



The new twin test house at Brough, showing a Turmo (left) and a Twin Turmo mounted for running. The intake and exhaust systems are noteworthy, as is the mounting of the Twin Turmo, the latter simulating the Whirlwind installation at 34 deg 51 min to the horizontal. Independent air-flow trunks enable readings to be taken for each unit of the Twin Turmo and recorded on the duplicated control panel.

The control panel for each cell incorporates the following: gearbox and turbine oil temperature gauges; oil, fuel and turbine pressures and flow rates; jet-pipe temperature; air temperatures within the engine; compressor, turbine and output r.p.m.; and mercury manometers giving static pressure, air-delivery pressure, port and starboard combustion pressures, and port and starboard vent pressures.

No. 3 cell (left) is fitted for single Palouste, Turmo or Artouste engines. For the Artouste, the brake is run along to the other end of the cell. For the Palouste, the air-bleed output is ducted via a 4in pipe to a calibration unit on top of No. 3 exhaust tunnel. In the far annexe are the fuel-supply and calibration units (duplicated for coupled units). The near annexe will house a compressed-air supply, electrical switch-gear, rectifier and CO<sub>2</sub> bottles for fire suppression. The latter purpose is also accomplished by temperature-controlled breaking links which discharge four CO<sub>2</sub> bottles for each cell and also close shutters over the intake and exhaust tunnels.

## BLACKBURN-TURBOMÉCA . . .

Accessories naturally depend upon the installation, but any Blackburn-Turboméca unit can carry four main units, such as a main and standby D.C. generator, a tachometer and a starter motor. To save space axially, these would normally be mounted on the rear face of the drive boxes, and additional units could then be accommodated on the front of the engine (as has, in fact, been done with the Palouste). Originally all accessories were bolted on, but ease of removal and replacement of all such units has now been greatly improved by adopting ring clamps. These are circumferential straps with a profile matching with tapered flanges on both the drive box and the appropriate accessory so that, when tightened by a tangential turnbuckle, the strap brings the accessory hard up to its mounting face.

The above features are common to all units in the Blackburn-Turboméca range, and are therefore not mentioned in the succeeding paragraphs. As for the Palas itself, there is at present no requirement for this small turbojet except for one-off installations, such as the Somers-Kendall SK-1 racer. Mention should also be made of the Turboméca Marboré, an 800-1,000 lb-thrust turbojet which is covered by the Blackburn licence agreement but which is not found at Brough at all, as it is larger than any of the standard units in the Yorkshire firm's rationalized range. As the J69, however, the Marboré is the most important engine of Turboméca's other licensee—Continental Motors Corporation, of Michigan.

**Palouste.** The sole purpose of this engine is to supply compressed air, the normal maximum delivery being about 2.5 lb/sec at a gauge pressure of about 42 lb/sq in. Compared with the basic Palas, the Palouste has an identical compressor handling air at the same rate; the P<sub>2</sub> air is, however, divided in the ratio

2.5 : 4.7, so that for every 100 lb of air delivered by the compressor about 65 lb is passed through the combustion system and turbines and 35 lb extracted for some other purpose (such as providing air for the tip-drive of a helicopter rotor).

As already noted, the standard Palouste is the Palouste 500, in which a full-capacity 600-size compressor is driven by a pair of turbine stages running on the reduced 500-size airflow. No Palouste 600 has yet been made, for such an engine would introduce a new size of compressor larger than that now used on all Blackburn gas turbines.

Apart from the basic alterations (use of two turbine stages, revision of the compressor diffuser throat area and alteration to the turbine nozzle-vane angles) the gas-producing part of the Palouste differs little from standard. The fact that the combustion system is required permanently to operate on a reduced flow is no great disadvantage and corresponds to a 600-series engine at part-power. Originally there was a degree of mal-distribution in the combustion system which has been overcome by adding a new part; thus, the Palouste chamber can be made to standard form and then have this extra piece added.

Alone among the original Turboméca units, the Palouste seemed to Blackburn's to be capable of almost immediate use in Britain. It was a Palouste which was first run at Brough in September 1952 (before the licence was signed); the first wholly British engine was also a Palouste, and it first ran in January of this year. Development of this engine is going ahead against a Ministry of Supply contract for use in the Fairey light A.O.P. helicopter. This Djinn-like aircraft employs a rotor driven by tip jets supplied with air from a single Palouste mounted horizontally in the rear part of the bubble-like fuselage.

As developed for the Fairey helicopter, the Palouste carries an