation of the theory. The first five chapters give a brief introduction to those aspects of hydrodynamics which are required for the development of the theory. The following chapters deal with the lift of an aerofoil in two-dimensional motion, with the effect of viscosity and its bearing on aerofoil theory, and with the theory of aerofoils of finite span. The last three chapters deal with airscrew theory.

* "Aerodynamik," by Richard Fuchs and Ludwig Hopf. Published by Richard Carl Schmidt & Co., Berlin, 1922.