Chapter 7

ACCELERATION CONTROL UNIT

(Avon Mk. 1 aero-engine) AL 32
TYPE BM 21231

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Introduction

1. The acceleration control unit fitted to the Avon Mk. 1 aero-engine limits pump output to accord with the airflow through the engine during rapid accelerations, by reducing the fuel system servo control pressure. By this means the fuel/air ratio is maintained at a value acceptable to the engine, and excessive jet pipe temperature and surge are avoided.

2. The control consists of two separate units, an acceleration control unit and a metering valve unit. The metering valve unit provides a measure of fuel flow in terms of pressure difference. This pressure difference together with the pressure difference across the engine compressor, is transmitted to the acceleration control unit which uses both forces to control bleed from the pump servo system.

3. As the acceleration control is normally required only during take-off and landing, no altitude compensation is provided and the control becomes progressively less effective at increasing altitudes above 5,000 feet.

Acceleration control unit

4. The acceleration control unit (*fig.* 3) contains a rocker arm which is pivoted at the centre and carries a half-ball valve which controls spill from the pump servo system. A compression spring load is imposed at each end of the rocker arm, but these spring forces are varied whilst the engine is running by changes in pressure difference across the air diaphragm and the fuel diaphragm.

5. To ensure that all air is expelled from the system on starting a permanent fuel bleed across the fuel diaphragm is provided. A perforated rubber locating washer is positioned below the fuel diaphragm for centralization, and a sealing disc prevents leakage of high pressure fuel past the sliding plunger. The sliding plunger is lubricated by low pressure fuel through a drilling which also acts as a hydraulic pressure release.

6. During rig calibration, the initial spring loading on each diaphragm may be varied by adjustment plates and calibration screws, and a movement limit stop can be adjusted to determine the total lift of the half-ball valve.

7. A sealing adapter reduces the base plate area subject to pump delivery pressure, and drillings are provided through the adapter and the base plate to prevent pressure building up on either side of the adapter due to leakage past the sealing rings.

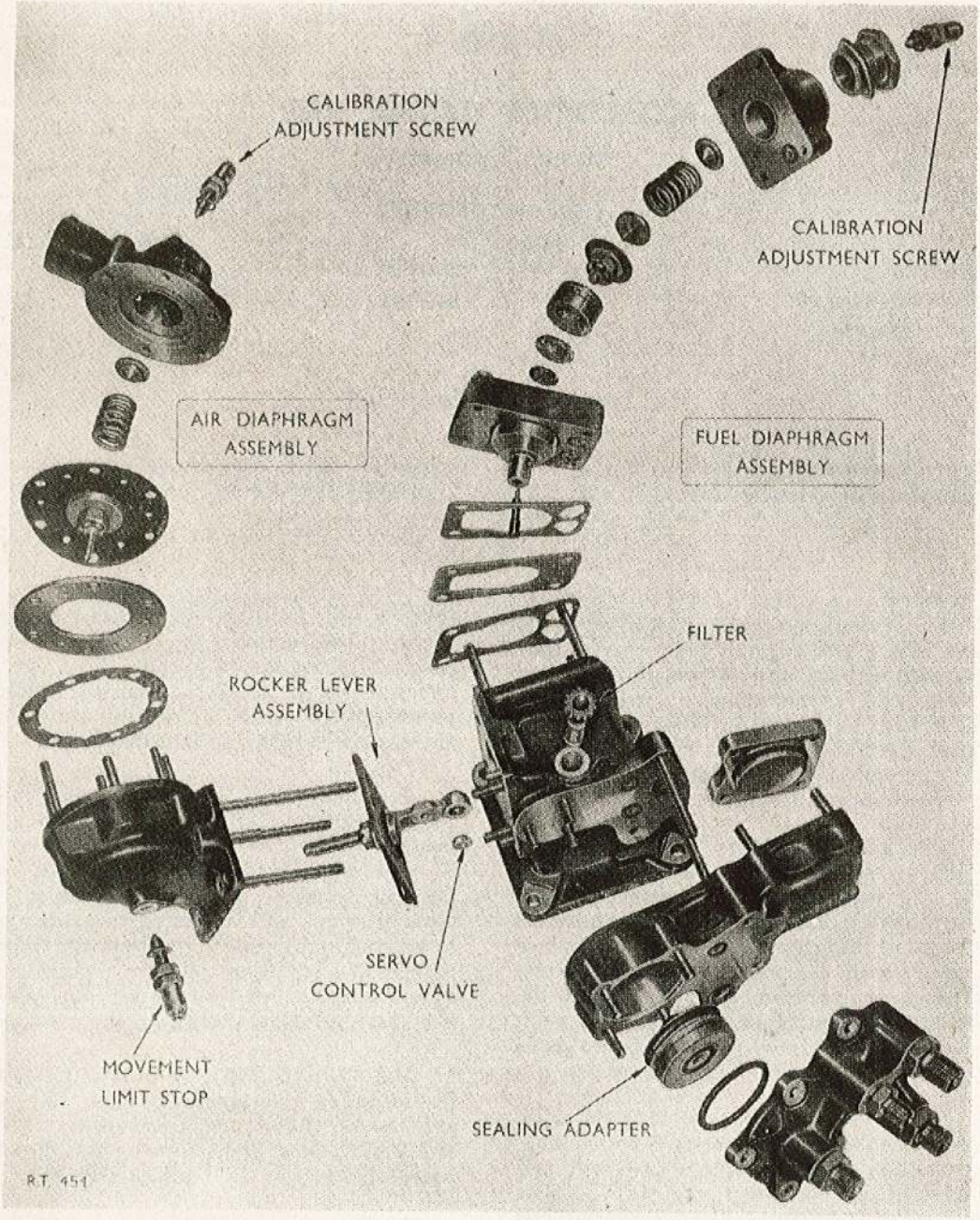

Fig. 1. Acceleration control unit (exploded view)

Metering valve unit

8. Total pump outlet flow passes through the metering valve unit which contains two spring-loaded valves, one a metering valve and the other a by-pass valve, which are calibrated to create a fuel pressure difference across the unit, proportional to flow. The metering valve remains open throughout the engine operating range, but the by-pass valve only opens at high fuel flows when the engine will accept momentarily richer fuel/air mixtures without experiencing excessive jet pipe temperatures or surge. When the by-pass valve is open, the pressure difference across the metering valve unit rises more slowly in proportion to further increases in fuel flow.

9. Adjusting washers are provided below each valve spring to vary spring setting during rig test, and a retaining pin is fitted below the head of the metering valve to protect the fuel system in the event of a fractured valve stem.

Operation

10. The acceleration control unit is set so that under steady engine running conditions, the forces exerted on the air diaphragm exceed those exerted on the fuel diaphragm consequently the half-ball valve is held on its seating and permits no spill from the servo system.

11. Opening of the throttle reduces the metering valve outlet pressure and this

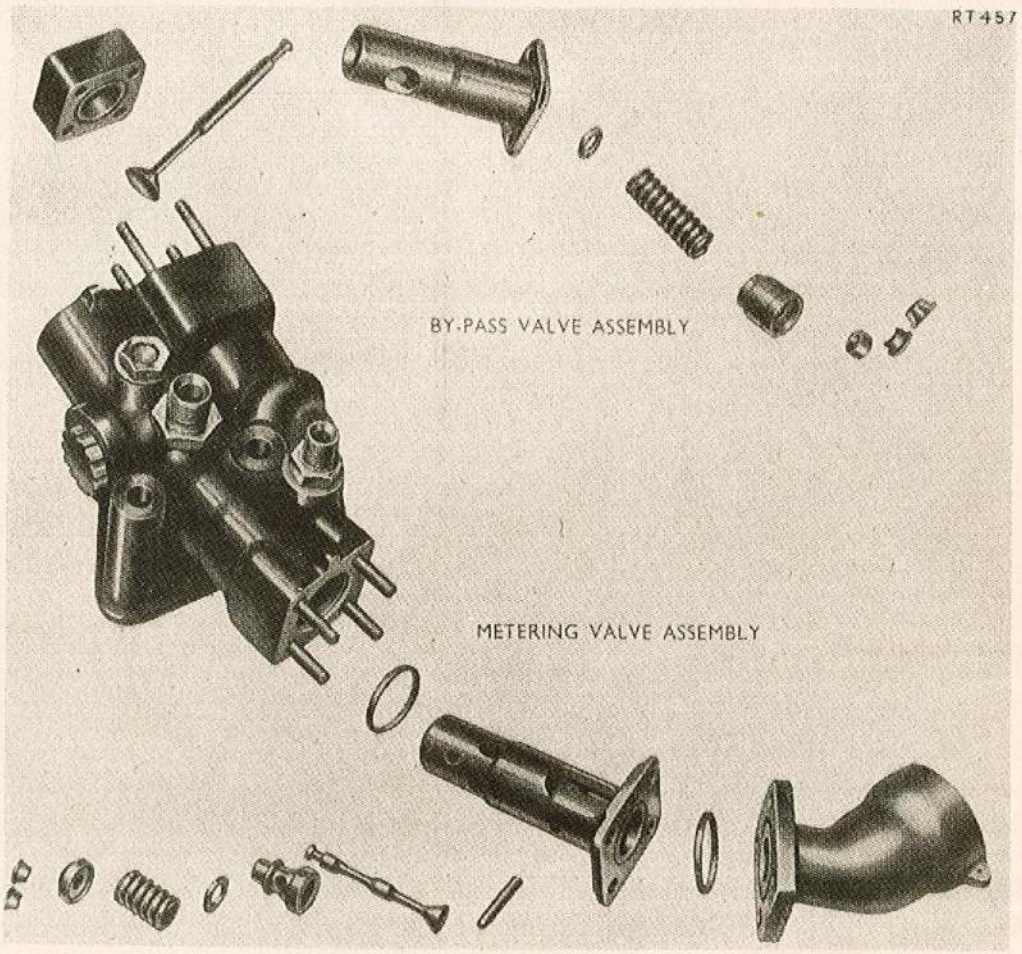

Fig. 2. Metering valve unit (exploded view)

together with the increase in pump flow caused by the barometric pressure control increases the pressure difference across the metering valve. If the throttle is opened slowly, rising compressor delivery pressure felt on the acceleration control will counteract the increased fuel pressure difference and the control will not operate.

12. When the throttle is opened quickly the pressure difference across the metering valve rises more rapidly than the engine can overcome inertia and accelerate to increase compressor delivery pressure, consequently an unbalanced force is produced on the acceleration control rocker arm which opens the half-ball valve and permits spill from the pump servo system; this limits pump stroke to the maximum suitable for compressor delivery. As engine speed increases, rising compressor pressure will progressively overcome the increased fuel pressure difference, until the half-ball valve is again on its seating and the engine is running steadily at the higher r.p.m. selected by the new throttle position.

Installing and adjusting

13. The acceleration control unit and the metering valve unit are calibrated together and must not be changed independently. Full instructions for removing, installing and inhibiting the complete unit are contained in A.P.4321A, Volume 6, Part 1, Section 2. This section also contains instructions relating to the limited adjustments that are permissible in service.