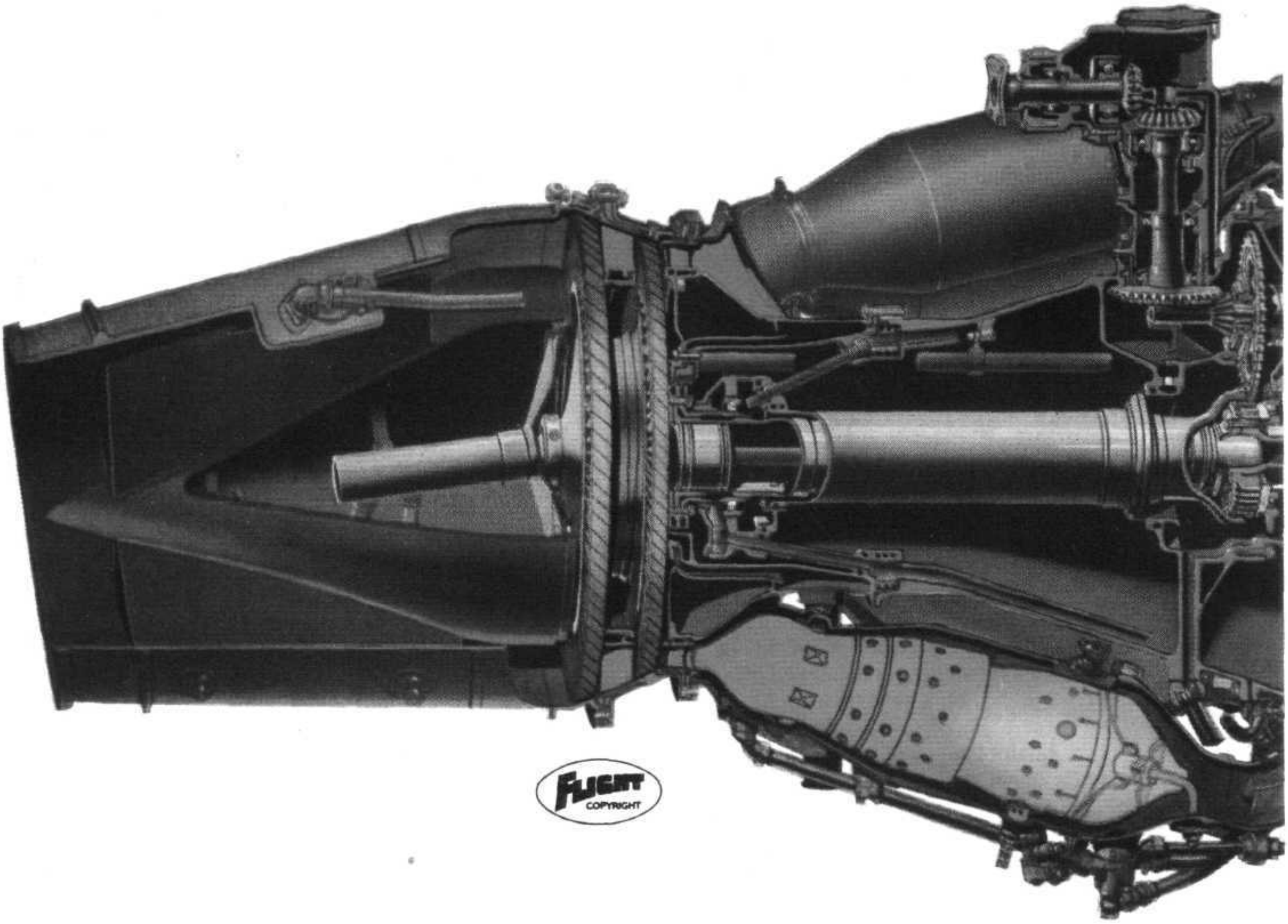
DART TURBOPROP



By functional use of colour in this special "Flight" drawing R. E. Poulton has succeeded admirably in making the operation of the Rolls-Royce Dart apparent almost at a glance; the entrained air, for instance, becomes visibly denser—as denoted by the increasing depth of green colour—as it passes through the compressor on its way to the combustion chambers, while maximum temperature in the flame-tubes is indicated by the lightest orange colour. Sections through components are indicated in the conventional red, the rotating assembly in metallic tones.

through the divergent entry throat giving on to the eye of the first-stage impeller. After initial compression, the air is thrown tangentially through a ring of diffuser vanes into a semi-toroidal inter-stage duct, in issuing from which it passes through a ring of ten infuser vanes and so into the entry eye of the second-stage impeller. On emergence from the latter through a surrounding ring of diffuser vanes, the air is delivered to the seven straight-flow combustion chambers. A helical array has been adopted for the combustion chambers in order to reduce, so far as possible, change of direction of airflow from the second-stage compressor. The efficiency of this compressor system is indicated by its delivery of a mass airflow of 18 lb/sec at a compression ratio of 5.5 : 1 at maximum r.p.m.

The combustion system employed on the Dart has benefited from Rolls-Royce experience with turbojets, and it is, therefore, quite natural that the chamber design should be fundamentally similar to that established with the Derwent and Nene. The expansion chambers are castings, and enclose coaxial straight-flow flame-tubes fabricated in Nimonic 75. From the centre of each flame-tube crown, fuel is sprayed downstream from the burner, secondary and tertiary air being admitted through rings of holes in the flame-tube walls, whilst the main diluent airflow passes outside the flame-tube to join with the burnt gases at the nozzle ring of the first-stage turbine. This diluent flow serves not only to reduce the gas temperature at the turbine inlet, but also acts as an insulating stream between flame-tube and combustion casing.

For the two-stage turbine used in the Dart, separate wheel discs are employed for the 123 blades comprising the first stage and the 103 blades of the second stage, the first disc being of Jessop's G.18B steel, whilst the second disc is of S.62 stainless steel: high- and low-pressure stages of blading are both machined from Nimonic 80, and are fir-tree-serrated into the disc rims. Each turbine wheel is cooled on its front and rear face by air tapped both from the first and second stages, whilst, in addition to a labyrinth seal interposed between the turbine wheels, a steel strip seal is also carried on the inner periphery of the low-pressure nozzle blades to prevent gas leakage.

The turbine wheels are coupled together and bolted to a relatively large-diameter shaft extending forward to drive the compressor. Both impellers are commonly splined on the compressor shaft, union betweeen which and the turbine output shaft is made through a spherically seated drive transfer coupling. Internal splines in the compressor shaft transmit torque to a coaxial quill-shaft which, at its forward