SECTION 8

ENGINE INSTALLATION

Section 8

ENGINE INSTALLATION

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

1. The aircraft is powered with a de Havilland Goblin Mk. 2 gas turbine engine. The engine consists of a single-stage centrifugal compressor supplying air, through specially shaped diffuser passages, to the 16 combustion chambers which discharge the products of combustion through the blades of a turbine wheel. The turbine wheel drives the compressor and the various accessories required for aircraft services. After leaving the turbine wheel, the gas discharges at a very high velocity to the rear, thus forming a propulsive jet.

2. The engine bearer frames are tubular-steel structures bolted to the main structure at bulkhead No. 4 (*Sect.* 5). The engine and jet pipe are accessible through detachable cowlings at the top and underside of the engine, and by removal of the tail cone fairing. Starting is by special electric starter motor and timing switch gear, operated *only* from a fully charged, 24-volt, ground starter battery of not less than 230 amp. hr. capacity, the plug socket for which is situated on the underside of the starboard engine cowling. The aircraft accumulators *must not* be used for ground starting. An auxiliary starting switch, at the forward end of the pilot's electrical panel (*fig.* 2), should be switched ON approximately 20 seconds after releasing the starter push-button, i.e., when ignition takes place. The action of the auxiliary starting switch causes the third stage relay to function and so permits the full current to pass to the starter motor, and assist the engine to attain idling speed.

ENGINE-DRIVEN ACCESSORIES

3. The following engine-driven accessories are fitted to the wheel-case at the front of the engine; their exact location is shown in Sect. 5 :—

On the upper wheelcase, port side :—
Hymatic compressor Marshall cabin blower.

On the lower wheelcase, port side :—
Starter motor. Fuel pump.

On the upper wheelcase, starboard side :—
1,500 watt generator
Vacuum pump

On the lower wheelcase, starboard side :—
Overspeed governor
Hydraulic pump

The air-intakes to the compressor are positioned in the leading edge of the wing, and are ducted through the side of the fuselage to the engine.

ENGINE CONTROLS (*fig. 1 and 2*)

4. The throttle control lever, the high-pressure and low-pressure fuel cock levers, which are the principal engine controls, are all mounted on the cockpit control box. Teleflex controls are used from the control box to the port side of the firewall. The movement is then transferred by transverse torque tubes to the centre of the firewall and continued by sprockets, chains and tie-rods to the appropriate control. The angular movement and control settings are given in Sect. 4, Chap. 3. Two cams are bracketed to the transverse torque tube of the throttle control on the firewall. The cams operate the two micro switches for the undercarriage warning lamp and the starter circuit respectively. The throttle must be in the fully closed position before the cam operates the micro switch to complete the starter circuit.

5. A booster coil push-switch, located on the left-hand cockpit coaming, is provided for testing the ignition equipment before starting. An audible ticking from the two ignition plugs is the indication that the equipment is functioning correctly.

ENGINE INSTRUMENTS

6. The r.p.m. indicator is the only instrument for recording the power output of the engine. The following additional instruments associated with the engine are provided in the cockpit :—a fuel pressure gauge, recording from the top of the fuel manifold ; oil pressure and temperature gauges recording from the top accessory box ; a jet temperature gauge recording from the thermocouple at the rear of the exhaust cone ; and a rear bearing temperature gauge. The fuel and oil pressure gauges are operated by pressure transmitters, (*Sect.* 4, *Chap.* 3).

FUEL SYSTEM (*fig. 3 and 4*)

General

7. The fuel system is shown diagrammatically in fig. 4. The fuel is contained in one metal centre (main-fuselage) tank and four Marston bag-type tanks in each wing. The three outboard tanks (No. 2, 3 and 4) in each wing are interconnected, and are served by one filler neck and one contents gauge for each group. The two inboard tanks (No. 1), each have a separate filler and contents gauge. An additional 100-gall. drop tank may be carried under each wing. The drop tanks (when fitted) are pressurised for fuel transfer by air pressure led through two reducing valves, set to $2\frac{3}{4}$ lb./sq. in., from the engine blower casing. Fuel transfer from the drop tanks to the centre tank commences when the fuel contents gauge of the latter reads 80 gall. and the float valve operates. For details of the drop tank attachment, refer to Sect. 4, Chap. 2.

Flow to engine-driven fuel pump

8. At the base of the centre tank is a fuel collector box (or negative " G " reservoir) fitted with gravity valves which close during inverted flight (*fig.* 5). The capacity of the reservoir is approximately $2\frac{1}{2}$ gallons, sufficient for about 15 seconds inverted flight. Housed within the reservoir is an immersed booster pump which delivers fuel under pressure, through a low-pressure fuel cock and a filter, to the high-pressure fuel pump, located on the port lower engine wheel-case. A fuel-pressure warning switch, on the low-pressure fuel filter, lights a red lamp on the instrument panel, if the pressure should fall below 3 lb./sq. in.

Barostat

9. From the engine-driven fuel pump, fuel is fed at high pressure to the engine control box, and a tapping off this line is led to a barostat. The barostat is an altitude-sensitive relief valve, which by-passes an increasing amount of fuel as the ambient atmospheric pressure decreases. This excess fuel by-passes the control box, and flows through a purolator filter to the barostat and thence back into the centre tank.

Note . . .

The barostat is a self-contained unit with very fine limits of adjustment. It must never be adjusted in the field ; should any trouble develop, the unit must be replaced by a new one.

Throttle control and minimum-pressure valve

10. Fuel, at the pressure regulated by the barostat, is fed from the engine-driven fuel pump to the fuel control valve in the control box. This valve, which is directly controlled by the pilot, regulates the amount of fuel allowed to pass on to the remainder of the power unit system and serves the same purpose as the throttle on a normal engine. A minimum-pressure valve is connected to the control box, and by-passes a

small quantity of fuel across the metering needle. The purpose of this valve is to reduce the possibility of the flame being extinguished in flight due to insufficient fuel pressure in the fuel manifold, as would occur if the throttle were closed quickly at extreme altitude. Consequently, the valve is connected across the inlet and outlet ports of the metering control needle and, at low manifold pressures, sufficient fuel can by-pass the metering needle and so maintain a safe minimum fuel pressure irrespective of the position of the throttle control. The valve is mounted directly on to the control box.

Overspeed governor, accumulator and starting valve

11. The overspeed governor is in the line from the control box to the fuel manifold. It only comes into operation when the r.p.m. tend to exceed the maximum laid down, such as when diving with throttle open or during an acceleration. It therefore controls the maximum r.p.m., irrespective of the setting of the pilot's control. Between the overspeed governor and the fuel manifold, is a tapping in the line, leading to a fuel accumulator and a starting valve (*fig.* 4). The purpose of the accumulator is to store a small quantity of fuel at the pressure required for starting the engine. The starting valve will not open until the pressure is sufficient to give a good burst of fuel to the burner manifold.

High-pressure fuel cock and dump valve

12. Incorporated in the control box are the high-pressure fuel cock and the dump valve. This cock directly controls the flow of fuel from the control box to the burner manifold through the overspeed governor and starting valve. The dump valve, which is interconnected with the cock, is attached to the side of the control box. It is a small aluminium casing containing a poppet valve and two ports, the inlet port being connected to the burner manifold through the starting valve and the outlet port to the atmospheric drain. The common operating lever for the cock and the dump valve is interlinked with the starting valve by a Bowden cable. When the lever is moved forward to fuel ON, fuel is fed to the starting valve and the dump valve is automatically closed. When sufficient pressure has built up to open the starting valve (*para.* 11), it is locked in the open position by a spring-loaded plunger, thus allowing a free passage of fuel to the burner manifold. When the lever is moved back for fuel OFF, the supply of fuel to the burner manifold is cut off and the dump valve is automatically opened. By means of a catch on the lever and the cable, the locking plunger is withdrawn from the starting valve which is allowed to close. Surplus fuel may now drain from the burner manifold, by-passing the starting valve, then through the dump valve, which is now open, to the atmospheric drain.

OIL SYSTEM

13. The oil system is completely self-contained within the engine; details of the installation and servicing will, therefore, be found in A.P.4121A & B, Vol. 1 and Vol. 2, Part 3. The filling and draining instructions are given in Sect. 4, Chap. 2.

G2662 M15803 2/49 360 C.B.&S.Ltd. Gp.30

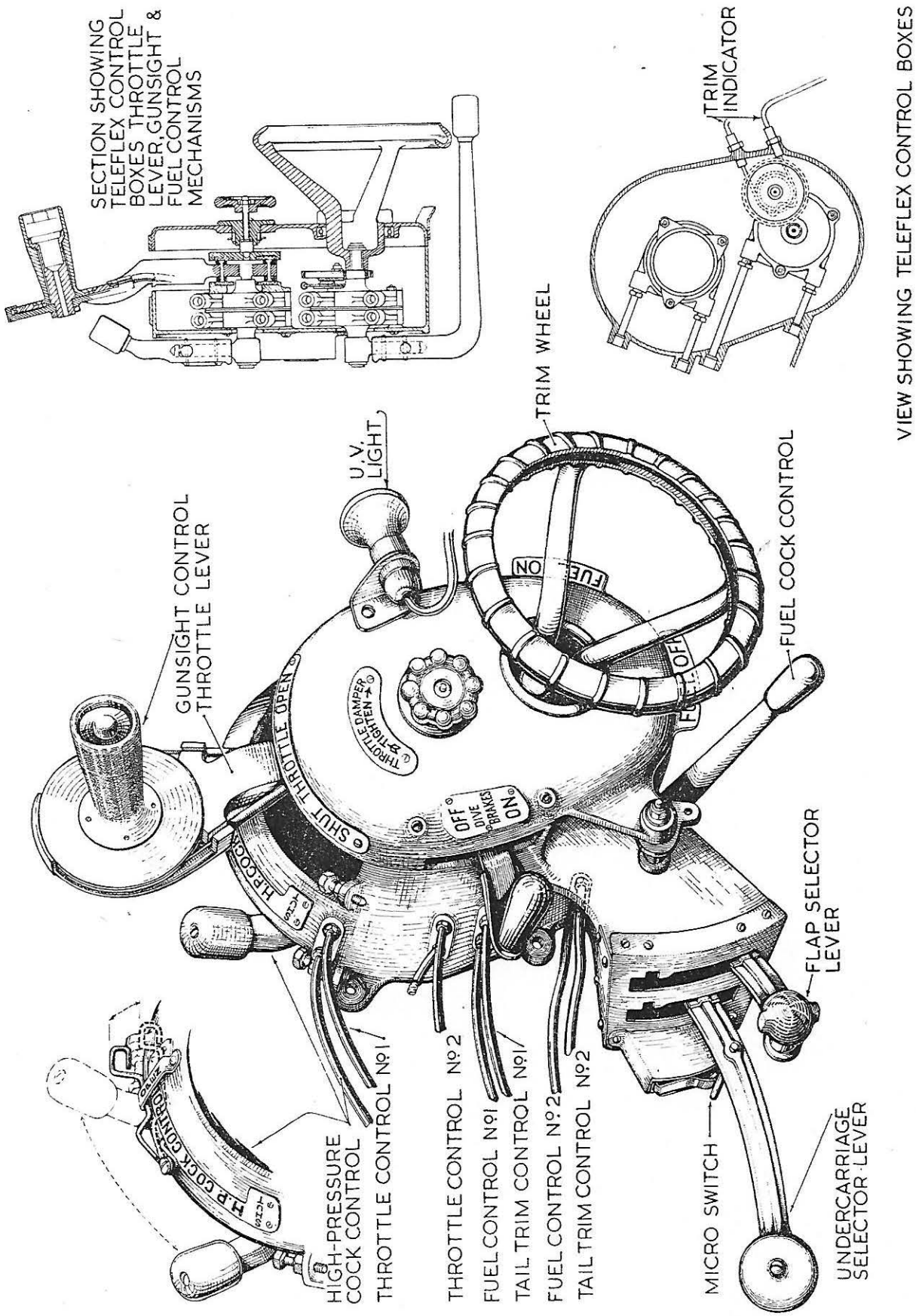

FIG. 1 ENGINE CONTROL BOX

G2663 M15804 2/49 360 C.B.& S.LTD. GP55.

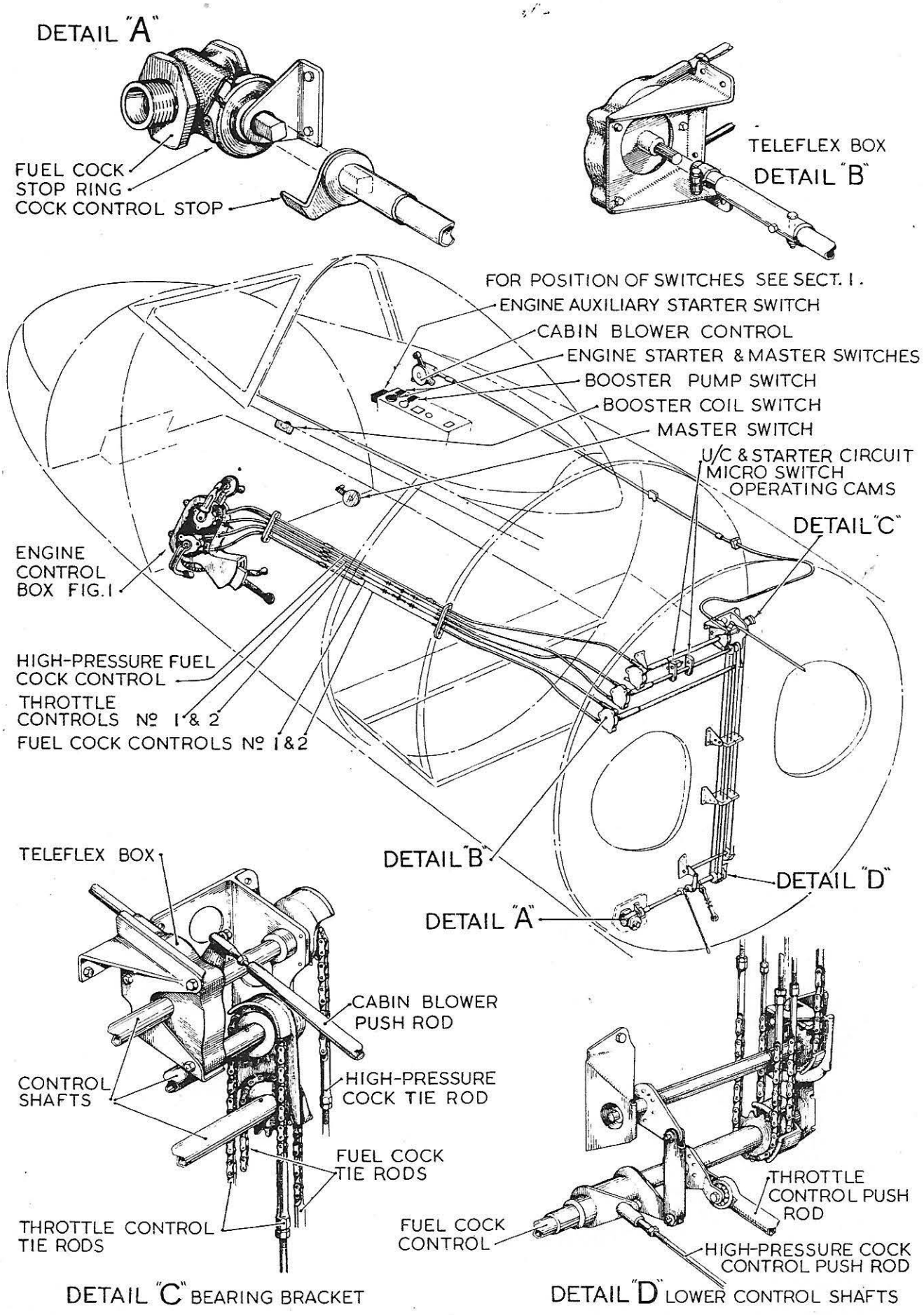

FIG. 2 ENGINE CONTROLS

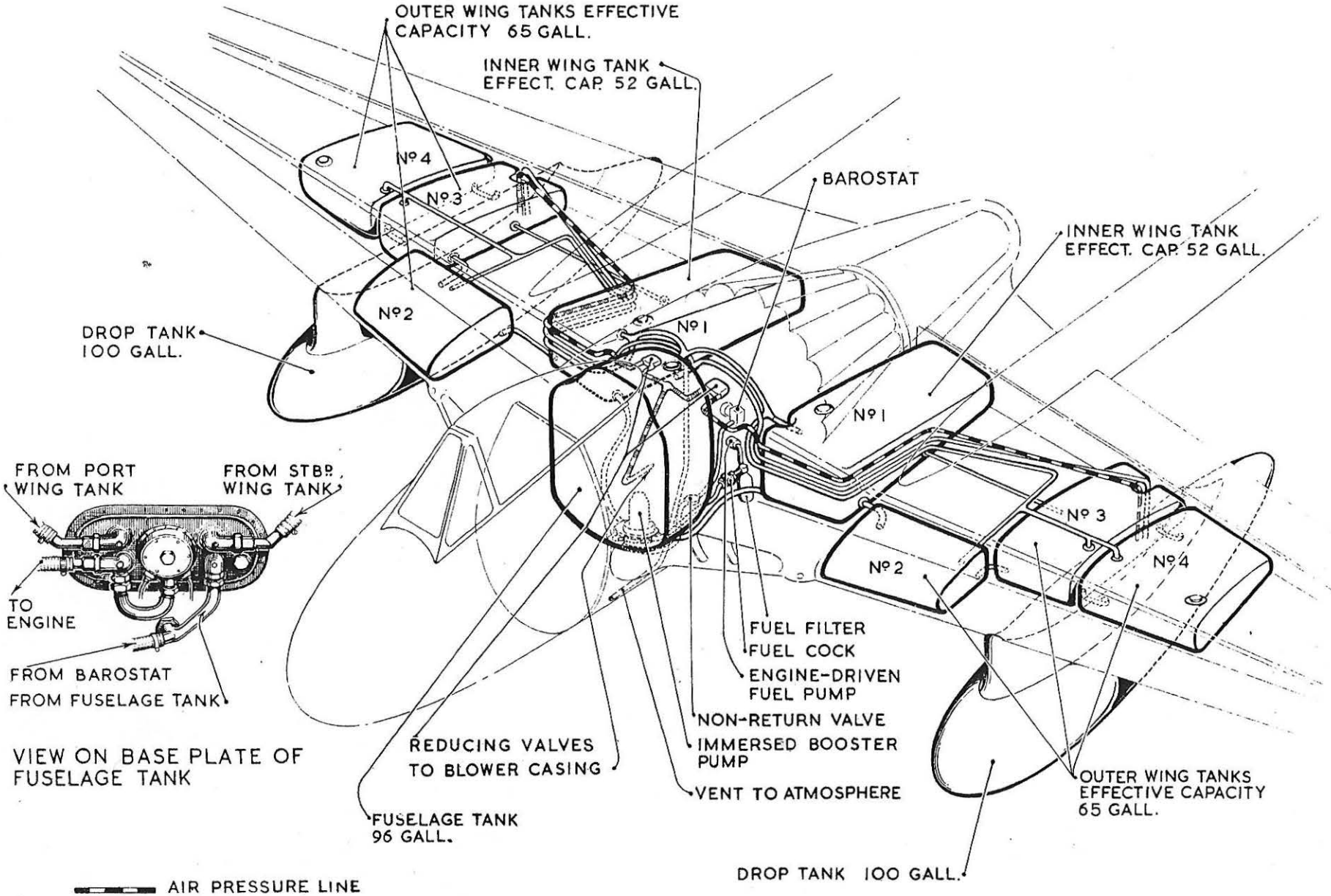

FIG. 3 FUEL SYSTEM

G2663 M15804 2/49 360 C.B.& S. Ltd. Gp.55.

This leaf issued with A.L. No. 10, Jan. 1949

A.P.4099E, Vol. 1, Sect. 8.

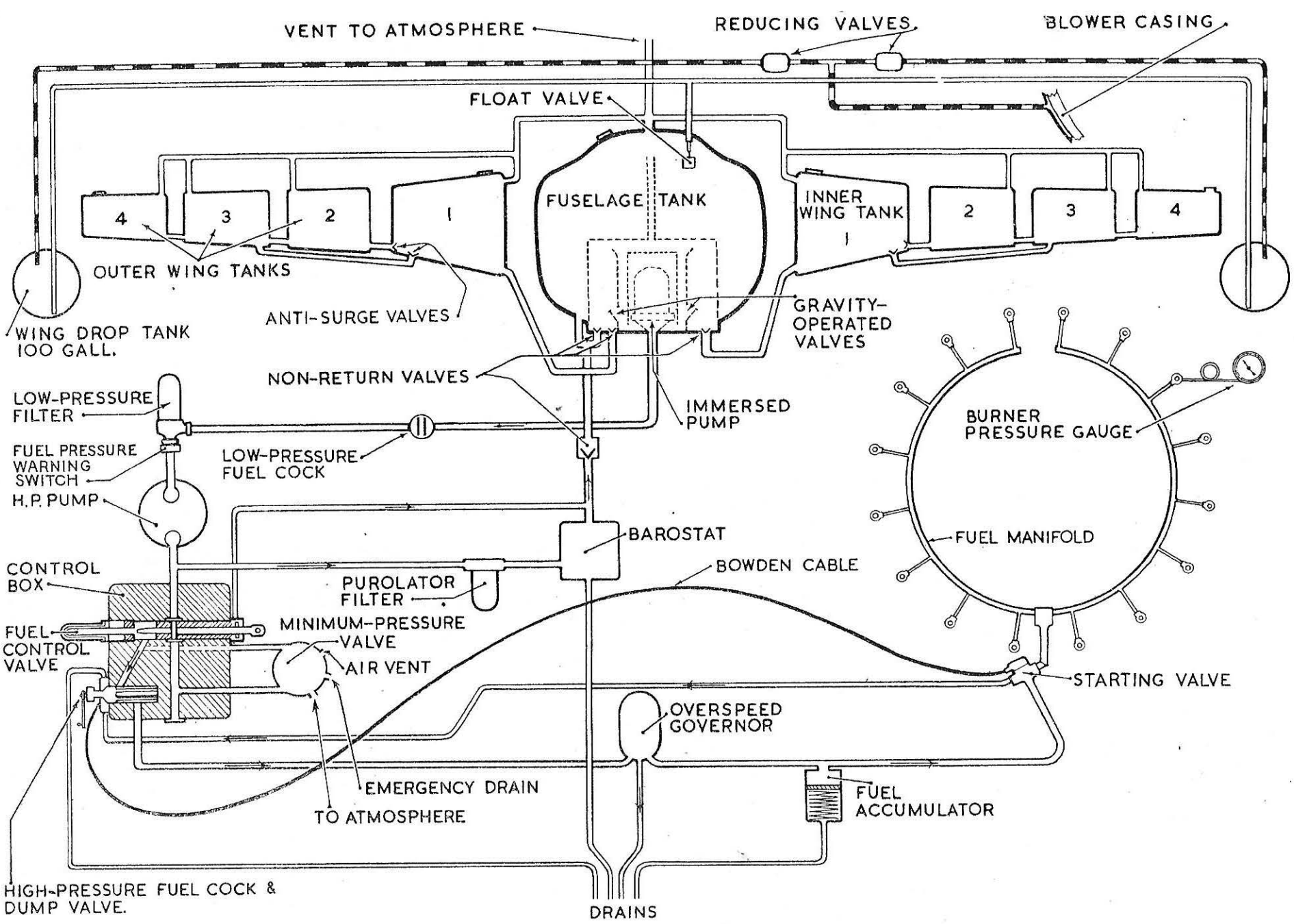

FIG. 4 FUEL SYSTEM DIAGRAM

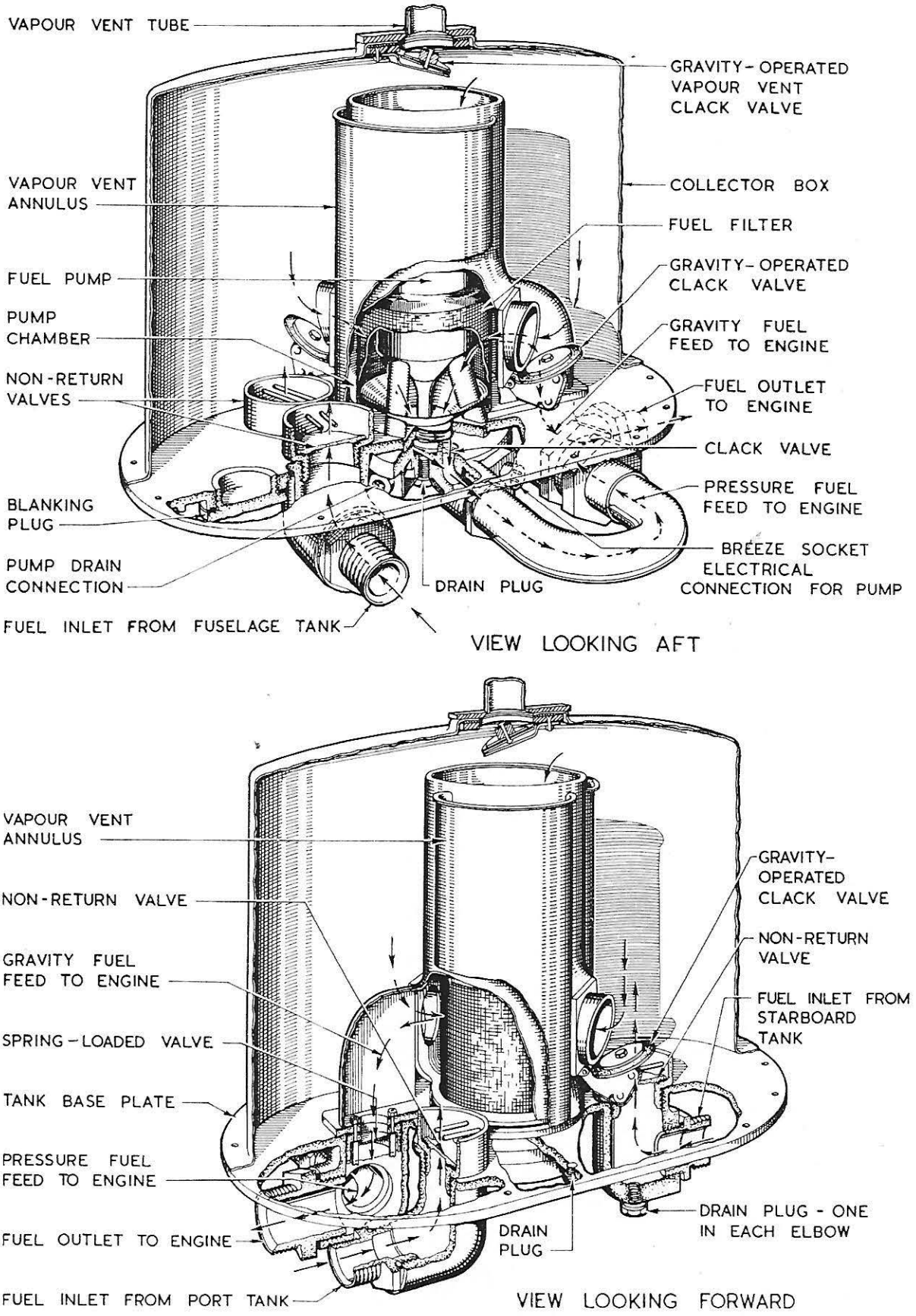

FIG. 5 FUEL COLLECTOR BOX

G2663 M15804 2/49 360 C.B.&S.LTD. G255.