Chapter 1

AIR/FUEL RATIO CONTROLS, TYPE AFR.2, AFR.4 and AFR.100

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

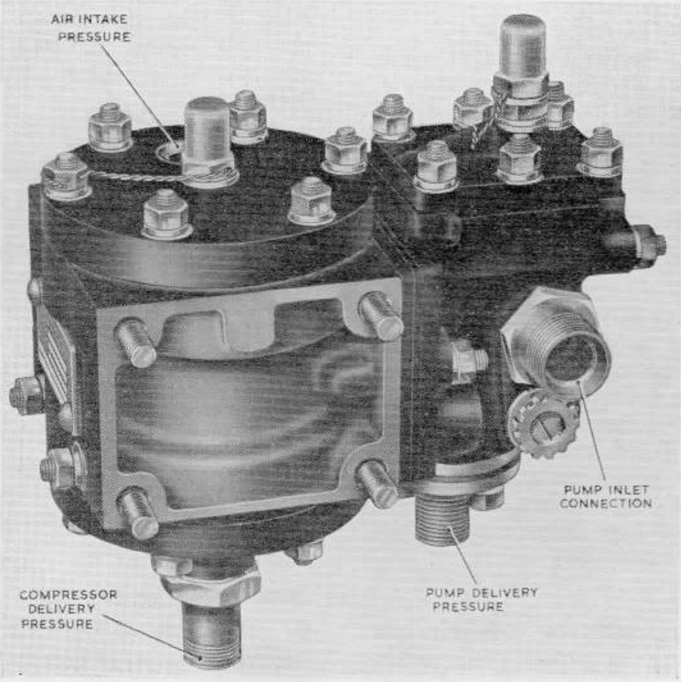


Fig. 1. AFR.2 and AFR.4

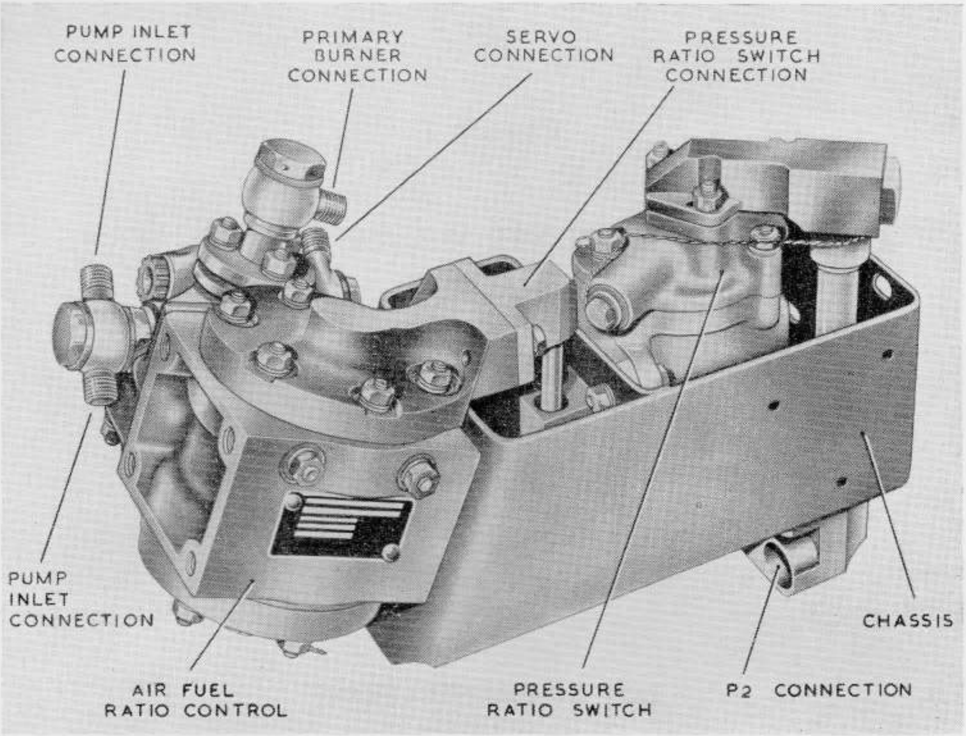


Fig. 1A. AFR.100

Introduction

1. The a.f.r. 2 and 4 units differ only in their installation features and calibration details. The a.f.r. 100 is similar in construction and operation but it also incorporates a pressure ratio switch which is mounted on a chassis and is attached to, and calibrated with, the a.f.r. The pressure ratio switch is described in Chapter 2, Supplement 1.

2. When the engine is being accelerated, the a.f.r. prevents the occurrence of excessive temperatures in the combustion chambers which may lead to stalling or surging of the compressor. It also maintains the temperature at a safe value if the effects of altitude, mechanical defects, or deterioration cause the engine to overheat. In addition, the control exerts its influence at high altitudes to prevent the onset of flame extinction.

3. The control operates on the principle that, by maintaining the air/fuel ratio within certain limits, the temperature rise of combustion can be controlled to a known value. Also, as the variation in compressor temperature is small, the total temperature after combustion will be maintained very nearly constant.

4. Over the greater part of the operation range of the engine, the air mass flow through the engine depends very closely on the compressor pressure absolute and, by controlling the ratio of pressure absolute to flow, a certain value of air/fuel ratio is maintained, and combustion temperature controlled accordingly.

5. The fuel pressure is made a direct measure of flow by the use of a pressurizing valve and is balanced against compressor pressure absolute in the control unit.

Description (fig. 2)

6. The body of the unit is divided into a capsule chamber (14) and a valve chamber (6) by a plate assembly (2) carrying a rocker lever (12) which extends into both chambers.

7. The end of the rocker lever extending into the valve chamber is fitted with a half-ball valve (7) which seats on the orifice (8). This valve is closed by a spring, the loading of which may be varied by the adjustment screw (4) in the valve chamber cover. Fuel at pump servo pressure is supplied to the underside of the orifice through a filter.

8. The rocker lever is operated by fuel at pump delivery pressure through a diaphragm (11), piston (10) and push rod (9). The upper end of the push rod operates against an adjustment screw (3) in the rocker lever.

9. The other end of the rocker lever, which extends into the capsule chamber, is pivoted in such a manner as to be acted upon by forces produced as a result of pressure on the diaphragm (13) and on an evacuated capsule stack (1). Since the diaphragm and capsule stack have the same effective areas, the effects of pressure on the lever inside the capsule chamber are cancelled out, leaving the rocker arm responsive to a force proportional to absolute pressure on the underside of the diaphragm (13). This is connected to compressor pressure and movement of the rocker lever is therefore dependent on the value of compressor pressure P_2 opposing the fuel delivery pressure P_D.

Operation

10. At steady running conditions the unit is inoperative.

11. During engine acceleration, the system is in equilibrium, and the half-ball valve is just floating. As the fuel pressure is made a direct measure of flow, then the pump output is sufficient to balance the compressor pressure (P_2) and a correct air/fuel ratio will exist.

12. If the compressor pressure increases, the force exerted on the rocker levei will cause the half-ball valve to be held in the closed position, thus allowing the pump delivery to be increased until the state of equilibrium is again reached, and the correct air/fuel ratio restored.

13. With this arrangement the fuel pressure (P_D) is relatedto the compressor pressure (P_2) by the equation $P_D = aP_2 + b$, where a and b are constants depending upon the setting of the unit.

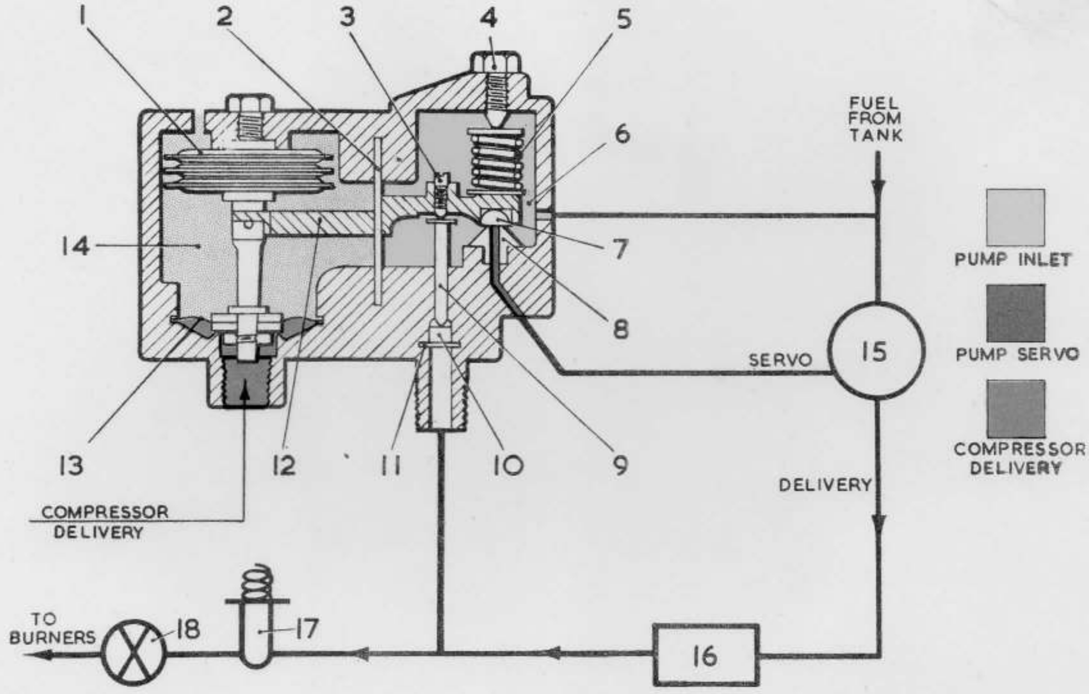
Installing and servicing

14. For instructions on installing the unit on the engine, refer to the engine Air Publication.

15. No servicing is required apart from checking connections for leaks.

16. If any pipes or connections are disturbed, the system must afterwards be bled to expel any air.

17. For inhibiting instructions refer to A.P.4471A.



1 CAPSULE STACK
2 PIVOT PLATE ASSEMBLY
3 ADJUSTMENT SCREW
4 ADJUSTMENT SCREW
5 SPRING
6 VALVE CHAMBER
7 HALF BALL
8 ORIFICE
9 PUSH ROD
10 PISTON
11 DIAPHRAGM
12 ROCKER LEVER
13 DIAPHRAGM
14 CAPSULE CHAMBER
15 FUEL PUMP
16 THROTTLE VALVE OR FLOW CONTROL
17 PRESSURIZING VALVE
18 SHUT-OFF COCK

Fig. 2 Schematic diagram of unit


MOVE STAND
DO NOT TOW