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ADDITIONAL NOTES

Reheat Operation.

To select reheat the throttle is opened to 96% r.p.m., a throttle switch is closed at 94% r.p.m. and when the throttle is passed through the gate a second switch is closed. These switches provide the following services.

1. The Pilot Shut off Cock solenoid is energised which opens the ball valve A this allows H.P. fuel to flow from the engine fuel pumps to the pilot atomisers in the jet pipe.

2. Current flows through the time switch to energise the Igniter Box & a spark occurs at the H.E. plug, item 142 produces a light up & the flame spreads along the five gutters and is enhanced by the stabiliser rings.

3. The P/H bleed section is energised which opens the ball valve "B", thus bleeding P/H pressure to atmosphere from the top chamber. P2 pressure in the centre chamber moves the differential area diaphragm assembly upwards thus closing ball valve "C".

4. The solenoid for the air shut off cock is energised and closes ball valve "D". The closing of H.B.V. C & D causes servo pressure on top of the servo piston to increase, this causes a downward movement of the piston which in turn opens the air throttle & allows a flow of P.2. to the turbo fuel pump.

5. The press switch closes at 80 lb/in² which will energise the press switch relay.

6. The P/H bleed is deenergised & allows H.B.V "B" to close & and the P/H press build up in the top chamber & the control unit will then reduce air flow to the turbo fuel pump if the P2/PH ratio changes to 3.145 to 1.

7. The main shut off cock is energised & H.B.V "A" is opened this reduces the fuel press on the opening side of the diaphragm, the diaphragm moves & fuel passes from the pump to the main burner ring & the spray from the central main flame unit is ignited by the pilot atomisers.

8. The nozzle control valve solenoid is energised which operates a throttle acting piston which uses high press air from front to rear side of the cam & then opens the bleed. The gases are fitted in the exhaust lines & to give a 27½ sec opening. They do not affect closing of the eyelids.

9. The time switch is energised and No 1 contacts open after 3 secs completion a Temp. Trip relay circuit if excessive JPT occurs the Temp limiter will energise the trip relay & cancell reheat. The trip relay will energise a hold on coil & also create a circuit to earth through the nozzle indicator (Pale eye white)

10. Nozzle indicator also shows white if the eyelids remain closed.

" " open on exit cone.

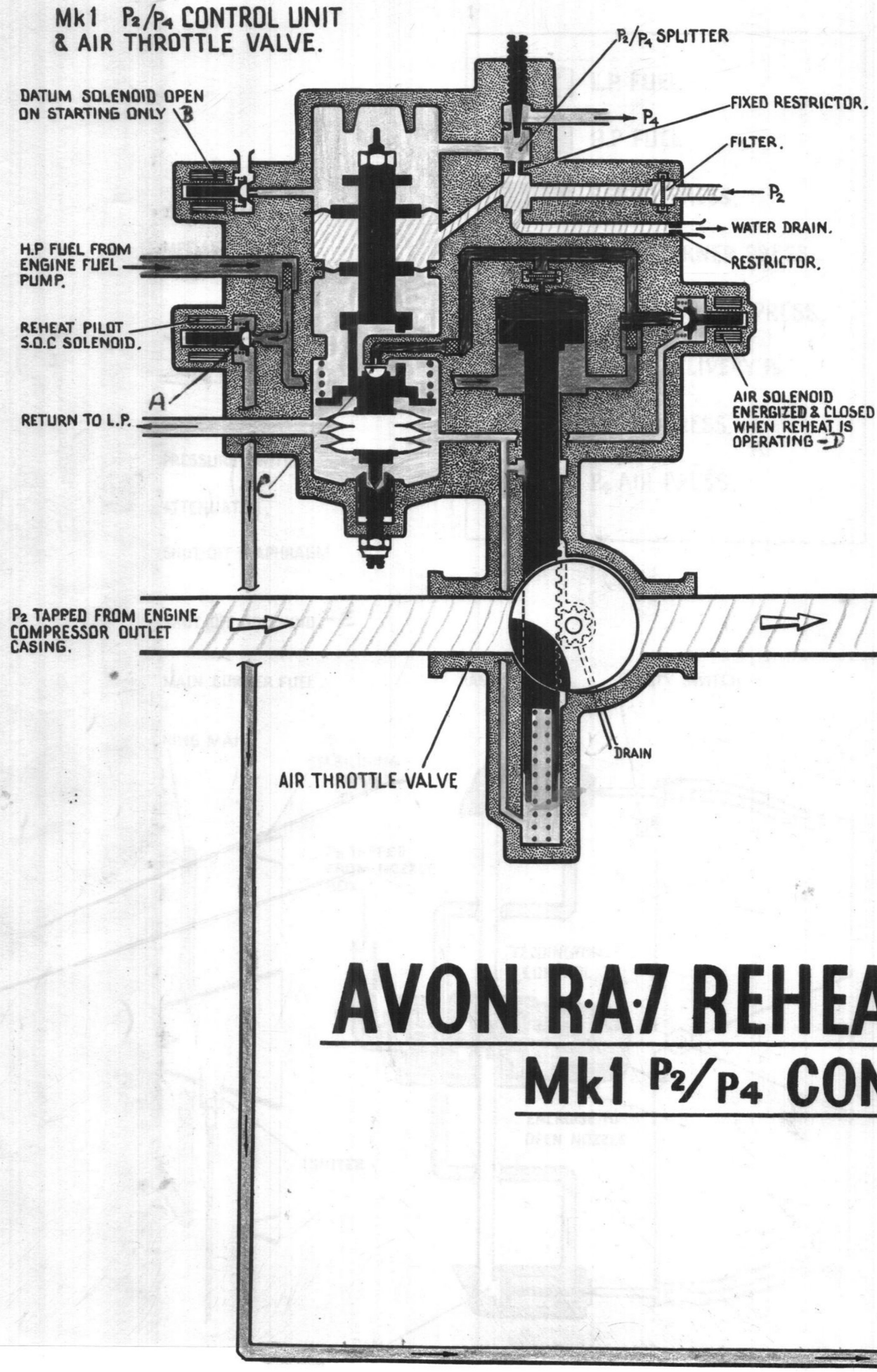
11. The time trip is inoperative until u/c is retracted.

Reheat weak = Low J.P.T. at S/L. } (TOP) SPLITTER
" rich = High " " " } adjust bars to richen 1 turn 30° to 50°.

Reheat drifting weak Low J.P.T at altitude } BOTTOM SPLITTER
" rich HIGH " " " adjust in. richen 1 turn = 25° entry & turn at time followed by 1 turn on splitter rod

Normal Limit MAX 7280
REHEAT. 9,280

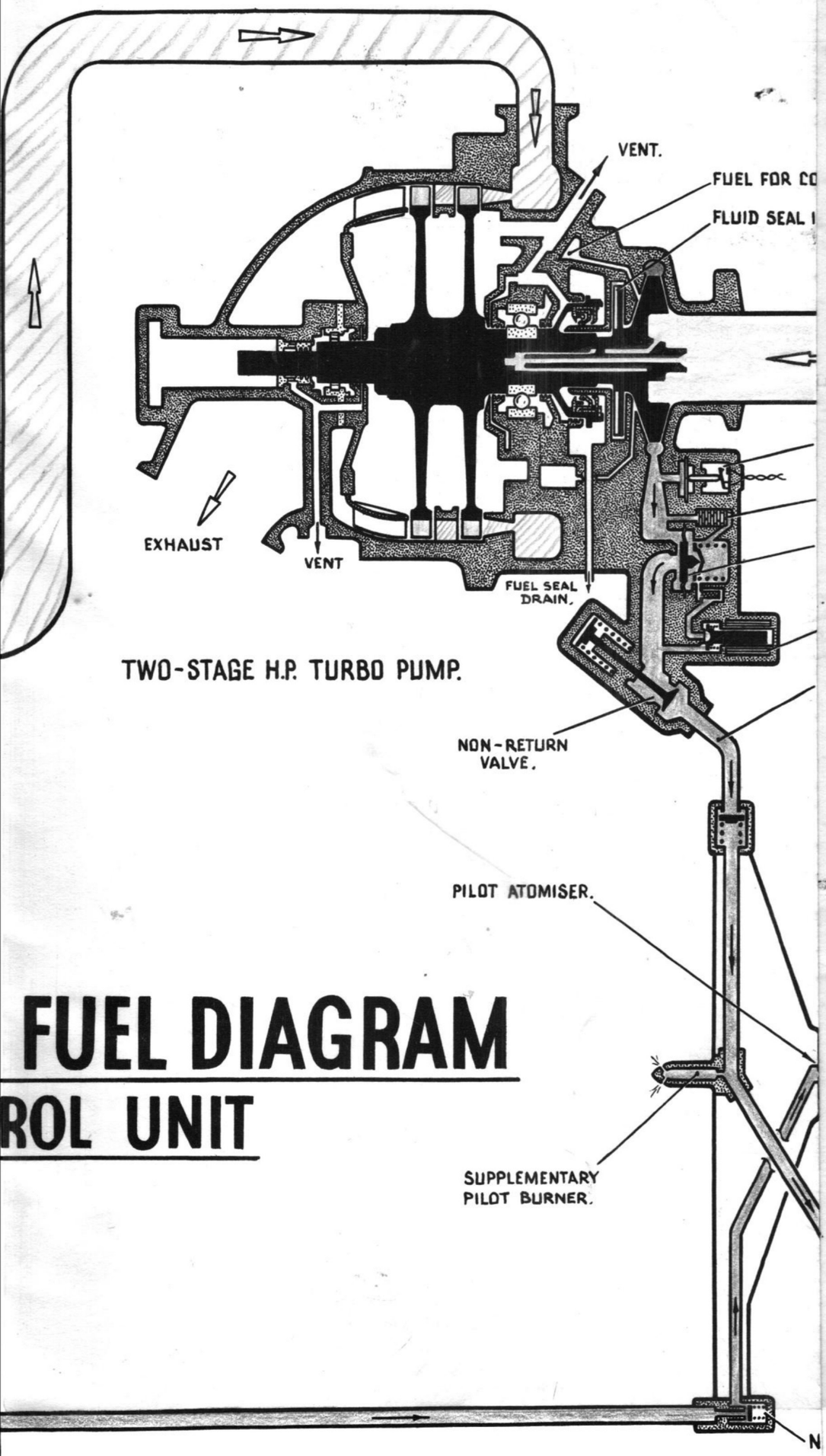
Consumption from PH to 1.8.



AVON R·A·7 REHEAT

Mk1 P2/P4 CONT

1·3·54



FUEL DIAGRAM

ROL UNIT

L.P. FUEL
H.P FUEL
SERVO PRESS.
MAIN BURNER PRESS.
PILOT BURNER PRESS.
COMP. DELIVERY P_2
P_3 AIR PRESS.
P_4 AIR PRESS.

OLING BEARING.
MPELLER.

L.P. FUEL INLET.

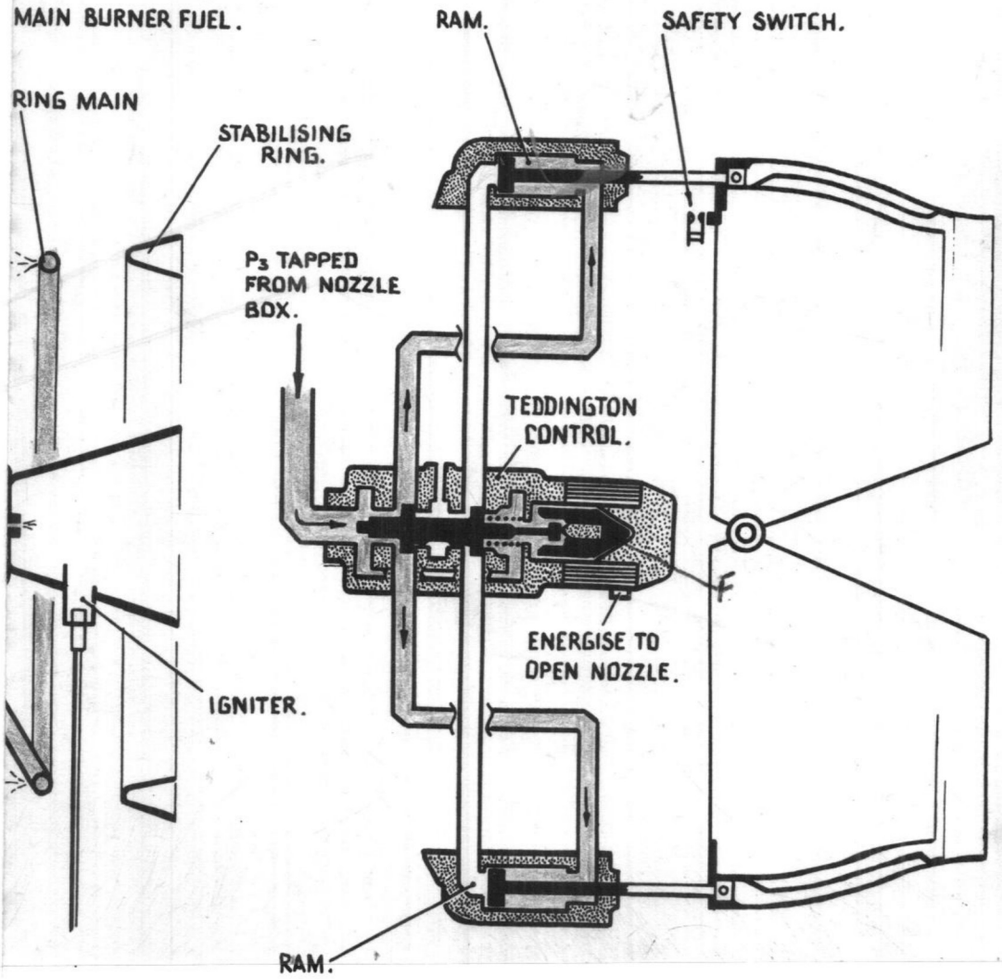
PRESSURE SWITCH.

ATTENUATOR.

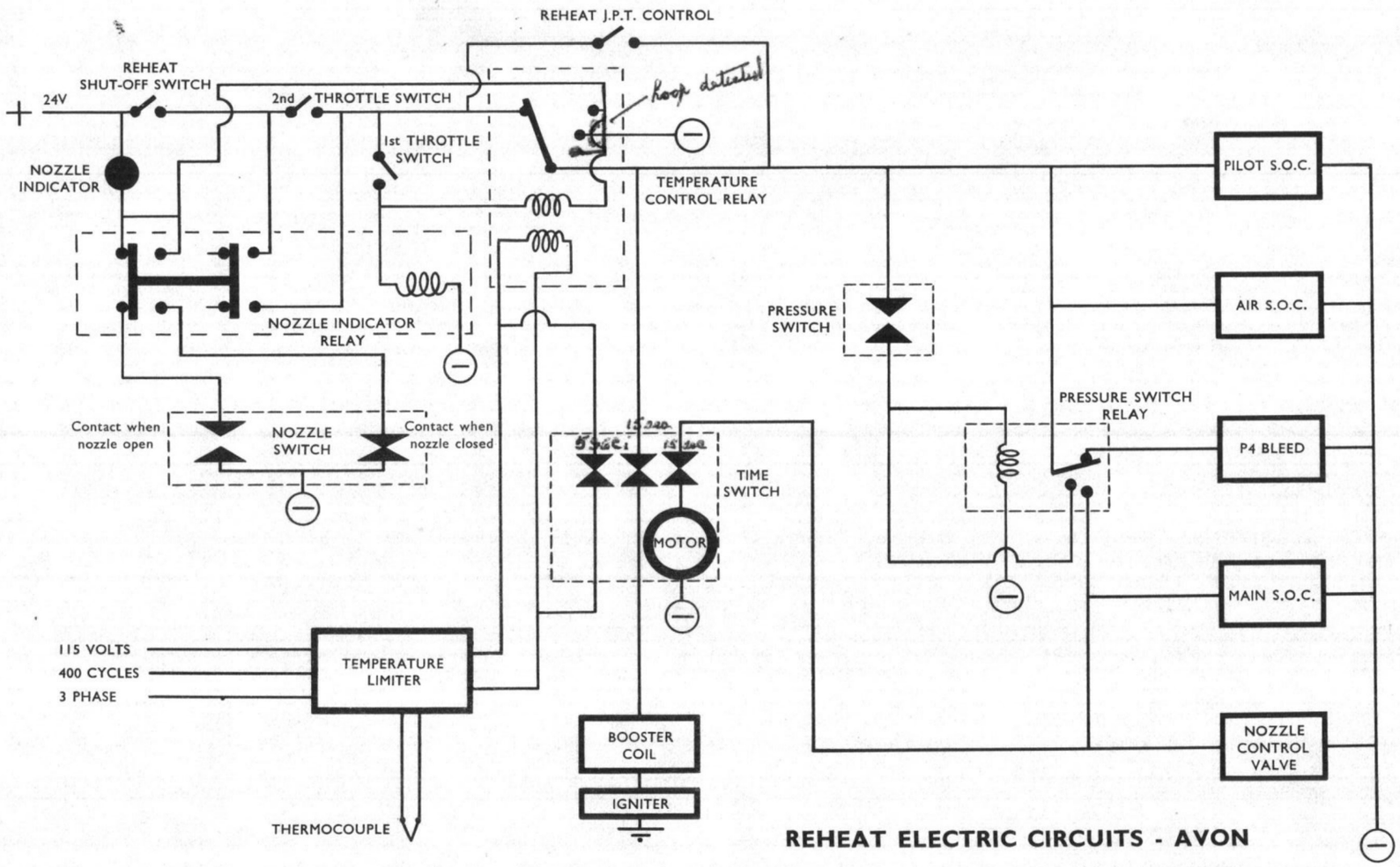
SHUT-OFF DIAPHRAGM.

SHUT OFF SOLENOID. - E

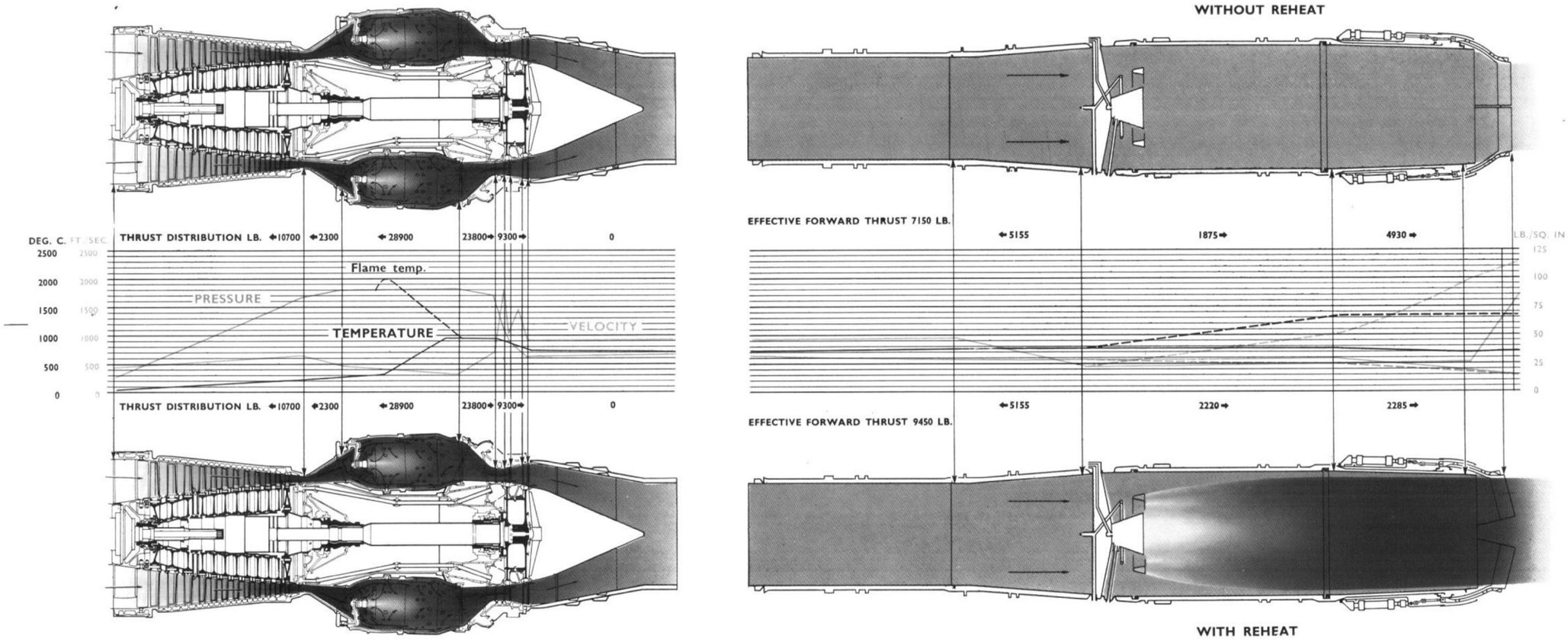
MAIN BURNER FUEL.



.R.V.



REHEAT ELECTRIC CIRCUITS - AVON



GAS FLOW WITH AND WITHOUT REHEAT—AVON

AVON.

INTRODUCTION TO REHEAT.

Reheat, or after burning, is a method of temporarily increasing the thrust of a jet engine for take-off, combat or supersonic flight.

It consists of introducing and burning fuel in the jet pipe between the turbine and the final nozzle. The increased temperature of the exhaust gases causes an increase in the jet velocity and hence an increase in thrust.

As the reheat combustion takes place downstream of the turbine assembly, gas temperatures up to 2000°K can be used to obtain the maximum benefit from the system. This temperature would give a thrust boost of approx.50% at static S.L. conditions, increasing to 95% at 700 m.p.h. It is not possible to burn all the surplus oxygen in the jet pipe, as a layer of relatively cool gas is needed to insulate the jet pipe skin from the combustion heat.

No special fuels are necessary, as the reheat system is fed by fuel from the normal aircraft tanks. The additional fuel consumption is high in comparison with the normal engine consumption but is lower than that of water/methanol injection or rocket systems.

Selection of reheat is by the pilot moving the throttle through a gate into a "Reheat" portion of the quadrant. Pulling the throttle back through the gate cancels reheat and returns the engine to its normal operation conditions.

Reheat is only applied at maximum engine R.P.M. or combat rating and is at present purely an ON - OFF system.

A reheat system consists of four main sections:-

1. Jet pipe.
2. Burner assembly.
3. Fuel pump.
4. Control unit.

Jet Pipe.

To reduce losses during combustion it is necessary to apply reheat to a slow moving gas stream, and the combustion zone of the jet pipe is therefore of larger diameter than the standard pipe. A special diffusing section is used to connect the engine exhaust unit to the parallel combustion section.

The whole jet pipe is of double skin construction and air is drawn through the annular gap by the ejector effect of the jet stream passing through the final nozzle. This reduces the outer skin temperature to prevent damage to the aircraft structure.

Due to the reduced density of the jet stream when reheat is in operation a larger final nozzle is required, but to enable the engine to operate without reheat the nozzle must be returned to its normal diameter. The change in area is effected by opening or closing a pair of "eyelids" mounted at the rear of the jet pipe and actuated by pneumatic rams. The "eyelids" when in the closed position form the normal final nozzle and when in the open position reveal the fixed diameter reheat nozzle.

/continued.

Burner Assembly.

To maintain stable combustion it is necessary to provide a region of turbulence by means of a perforated cone which is held in the jet pipe by a cross bar.

A pilot atomiser in the centre of the cone sprays downstream and ignition is provided by an igniter plug in the cone wall. Vee section gutters feed radially outwards to an annular gutter supported in the jet pipe at three points.

Forward of the cone is the main burner in the form of a ring pipe carrying short radial spokes which are drilled to provide fuel outlets. A supplementary pilot burner is carried at the apex of the cone and sprays upstream, fed from the main fuel supply.

Combustion is initiated by the igniter lighting the atomised fuel from the downstream pilot burner. The flame is then carried outwards into the annular gutter where it ignites fuel flowing from the ring main spokes. The central upstream jets maintain flame stability by supplementing the hot cone to prevent flame extinction by the main fuel supply.

Fuel Pump.

The fuel pump supplying the reheat burners may have to deliver approx. 2000 G.P.H. at low altitude, high forward speed conditions.

A two stage turbine driven by air from the compressor outlet casing rotates a centrifugal fuel pump at very high speed. Fuel from the pump rotor passes through a divergent outlet passage which further raises the pressure to approx. 250 p.s.i. The pump outlet embodies a solenoid operated shut-off valve, so that fuel flow to the reheat burners can be synchronised with the opening of the two-position nozzle.

The pump shaft carrying the turbines and fuel rotor is supported in grease packed ball and roller bearings and is hollow to permit an internal L.P. fuel flow for cooling purposes. Fuel is also used to cool the ball bearing outer housing.

Control Unit.

The control unit adjusts the fuel supply to the reheat burners so that the "compressor/turbine" working relationship is maintained the same as when operating at Max. R.P.M. without reheat. It does this by sensing and maintaining the ratio of Compressor Delivery Pressure to Exhaust Cone Pressure, i.e. P_2/P_4.

These pressures are fed to the control unit and, via an H.P. fuel servo piston, position an air throttle to regulate the airflow to the turbo fuel pump.

The unit is temporarily made ineffective on selection of reheat so that reheat conditions can be established and is then immediately brought back into control.

An electrical circuit works in conjunction with the control unit and embodies numerous safety switches and also a temperature limiting device which cancels reheat if the maximum J.P.T. is exceeded.