LIGHTWEIGHT CANARD

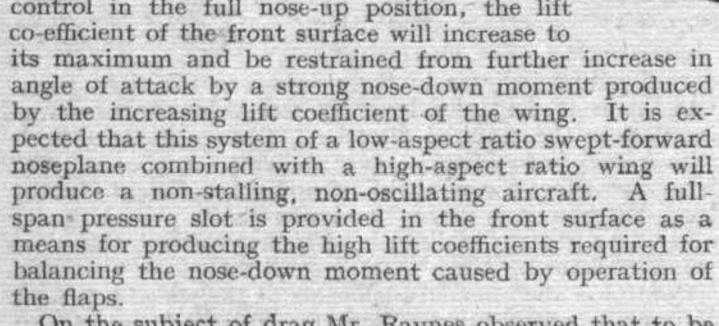
disadvantages in the high-speed range and increased production costs. The small wings used on the M.O.-1 further simplify the storage and handling problems.

Toed-in end-plate fins at the wing extremities are used to give directional stability. Pitching moments are produced by movable elevators attached to the noseplane, this surface combination operating at a higher lift coefficient than the wing and having a much lower aspect ratio. Both of these factors create longitudinal stability. The low aspect ratio front surface has a flat lift-curve slope, and the quarter-chord line of the noseplane/elevator combination is swept forward 10 deg. Forward sweep produces a flat-peaked lift curve which is desirable in reducing the tendency of a Canard type to oscillate following stalling of the front surface.

The weight balance and lifting forces are distributed in such a manner that stalling of the main wing is impossible. With the pilot's control in the full nose-up position, the lift co-efficient of the front surface will increase to its maximum and be restrained from further increase in angle of attack by a strong nose-down moment produced by the increasing lift coefficient of the wing. It is expected that this system of a low-aspect ratio swept-forward noseplane combined with a high-aspect ratio wing will produce a non-stalling, non-oscillating aircraft. A full-span pressure slot is provided in the front surface as a means for producing the high lift coefficients required for balancing the nose-down moment caused by operation of the flaps.

On the subject of drag Mr. Raynes observed that to be of general utility, a personal aircraft must be able in some measure to compete with airline travel as regards speed. Present-day light aircraft cruising at 110 to 140 m.p.h. are much too slow for cross-country travel; cruising speeds of 200 to 300 m.p.h. would be much more desirable. Few compromises were made in the M.O.-1 design with drag. Considerable investigation was made in the basic fuselage contours in an effort to reduce the drag of this component to a minimum, and a number of approaches to this subject were explored.

The method of obtaining sufficient air for submerged engine cooling and flight control purposes was one of the major design problems. External scoops are, of course,

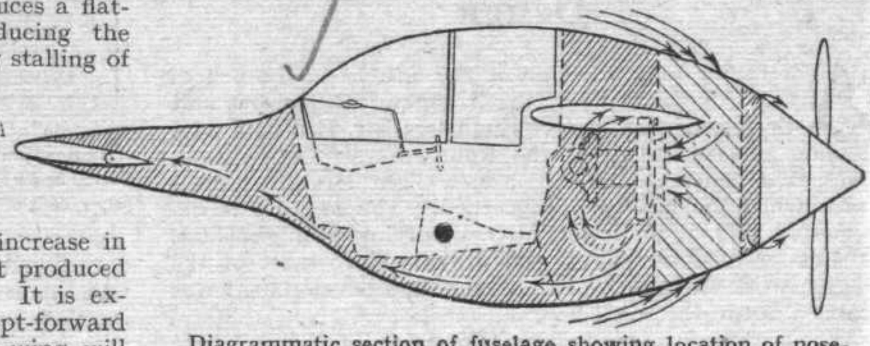


Diagrammatic section through sealed wing showing flow of pressure air to slot in order to effect lateral control. The lower drawing shows the bellows operation of the split flap.

the simplest means of obtaining a large quantity of air at suitable pressures; however, a scoop takes in air which is virtually stationary in space and the energy required to accelerate this air to the speed of flight absorbs considerable power. In the M.O.-1 a multitude of slots are arranged around the after portion of the fuselage, and the boundary layer is drawn in through these slots.

Two advantages are claimed for this system: first, the air which is taken in has travelled a considerable distance along the fuselage skin and has been accelerated by surface friction to a speed near that of flight, so that it is, so to speak, already "on board" and requires no additional energy to accelerate it to the speed of flight. Secondly, by drawing-off the boundary layer around the complete fuselage a lower fineness ratio may be used without separation, and the consequent drag reduction can be captured. A pressure-slot is also provided around the tail of the fuselage a short distance ahead of the propeller to accelerate the boundary layer and so stabilize the flow conditions into the propeller blades. This pressure-slot also functions as an aid to the re-establishment of the increasing pressure gradient, and minimizes the adverse effect which a pusher propeller has on fuselage drag. Pushers are noted for their poor efficiency caused by the presence of the fuselage in the up-stream flow. It is expected that the use of both suction and pressure slots in the after portion of the fuselage will so stabilize the flow around the fuselage as to produce conditions compatible with normal airscrew efficiency.

A laminar-flow wing section is used having excep-



Diagrammatic section of fuselage showing location of noseplane, cabin, wings, engine and blower, and illustrating the airflow into the blower and out to the surfaces and propeller.

tionally low drag coefficients in the range of Reynolds' numbers corresponding to the high-speed condition.

The low overall structure weight of the M.O.-1 has been made possible by a unique grouping of the major forces and weights into a small area. The major weight items, such as the main landing gear, seats, and engine, are all attached to a single bulkhead. The main forces applied come from the front spar and main landing gear, thus structural economy and efficiency is achieved.

The fuselage bulkheads are used to separate the high- and low-pressure air chambers and to conduct air to the wing and noseplane. No engine mounting in the usual sense is required, since the engine is carried from the cylinder heads on corner brackets joining the fuselage skin and main bulkhead.

In cases where specialized functions are to be performed and unusual conditions are to be met, designers frequently develop separate devices for each requirement, and the aircraft suffers from added complexities. It is indeed fortunate when a single device which solves many problems can be found. Mr. Raynes then mentioned that the blower as used in the M.O.-1 furnishes cooling air for the engine, high lift coefficients for the wing, creates conditions favourable to a two-control design, makes possible increasing lateral control with decreasing speed, operates the flaps, controls airflow conditions ahead of the propeller, compensates for the nose-down moment of the flaps, and eliminates the ailerons.

Without in any way wishing to decry the seeming far-sightedness of this design, we cannot but reflect that it has the appearance of having one's cake and eating it too; nevertheless, we shall await the flight trial reports with great interest.

FORTHCOMING EVENTS

Jan. 17th.—I.Mech.E.; "Recent Developments in Flying Boats." Mr. H. Knowler.

Jan. 24th.—R.Ae.S. (Belfast Branch); Smoking Concert.

Jan. 24th.—Aircraft Golfing Society; First Annual dance. Brent Bridge Hotel, Hendon, N.W.4.

Jan 24th.—R.Ae.S. Grad. and Stud. Sectn.; "The Aerodynamics of High Speed Flight." A. D. Young.

Jan. 25th.—Soc. of Licensed Aircraft Engineers; "Radar in War and Peace." A.V.-M. D. C. T. Bennett.

Jan. 25th.—R.Ae.S. (Portsmouth Branch); General Discussion on the Prospects of Civil Air Transport by Sir Frederick Handley Page, Sir Harold Hartley and A.V-M. D. C. T. Bennett.

Jan. 28th.—R.Ae.S. (Bristol Branch); "Large Aircraft." Mr. A. E. Russell.

Jan. 29th.—R.Ae.S. (Southampton Branch); "Installation of Radio Equipment in Aircraft." Mr. W. T. Davies.