been based on proving stand data, and the figures taken into consideration are average, and not max. Employing liquid oxygen, with petrol as fuel, the rocket (see illustration) consists basically of the following components: the reaction motor; liquid-oxygen tank; petrol tank (with gas charger); gyro-control, and parachute—encased in a light metal shell.

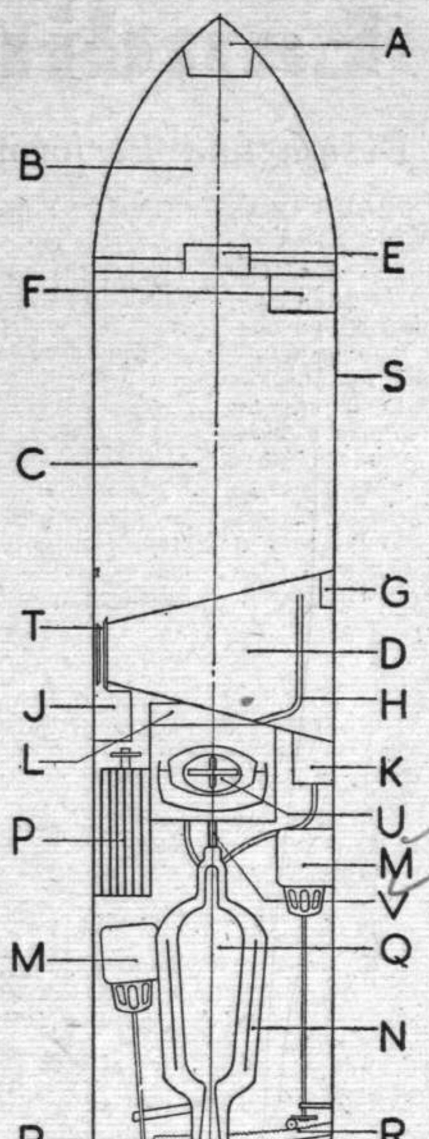
The method employed in the mounting of the reaction motor is rather original, in that a gyro-control, brought into play immediately the rocket deviates from its true path, at once effects variation of the direction of thrust—the motor being pivoted at the "head" by means of a universal thrust bearing, and at the nozzle end held in place by a system of slides and ratchets. This ensures easy movement of the motor in any direction around the central pivot, to apply thrust at angles ranging from 0 to 15 degrees from the axial thrust line. Reversible field electric motors serve to effect movement of the reaction motor. No motive power is provided in the rocket for the function of the master gyroscope, which is rotated just prior to flight by means of an auxiliary ground motor. The inertia caused by the initial force of rotation will be sufficient to maintain its efficient operation throughout the period of powered flight.

During the course of the rocket's ascent, any deviation from the true path of flight will, as previously stated, immediately actuate the gyro-control, to effect the function of the servo-motors, thereby changing the direction of thrust of the reaction motor to oppose the deviation and return the rocket to its normal line of ascent.

Fuel Supply

The liquid oxygen and petrol are housed in duralumin pressure tanks, which are designed to allow, as far as possible, unrestricted flow to the reaction chamber. The feeding of the liquid oxygen is a simple matter—being expanded into the reaction chamber by its own pressure, while the petrol is introduced by the pressure of an inert gas (nitrogen), acting directly on to the fuel surface.

The reaction motor, constructed of light aluminium alloy, is internally sprayed with a coating of steel for protection against the high temperatures developed in the reaction chamber and nozzle throat. The main parts are detachable to facilitate replacement should any of the components "burn-out," or become otherwise damaged during proving stand tests. The outer sides of the reaction chamber are ribbed by longitudinal cooling fins, air being introduced via small air-scoops and accelerated by means of negative pressure created by the rush of the exhaust gases, to effect a swift, cooling flow past the reaction motor.



A and E, parachute release mechanism; B, parachute compartment; C, liquid oxygen tank; D, fuel tank (petrol); F, liquid oxygen safety valve and filler; G, fuel filler cap; H, nitrogen pressure feed pipe; J, oxygen valve; K, fuel valve; L, nitrogen valve; M, servo reversible field motors; N, reaction motor cooling fins; P, electric storage cells; Q, reaction motor; R, reaction motor guides; S, cylindrical rocket shell; T, oxygen feed pipe; U, gyroscope (including electrical switch, relays and controls); V, universal thrust bearing.

The parachute, housed in the nose of the rocket, is opened by means of a release mechanism, adjusted to function when the air pressure inside the lower shell is built up to a pre-determined figure, as the rocket falls back to earth tail first, due to the weight displacement when the tanks are empty. Should, however, the rocket descend nose first, due to accident, an auxiliary device is fitted in addition to release the parachute.

Performance

General particulars of the design, and calculated performance figures are given below.

The total weight of the rocket is 50.0 lb., of which 22.5 lb. is fuel and 27.5 "payload." The itemised weight statement follows, the figures being in pounds: Motor, 2.8; oxygen, 17.8; petrol, 4.7; nitrogen, 3.0; gyro controls, 4.0; motor supports, 0.6, fuel tank ends, 1.2; fuel tank case, 3.3; curved ends of rocket, 5.2; copper tubing, 0.9; nitrogen tank, 1.0; parachute, 0.5; parachute release, 0.2; extras, 4.8 lb.

The volume of liquid oxygen is 0.29 cu. ft., and of petrol, 0.08 cu. ft. Following are the main dimensions, in inches: Length of oxygen tank, 10.0; radius of oxygen tank, 4.0; length of petrol tank, 3.0; radius of petrol tank, 4.0; overall length of tanks, 13.0; overall length of rocket, 35.0; diameter of rocket shell, 8.0; length of motor, 10.0in.

Estimated power and performance characteristics are as follows: Jet flow, 0.464 lb./sec.; jet reaction, 53.280 lb.; expansion ratio, 50,000; area of nozzle throat, 0.049 sq. in.; coefficient of drag of shell, 0.03; frontal area of shell, 0.356 sq. ft.; reaction chamber pressure, 700 lb./sq. in.; fuel tank pressure, 1,050 lb./sq. in.; jet velocity, 5,000 ft./sec.; acceleration, 24 ft./sec./sec.; time of power ($a=k$), 43 sec.; time of power ($v=k$), 5 sec.; time of no power ($a=-g$), 30 sec.; total time ascending, 78 sec.; height reached under power ($a=k$), 23,000ft.; height reached under power ($v=k$), 6,000ft.; height reached under momentum, 18,000ft.; total height reached, 47,000ft.

HE SHOULD KNOW

A PILOT who began bombing the Germans three years ago and is still bombing them has said that he notices little difference in the opposition then and now.

He is Sqn. Ldr. E. H. O'Neill, D.F.C., of Melbourne, who was among the first group of Australian airmen trained under the Empire Scheme to arrive in Britain on Christmas Day, 1940. He now receives the D.S.O. for "great success due to courage, determination and skill," says the Air Ministry News Service.

Sqn. Ldr. O'Neill believes that the "sameness" of the opposition is due to the fact that though the Germans have increased their defences tremendously our bomber force has increased even more so, and the individual crew receives about the same degree of attention now as always.

"But the difference between the aircraft I flew then and now is immeasurable," he says. "The Mosquitoes are through the ground defences almost before the enemy is aware that they are overhead, and they fly so fast that the fighters cannot catch them."

Sqn. Ldr. O'Neill has flown Mosquitoes, Wellingtons and Lancasters, bombed the heavily defended Ruhr nearly 30 times and most other important targets several times. He won his D.F.C. in November, 1941, for an attack in which the Gneisenau was hit at Brest, and bombing Bremen when he had about 150 holes shot all over his machine.

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