PART I

DESCRIPTIVE

NOTE.—The numbers quoted in brackets after items in the text refer to the illustrations in Part V.

INTRODUCTION

The Vampire F. Mk. I is a jet-propelled, single-seat, twin-boom fighter armed with four 20 mm. guns. On early aircraft the power plant is a Goblin Mk. I straight-flow-combustion gas turbine engine. On later aircraft this is replaced by a Goblin Mk. II engine of higher power.

FUEL AND OIL SYSTEMS

1. **Fuel tanks.**

(i) Three permanent self-sealing tanks are fitted, one in the centre fuselage and one in each wing. The tank capacities are as follows :—

Centre fuselage tank	96 gallons
Wing tanks (53 gallons each) ...	106 gallons
Total	202 gallons

(ii) The fuel from all three tanks passes to a collector box incorporating a negative "*g*" valve which affords a fuel supply for approximately 20 seconds inverted flight. The tanks, which are not pressurised, are vented to atmosphere. A satisfactory delivery pressure at altitude is ensured in later aircraft by a booster pump fitted in the main delivery line from the collector box.

(iii) Fuel passes from the collector box, through a low pressure cock and a filter, to an engine-driven pump capable of maintaining a constant fuel pressure throughout the power range. An aneroid-operated barostat, fitted to the delivery line of this pump, so controls this pressure by returning surplus fuel to the collector box that, as height is gained, the engine r.p.m. remain substantially constant at the selected throttle lever setting.

From the engine-driven fuel pump, fuel passes under pressure to the throttle (fuel control valve) and a high pressure cock. Modification action is being taken to fit a *minimum* pressure valve in parallel with the throttle, to ensure that at altitude, regardless of the throttle setting, sufficient pressure will be maintained at the burner ring to prevent flame extinction. *Maximum* pressure at the burner ring is controlled by an overspeed governor. From the overspeed governor, fuel passes to the trip valve, and the line is tapped to supply a fuel accumulator. The purpose of the accumulator is to provide a fixed quantity of fuel at a known pressure at the moment of starting. A dump valve is fitted to drain any fuel present in the system before pressure has been built up when starting the engine, and after it has fallen when shutting down the engine in order to prevent free fuel draining into the combustion chambers.

2. **Fuel gauges**

(i) Contents gauges : Three fuel contents gauges (33) are mounted below the lower instrument panel. The left-hand gauge shows the contents of the port wing tank, the centre gauge shows the contents of the centre fuselage tank, and the right-hand gauge shows the contents of the starboard wing tank. The gauges will indicate the contents of their respective tanks when the MASTER SWITCH (1) is at FLIGHT.

(ii) Burner Fuel Pressure Gauge : A burner pressure gauge (16), which is calibrated in hundreds of pounds and records the fuel pressure at the burner ring, is fitted on the left-hand side of the instrument panel.

3. **Fuel booster pump**

(i) The booster pump fitted in later aircraft is controlled by an ON-OFF switch (43) on the electrical panel. It is used to maintain delivery pressure from the fuel tanks at heights above 20,000 ft., but it may safely be left ON at all times in flight.

(ii) Early aircraft may not have a booster pump or a minimum pressure valve and if this is the case they must not be flown above 20,000 ft. owing to the danger of engine failure through fuel starvation. (See para. 33, Note (*b*)).

4. **Fuel cocks**

In early aircraft the low pressure and the high pressure cocks are both controlled by one lever (9) which is mounted under the engine control box on the left-hand cockpit wall. It has two positions, marked FUEL OFF (down and back) and FUEL ON (forward and up). In later aircraft, this lever operates the low pressure fuel cock only and a second lever, mounted outboard of the throttle lever (6) (and which in early aircraft operates the CANOPY SEAL) controls the high pressure cock.

5. **Oil system**

(i) There is no oil tank, but the power unit has a sump of about 1½ gallons capacity, for lubrication of the engine-driven accessories and of the impeller bearings.

(ii) The oil pressure gauge (34) is fitted on the left-hand side of the instrument panel. It records the main oil pump pressure, which should normally be 40-45 lb./sq. inch.

MAIN SERVICES

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6. **Pneumatic System**

An engine-driven compressor charges a bottle for operation of the brakes. The triple pressure gauge (30), on right-hand side of the instrument panel, shows the available pneumatic pressure. On early aircraft this pressure, after having been through the reducing valve is 200 lb./sq. in. On later aircraft the actual bottle pressure is shown and registers 450 lb./sq. in. The brake pressure when the brakes are operated should be 90 lb./sq. in. on early aircraft and 120 lb./in. on later aircraft.

(ii) An engine-driven vacuum pump operates the instrument flying panel. On some aircraft a suction gauge, marked SUCT. INS. HG. is fitted on the right-hand side of the instrument panel and should normally record 4-4½ ins. Hg.

(iii) A rubber cabin seal is inflated by pressure (from the pressure side of the vacuum pump) which is controlled by a lever marked ON—CANOPY SEAL—OFF. On early aircraft the lever (5) is on the engine control box, outboard of the throttle lever. On later aircraft this

lever becomes the high pressure fuel cock, and the CANOPY SEAL lever is mounted on the right-hand wall of the cockpit.

(iv) On later aircraft the cockpit can be pressurised by a lever mounted forward of the CANOPY SEAL lever. This lever should be moved DOWN for pressurising and UP when pressuring is not required.

7. **Electrical system**

(i) An engine-driven 24-volt generator charges two 12-volt batteries connected in series. These in turn supply the whole of the electrical system except the automatic engine starting system.

(ii) A generator warning light (31), and (on some aircraft) a voltmeter, are mounted on the top right-hand side of the instrument panel. The warning light indicates when the generator is not charging the batteries : it is wired directly to the batteries and will, therefore, be on continuously, irrespective of the position of the MASTER SWITCH, whilst the engine is not running.

(iii) A MASTER SWITCH (1) with GROUND and FLIGHT positions, is fitted on the left-hand cockpit wall. Two external sockets are fitted, one on each side of the fuselage, below the wing. The port socket is for normal ground test purposes, and is marked RADIO TEST SOCKET. The socket on the starboard side is marked 24 VOLT GROUND STARTER SOCKET, and is wired only to the automatic engine starting system.

(*a*) *When the MASTER SWITCH is set to GROUND :* the electrical services are isolated from the generator and aircraft batteries ; the system (except the automatic starter) can be connected to a ground battery if this is plugged in to the port socket.

(*b*) *When the MASTER SWITCH is set to FLIGHT :* all the electrical services, except the automatic engine starting system, are connected to the aircraft batteries; the automatic engine starting system can be operated if a 200 ampere-hour, 24-volt ground starter battery is plugged into the starboard socket but only if the MASTER SWITCH is at FLIGHT.

8. **Hydraulic system**

(i) Hydraulic pressure, supplied by an engine-driven pump is stored in a pressure accumulator, from which it operates the

Undercarriage,
Flaps,
Dive Brakes

when the appropriate selector lever is placed in the required position.

(ii) Sufficient pressure will be available in the accumulator for one complete one-way operation of the undercarriage or of the flaps after failure of the engine-driven hydraulic pump.

(iii) A handpump is provided on the left of the pilot's seat for use when accumulator pressure is not available: with the appropriate selector lever in the required position, operating the handpump will transmit hydraulic fluid direct from a reserve supply in the reservoir to the jacks (without going through the accumulator) under sufficient pressure to operate the desired service (except the dive brakes) at a reduced rate.

AIRCRAFT CONTROLS

9. **Undercarriage**

(i) The undercarriage selector lever (2) is on the rear face of the engine control box, and has two positions only, UP and DOWN. As long as the wheels are on the ground it is locked in the DOWN position by a solenoid. The solenoid can be over-ridden to permit UP to be selected on the ground, in case of emergency, by a switch marked U/C EMCY. RETRACTION, fitted at the top left-hand side of the instrument panel.

(ii) The undercarriage position indicator (12) is on the bottom left-hand side of the instrument panel. The warning lights have dimmer screens for night flying, which should be open by daylight or indications will be too weak to be noticed. Indications are:

Wheels locked UP	No lights
Wheels between UP and DOWN	Three red lights
Wheels locked DOWN ...	Three green lights.

There is no warning horn but an additional red light (20), fitted above the R.P.M. indicator, comes on if the wheels are not locked down and the throttle is less than a quarter open.

(iii) If engine-driven pump pressure is not available and the residual accumulator pressure is insufficient, the undercarriage can be raised and lowered by the handpump with the selector lever in the appropriate position.

10. **Flaps control**

(i) Operation of the wing flaps is controlled by the selector lever (3) marked FLAPS next to the undercarriage selector lever. It has three positions : UP—NEUTRAL—DOWN. Any angle up to 80° can be obtained by returning the selector lever to neutral when the desired angle has been reached. The selector lever will not return automatically to neutral on completion of an operation. It should be left in the up position when the flaps are up.

(ii) A flaps position indicator (14) is fitted next to the undercarriage position indicator.

(iii) If engine-driven pump pressure is not available, and the residual accumulator pressure is insufficient, the flaps can be operated by the handpump, with the selector lever in the appropriate position.

11. **Dive brakes control**

The red-topped lever (4) fitted on the rear face of the control box has two positions only—ON and OFF, the dive brakes cannot be operated by the handpump.

12. **Flying controls**

(i) The control column is of the spade-grip pattern and incorporates the brake lever, the gun firing pushbutton, the cine-camera control and a spring-loaded PRESS-TO-SPEAK switch.

(ii) The rudder pedals can be adjusted for reach in flight.

13. **Flying controls locking gear**

The flying controls locking gear, for which there is no stowage in early aircraft, consists of a V-shaped fitting which joins a peg in the floor, near the control column, to the port rudder pedal, and of a Y-shaped tubular fitting which joins the control column spade-grip to the coaming above the instrument panel. On later aircraft a stowage is fitted on the left-hand side of the pilot's seat.

14. **Elevator trimming tab control**

The elevator trimming tab control wheel (8) is on the engine control box : the indicator is on the top left-hand side of the instrument panel.

15. **Wheel brakes**

The brake control lever and parking catch are on the control column. Differential control of the brakes is afforded by a relay valve connected to the rudder pedals.

ENGINE CONTROLS

16. **Throttle control**

(i) A conventional throttle lever (6), marked SHUT—THROTTLE—OPEN, fitted in the engine control box, is the only engine control and is used to regulate power in the normal way. The lever must be operated very slowly and at a uniform rate. The friction control is on the engine control box above the elevator trimming tab control wheel.

(ii) A REAR BEARING TEMP. GAUGE (13), a JET PIPE TEMP. GAUGE (15) and an R.P.M. indicator (17) are mounted on the lower left-hand side of the instrument panel.

17. **Engine starting controls**

(i) An electrical starter motor is fitted and is controlled by an automatic system which is operated by the ENGINE STARTING pushbutton (48), and interlinked MASTER and STARTER switches (37-36) on the electrical panel on the right-hand cockpit wall. This pushbutton, which should be pressed for about two seconds and then released, sets in motion the timing system which automatically controls and operates the starting sequences : it

provides first a turning period sufficient for attainment of the correct r.p.m. before combustion commences, and then a further period to allow r.p.m. to build up sufficiently to ensure satisfactory running before the starter motor is cut out. If the engine fails to start or to continue running after one sequence the defect must be found and remedied before a second attempt is made.

NOTE—(*a*) The engine should not be re-started for four minutes after it has been shut down.

(*b*) In early aircraft it is not possible to re-start the engine in flight. In later aircraft it will be possible to do so by means of a booster-coil switch on the left-hand cockpit wall (this must not be confused with the fuel booster pump switch on the electrical panel).

18. **Stopping the engine**

Cut-out controls are not fitted and the engine is stopped by closing the throttle fully and then turning off the fuel.

NOTE.—On aircraft which have two fuel cock control levers, only the high pressure cock should be turned off.

OPERATIONAL CONTROLS

19. **Guns**

(i) The selective firing pushbutton, on the control column spade grip, is fitted with a spring-loaded safety flap. When the flap is at SAFE, the cine-camera can be operated by pressing the knurled portion of the gun-firing switch. When it is set to FIRE the push-button will fire the guns and operate the cine-camera simultaneously.

(ii) The Gyro gun-sight master switch (44) is on the electrical panel, the combined dimmer and selector switch (24) is on the top right-hand side of the instrument panel, and the ranging control is incorporated in the top of the throttle lever.

(iii) There is a cine-camera footage indicator on the lower right-hand side of the instrument panel.

20. **Signalling equipment**

(i) The type 90R and 89R controller units are fitted on the lower right-hand side of the instrument panel, whilst the TR 1464 controller (35) is on the lower left-hand side of the instrument panel, next to the G switches.

(ii) The detonator for the R 3121 (42) is on the electrical panel.

(iii) The identification lights are controlled by an ON—OFF switch, and operated by a pushbutton (45) on the electrical panel.

COCKPIT EQUIPMENT

21. **Sliding hood**

(i) The sliding hood is opened and closed by the crank handle mounted on the right-hand cockpit wall. A spring loaded plunger, which is located in the crank-handle, engages in one of ten positions on a base plate. This permits the hood to be locked in any desired position.

(ii) When closing the hood, the crank handle should be rotated with sufficient force to ensure that the spring-loaded plunger engages in the next hole after the one in which it would engage if the extra force was not used.

(iii) The hood can be jettisoned in flight by first pulling smartly on the rubber knob fitted on the top centre of the windscreen (which releases two rail retaining catches) and then operating the yellow CANOPY JETTISON handle forward of the normal crank handles.

NOTE.—(*a*) On later and pressurised cabin aircraft the rubber knob is not fitted and it is only necessary to operate the canopy jettison handle.

(*b*) The canopy rail catches should be tested for freedom of movement by the pilot by operating the spring-loaded levers at the end of the rails with the hand, they must then be returned into the normal closed position. This applies to the first fifty aircraft only on which this type of hood is fitted.

(iv) A pushbutton on the outside of the fuselage, marked PRESS TO SLIDE CANOPY, is pressed to permit the hood to be opened from the outside.

22. **Cockpit heating and ventilation**

(i) On early aircraft there is no cockpit heating, but a pneumatically-operated rubber cabin seal is provided to exclude draughts : it is inflated when the CANOPY SEAL lever is moved to the ON position. The cabin seal should only be inflated when the sliding hood is closed, and must be deflated before the hood is opened. In early aircraft the lever is on the engine control box, outboard of the throttle lever : in later aircraft, it is on the right-hand wall of the cockpit, and the lever on the engine control box becomes the high pressure fuel cock.

(ii) Cockpit heating is provided in later aircraft, fitted with pressurised cabins, and is controlled by a lever marked HOT—CABIN BLOWER AIR—COLD, mounted on the right-hand cockpit wall, to the rear of the electrical panel.

(iii) An adjustable cold air ventilator is fitted on the left-hand cockpit wall, beneath the coaming.

23. **Cabin pressurising**

(i) When a pressurised cabin is fitted, the cabin blower is engine-driven and supplies air to the cabin through the cabin air regulator. The cabin pressure is automatically controlled by a Westland valve which starts pressurising the cabin at about 15,000 feet when the lever is DOWN, see para. 6 (iv), and progressively increases the differential cabin pressure to a maximum of $2\frac{3}{4}$ lb./sq. in. at 35,000 feet.

(ii) The cabin altimeter on the right-hand side of the instrument panel will show the altitude corresponding to the cabin pressure, and the pilot should regulate his oxygen supply to correspond with this altitude. A cabin pressure gauge and warning light are also provided. The warning light glows when the cabin pressure is $\frac{1}{2}$ lb./sq. in. below the standard ; this light may flicker on and off during the climb.

24. **Seat adjustment**

A lever on the right-hand side of the seat provides adjustment for height.

25. **Oxygen**

A Mark XIA oxygen regulator (29) high pressure control and indicator are mounted together on the right-hand side of the instrument panel.

26. **Windscreen de-icing**

A handpump with a regulator is mounted on the bottom right-hand side of the instrument panel.