OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

1. Nose Fairing (301 Engine)

The nose fairing is formed from light alloy sheet, is of double skin construction, the space between the skins allowing passage of air for engine anti-icing, and open at the front to ram air. The fairing is attached to the front face of the centre adaptor by studs and nuts, the fitting of a dowel being such that the fairing will be located in one position only, so lining up the ram air outlet and water drain outlet.

Slots around the mating faces line up to allow the anti-icing air to exhaust from the nose fairing to the centre passages through the twelve hollow vanes of the intake casing.

2. Nose Fairing (202 Engine)

Surrounds the oil tank and is of double skin construction, the space between the skins allows a passage for engine anti-icing air. Space between studs ensures that fairing will fit in one position only. Slots around the mating faces allow the anti-icing air to exhaust from the nose fairing into the leading edge of the six-hollow vanes of the intake casing.

3. Air Intake Casing (301 Engine)

The casing is an alloy casting and is located on the front face of the low pressure compressor extension.

The twelve hollow vanes, each with two passage ways link the outer casing with the centre section. Passages between these vanes duct the air from the aircraft intake to the L.P. compressor.

The rear diaphragm supports the L.P. compressor front bearing housing and the stationary member of the bearing seal. Housed in the centre adaptor is the oil separator and its front seal.

At the rear of the intake casing 30 hollow entry guide blades are fitted in recesses in the outer casing and are secured by set bolts which are screwed into the threaded base of each blade. At their inner ends the blades locate in the centre section.

A circumferential manifold located around the outer casing distributes hot air through the entry guide blades.

The aircraft intake duct is fitted by means of a manacle ring to the front flange of the casing, this facilitating speedy removal for inspection and engine changing.

All vanes vent anti-icing through their rear ducts whilst anti-icing air to the nose fairing flows through the front ducts.

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

For reference purposes the twelve hollow vanes are numbered one to twelve in a clockwise direction viewed from the rear of the engine, No 1 Vane being at 12 o'clock position and are used for the following purposes:

No 1 Vane - Joined by duct to No 12 vane to vent engine breather air from oil separator, to the rear of the mainplane. External fittings are the front one for the front hoist, during installation, or the engine sling, and the second one for the adjustable bracket to which is fitted the fixed length aircraft link.

No 2 Vane - External elbow venting anti-icing air from Nos 2 and 3 Vanes.

No 3 Vane -

No 4 Vane - Shielded perforated plate through which vents anti-icing air into the engine bay.

No 5 Vane -

No 6 Vane -

No 7 Vane - Oil scavenge from L.P. compressor front bearing and oil separator. Engine anti-icing air from vanes 5,6,7, 8 and 9 vertically downwards to atmosphere.

No 8 Vane - Nose fairing water drain. External elbow for ram air pressure to fuel system.

No 9 Vane - Ram air pressure to the elbow on Vane 8. Pressure oil to L.P. compressor front bearing.

No 10 Vane - Shielded perforated plate through which engine anti-icing air vents into the engine bay.

No 11 Vane - External elbow venting engine anti-icing air to join with that from Vane 2 and 3.

No 12 Vane - Joined by duct to No 1 and 12 vanes to vent breather air to rear of engine External connection at the vane accepts vent air from the constant speed drive unit oil tank.

4. Air Intake Casing (202 Engine)

The light alloy air intake is bolted to the low-pressure compressor casing and has an integral inner casing supported by six vanes. The oil tank is attached to the centre casing. Housed in the inner casing is the oil separator. The rear diaphragm supports the L.P. Compressor front bearing and the front diaphragm supports the oil separator front bearing. A ring of hollow compressor entry guide blades are fixed, as variable incidence blades are unnecessary with

/the

the spool compressor system. A circumfrontial collector ring located around the outer casing distributes hot air to the entry guide blades. The six vanes are numbered clockwise when viewed from the rear and are used for the following services.

Vane 1 - Lifting eye. Vent from oil separator.

Vane 2 - Oil feed to L.P. Compressor front bearing.

Vane 3 - Supply from tank to pump. Scavenge return to tank.

Vane 4 - Scavenge oil from L.P. Compressor front bearing.
Oil tank overflow pipe.

Vane 5 - Oil tank contents indicator shaft.

Vane 6 - Oil tank pressuring valve.

A ram air pilot head (P1) is fitted in front of Vane 4, and is heated by air from the engine anti-icing supply pipe.

5. Low Pressure Compressor Rotor (301 Engine)

A six stage compressor rotor, axial flow type, is driven by the second stage turbine wheel.

The main assembly consists of the front rotor shaft, the six rotor discs with the five spacer rings, the rotor driving shaft and rotor tail shaft.

Each stage of the compressor rotor blades is mounted in an aluminium alloy rotor disc, the fitting being of fir tree root form. The fifth and first stage blades are designed with a front and rear key respectively to the fir tree roots to provide end locating, spacer rings bolted between each stage provide a positive location for stages two, three and four.

The zero stage disc complete with blades having rear keys, is located by two dowels to the first stage discs.

The spacer ring and the front shaft retaining bolts complete the assembly of the zero stage to No 1 stage disc.

The compressor driving shaft is secured by its integral flange to the rear of the rotor by bolts passing through discs number four and five. A bearing seal is located to the rear of the flange followed by a single thrust bearing which locates the rear end of the compressor rotor within the intermediate casing.

/The compressor

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

The compressor driving gear, located on the driving shaft by serrations, the bearings and bearing seal, are all secured by tab washer and ring nut. An adjusting washing located the rotor assembly in relation to the intermediate and L.P. compressor casings.

Splined into the rear of the driving shaft is the rotor tail shaft, on to the rear of which is splined the L.P. compressor driven coupling. Located inside the rear of the tail shaft, by three retaining pins, is a threaded steel ball into which is screwed the forward end of the centre tube unit, the other end obing locked to the rear of the L.P. turbine disc.

6. Low Pressure compressor casing

The alloy casing is in two sections, the extension unit and compressor casing and secured by bolts along the centre lines.

Grooves of dove-tailed section house the five rows of steel stator blades. Retaining plates, secured by countersunk head screws to the casing joint faces at the ends of each half row of blades, retain the blades of stages 1, 2 and 4 in position when the casings are separated.

A mounting bracket on the starboard side lower half casing, is the location for the Constant Speed Drive Unit and Alternator, whilst the port side mounting accepts the engine oil tank.

The front bulkhead is bolted to the flange on the casing, the Elliot fuel flowmeter is mounted on the rear lower portion.

A banjo standard, to which bolts a two way connection, is tapped into the rear of the L.P. lower half casing. L.P. delivery air from No 1 Vane intermediate casing is piped to the C.S.D.U. oil tank and also to the banjo connection to pressurise the front and rear bulkheads seals.

A transportation and test bed attachment point is located on the lower half casing.

The first four rows of stator blades, the '0', 1, 2 and 3 stages are bolted, with two bolts to each blade, to the compressor casing, so providing positive location.

7. Low Pressure Compressor Rotor and Casing (202 Engine)

The five stage axial flow compressor rotor is driven by the second stage turbine wheel. The oil separator is driven from the front of the compressor, the fuel pump and engine tachometer being driven from the rear. The alloy casing is in two parts secured by bolts along the centre line. The engine front mounting support is attached to the top of the casing and steadies the front end of the engine by means of a single adjustable link. A mounting bracket on the starboard side lower half casing is the location for the Constant Speed Drive Unit and Alternator. A fourway connection is tapped into the rear of the L.P. lower half casing. A transportation and test bed location point is located on the lower half casing.

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

8. The Front Bulkhead and Seal

Comprises top and bottom units, attached to the L.P. Compressor Casing, forming the dividing wall between Zone 1 and 2A of the engine installation. A seal, located around the bulkhead, is kept to a value of 5 p.s.i. by a valve. Two covers are provided for the Flow meter and the Constant Speed Drive Unit. Passing through the bulkhead are Air, Fuel and oil and hydraulic pipelines, the throttle control rod and various breeze plug connections.

9. Intermediate Casing

The intermediate casing is situated between the two compressors and contains both the L.P. exit guide blades, and H.P. entry guide blades.

The central section of the casing is connected to the outer portion by eight cambered hollow vanes, the area between which is used to convey the L.P. delivery pressure air to the H.P. compressor inlet.

The rear L.P. compressor and front H.P. compressor bearings are accommodated within the front and rear walls of the casing.

Spur gears mounted on the compressor shafts initiate drives which are conveyed through three of the hollow vanes to the outside of the casing.

Mounting faces for the auxiliaries are arranged around the outer casing forming two groups, namely L.P. and H.P. driven. The former comprises the compressor tachometer generator and L.P. driven fuel pump. The latter comprises the following:

H.P. Driven Fuel Pump
Main Oil Pump and four Scavenge Pumps
Constant Speed Drive Unit
Hydraulic Pump
H.P. Tachometer Generator (When fitted)

In addition it transmits the drive from the starter to the H.P. compressor when the starter is in operation.

Vanes of the casing are used as follows:

301 Engine

No 1 Vane - Two connections, piping L.P. delivery air to pressurise:

a. Constant speed drive unit oil tank.

b. Front and rear bulkhead seals.

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

No 2 Vane - Blank

No 3 Vane - Blank

No 4 Vane - Drive to the constant speed unit and starter

No 5 Vane - The oil pumps and auxiliary drives. Oil drain to the sump

No 6 Vane - Front - L.P. Driven fuel pump drive. Rear H.P. driven fuel pump drive. (L.P. R.P.M. Tachometer generator, L.P. and H.P. Hand turning gears).

No 7 Vane - Vents engine oil tank via spring loaded valve to gear chamber.

No 8 Vane - Blank

202 Engine

Vane 1 - Banjo connection for pressurising front and rear bulkhead seals.

Vane 2 - Blank

Vane 3 - Oil feed to L.P. Compressor front bearing

Vane 4 - Drive to Constant Speed Drive Unit and starter

Vane 5 - Drive to oil pump and auxiliaries oil Drain to Sump.

Vane 6 - Front - L.P. Fuel Pump drive and hand turning gear.
Rear - H.P. Fuel pump drive and hand truning gear.

Vane 7 - Blank

Vane 8 - Blank

10. High Pressure Compressor Rotor

a. The seven stage high pressure compressor is made of heat resisting steel.

b. The rotor blades are mounted, by fir tree root form, in the seven steel discs between which are bolted six spacer rings, the whole assembly being contained between the front rotor shaft and the rear rotor centre.

c. The front rotor shaft, which carries the compressor front bearing, bearing seal and driving gear, is bolted to stages one and two.

d. The rear rotor centre, which carries the double thrust bearing, bearing seal, compressor rear air seals and compressor driving coupling is bolted to number six spacer ring and number seven rotor disc.

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

Inside the compressor are assembled concentrically an inner oil tube and an outer air transfer tube, both made of light alloy.

11. High Pressure Casing.

The cast steel casing is split on the horizontal centre line and has seven dove-tailed grooves machined in its inner diameter to accept the seven stages of compressor stator blades.

Retaining plates secured by screws to the casing joint faces at the ends of each half row of blades, retaining the blades in position when the casings are separated.

Air via an outlet from the third stage of the compressor casing upper half is used for cooling the rear face and pressurising the bearing seal of the L.P. turbine.

12. Delivery Casing

The stainless steel delivery casing is situated between the rear face of the H.P. compressor casing and the combustion chamber outer casing. The inner and outer casings are linked together by eight hollow vanes.

Two mounting trunnions are bolted to the outer casing at the 3 o'clock and 9 o'clock positions, and are two of the three attachment points for the engine sling. (The third point being on the air intake casing 12 o'clock position).

The H.P. Compressor rear bearing support and coupling chamber unit is located on the front of the inner casing flange, the access hole to the eight locating bolts of the H.P. coupling being blanked by a cover plate with special seals. Mounted on the rear of the inner casing flange is the H.P. turbine rear bearing support unit.

Delivery casing external locations are P1/P3 switch tapping, Oil cooler and fuel filter attachments, Unit fuel system brackets and eight duplex burners.

The inner faces of the burner locations receive the heads of the eight flame tubes.

The hollow vanes are utilised in the following manner:

No 1 Vane - Blanked

No 2 Vane - A/C Hot air services and air starting duct.

No 3 Vane - Fuel tank pressurising and inducer valve.

No 4 Vane - Oil Feed pipe and oil drain pipes.

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

No 5 Vane - Vent to atmosphere

No 6 Vane - Fuel heater pipe.

No 7 Vane - Engine anti-icing air outlet

No 8 Vane - Blanked

13. Compressor Turbine Couplings. The compressor turbine coupling assembly is housed within the chamber in the delivery casing and connects the H.P. & L.P. compressors with the 1st and 2nd stage turbines respectively.

The inner coupling which drives the L.P. compressor is situated within the H.P. coupling and rotates independently on the inter-shaft roller bearing. The external teeth of the compressor coupling engaged with internal teeth of the L.P. turbine coupling and is secured by the fitting of the centre tube unit through the L.P. turbine shaft. This centre tube is located in the threaded steel ball in the compressor tail shaft, the swivelling of the ball allowing for any malalignment.

The outer driven coupling is fitted to the H.P. compressor rear shaft by the same means as the inner driven coupling i.e. splined and retained by a locked ring nut, and receives the drive from the outer turbine coupling internal teeth. The outer track of inter shaft bearing is located between two circlips inside the HP compressor shaft coupling.

Eight lugs extend forward from the outer turbine coupling. Each carry a locating bolt and nut which secures a thrust ring housing to the coupling. The head of each bolt is drilled to engage with one of two spring loaded plungers fitted to each coupling lug.

This device and the special nuts ensures the security of the locating bolt assemblies. The thrust ring housing, being positioned by bolts of a smaller diameter than their locating holes in the coupling, permits a flexing of the H.P. rotating assembly.

An external labyrinth is carried on this coupling to form a seal with the coupling chamber housing.

14. Rear Bulkhead

This bulkhead forms the dividing wall between zone 2a and 2b, air seal inflated to 5 p.s.i. by the L.P. Compressor, completes the efficient sealing between the zones. Attached to the front face is the started exhaust pipe and the throttle rod rear bearing while on the rear face are the two Breeze plug connections for the zone 2a fire detectors. Pipelines for the following services pass through this bulkhead.

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

(i) H.P. 3rd stage air.
(ii) Pressure oil to L.P. Turbine bearing.
(iii) Scavenge oil from L.P. Turbine bearing.
(iv) Drain and dump valve fuel.
(v) Zone 2b inducer.

15. Bearings.

There are seven main bearings located in the following positions.

No 1 - L.P Compressor front bearing (ROLLER) positioned at the rear of the air intake casing.

No 2 - L.P. Compressor rear bearing (SINGLE BALL) positioned in the front wall of the intermediate casing.

No 3 - H.P. Compressor front bearing (ROLLER) positioned in the intermediate casing rear diaphragm.

No 4 - H.P. Compressor rear bearing (DOUBLE BALL) positioned in the front of the coupling chamber.

No 5 - Intershaft bearing (ROLLER) positioned between the L.P. and H.P. Couplings.

No 7 - H.P. Turbine rear bearing (ROLLER) positioned at the rear of the turbine inner drum.

No 8 - L.P. Turbine rear bearing (ROLLER) positioned in the exhaust annulus diaphragm.

16. Combustion Chamber Outer Casing

This outer casing of steel, is fitted between the delivery casing rear flange and the front flange of the L.P. turbine casing, this rear joint has located between the flanges the turbine stator support ring.

The casing comprises the top and bottom halves, joined along the horizontal flanges by bolts, spring washers and flanged nuts.

The bottom half casing has three mountings two for the ignition plugs and the other for the turbine drain connection, also brackets for the two drain bosses for dump valve and fuel system seal drains.

When assembled, the outer casing encloses the flame tubes, turbine entry duct, H.P. turbine stators and H.P. turbine casing in which rotates the H.P. turbine.

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

17. Flame Tubes.

Eight flame tubes are situated in the annulus formed between the combustion chamber outer casing and turbine inner drum. Each combustion chamber comprises two main units, i.e. the flame tube head and the flame tube unit, Nos. four and six tubes are fitted with steel inserts for the igniter plugs.

The flame tube head is of "streamline" form and has a flanged connection by which it is secured to the inner surface of the delivery casing, also a retaining strap which is bolted to a threaded boss on the flame tube.

Each flame tube unit comprises four sections welded together to make a rigid assembly. The front section carries an outer joint ring at its forward end which locates on the inner ring of the flame tube head.

A flare of conical form is spot welded to the bore of the front section which carries a swirler at its apex, faces towards the front of the assembly, and in the bore of the swirler the "Duplex" burner is located. Two inter-connecting flanges positioned part way along the tube are fitted to link with the adjacent flame tubes. The rear end of the tube accommodates a locating ring which fits into the turbine entry duct.

18. Turbine Entry Duct Unit

The turbine entry duct, housed in the rear of the combustion chamber outer casing is bolted to the H.P. turbine stator support cone. The entry duct is made of sheet steel and supports the downstream ends of the eight flame tubes. Seventeen H.P. turbine stator segments are inserted into the rear of the entry duct, each segment being located by the H.P. turbine casing.

19. Turbine Assembly

The main units of the turbine section are:

a. H.P. Turbine bearing support housing.

b. H.P. Turbine rotor.

c. L.P. Turbine rotor.

H.P. Turbine support housing

The H.P. turbine support housing is carried in the combustion chamber unit casing which is secured atits front end to the rear face of the delivery casing.

The rear end of the casing accommodates the turbine bearing and housing, the stationery portion of the turbine bearing seal, the stator support cone and H.P. turbine stators.

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

An oil jet and filter assembly located in the housing provides bearing lubrication.

H.P. Turbine Rotor

The turbine disc is bolted to the large flange at the rear end of the hollow turbine shaft. Forward of this flange are the bearing and front and rear seals, all three components being secured to the shaft by a retaining nut.

At the front end of the shaft is the compressor driving coupling assembly.

The turbine blades are of aerofoil section and are shrouded at the tips. Each has a root of "fir tree" form which is located axially by a projection at the forward end of the root and a locking tab at the rear.

L.P. Turbine Rotor

The hollow L.P. turbine shaft passes through the bore of the H.P. turbine shaft. A seal at its forward end prevents hot air from the turbine passing between the shafts to the coupling chamber. Splines at the front end of the shaft carry the turbine coupling.

The turbine blades are shrouded at the tips and are fitted and secured in a similar to the H.P. turbine blades.

The L.P. turbine bearing, together with the bearing seal fitted between the bearing and disc, is secured to the wheel hub by a retaining nut. The centre tube passes through the bore of the shaft, and a connection piece at its forward end locates in the L.P. compressor shaft. The tube provides positive location between the L.P. turbine and compressor.

20. Exhaust Annulus

The exhaust annulus is located on the rear face of the L.P. turbine casing. It consists of an inner and outer ring which are separated by eight radially disposed hollow vanes. A flange at the rear of the inner ring accommodates the exhaust inner cone, whilst a diaphragm at the front end supports the L.P. turbine bearing and housing.

Upper and lower connections on the rear of the bearing housing connect with the air and oil drain pipes respectively.

Three of the eight hollow vanes are utilised in the following manner.

No 1 Vane - Conveys 3rd stage H.P. compressor air for L.P. turbine cooling and bearing seal pressurising.

No 4 Vane - Houses the oil feed pipe to oil jet assemblies in the rear bearing housing cover.

OLYMPUS 202/301 SERIES

SECTION 2

ECU DESCRIPTION

No 5 Vane - Accommodates an oil drain pipe from the bearing housing.

A hole at the bottom of the annulus forms a drain which connects with the turbine drain system.

Upper and lower heat shields, attached by brackets, encase both combustion chamber outer casing and exhaust annulus.

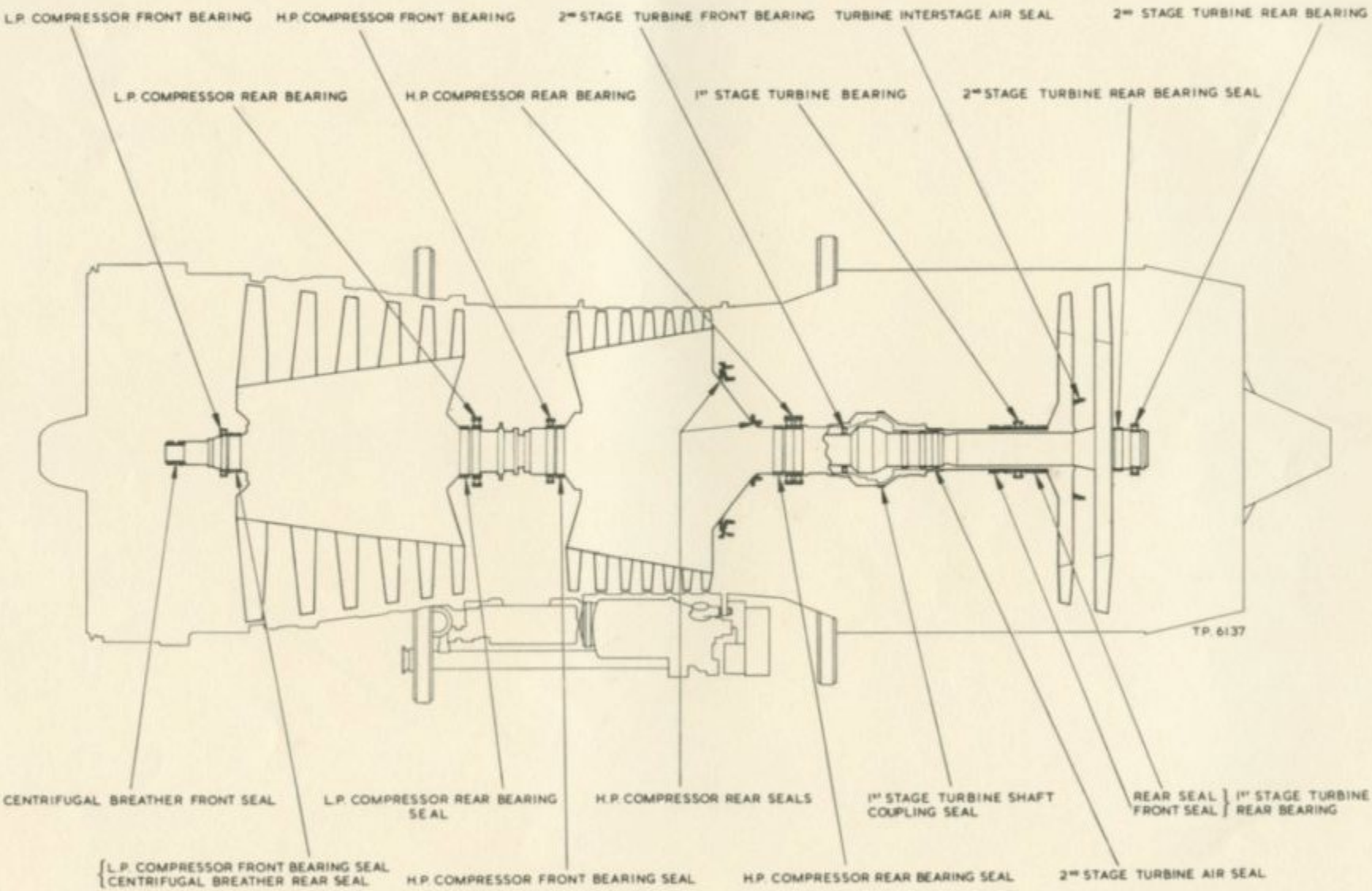
21. Exhaust Cone Unit.

The exhaust outer cone, bolted to the turbine exhaust annulus rear flange, has front and rear flanged bellows units designed to permit a limited articulation which allow for malalignment between jet pipe and engines.

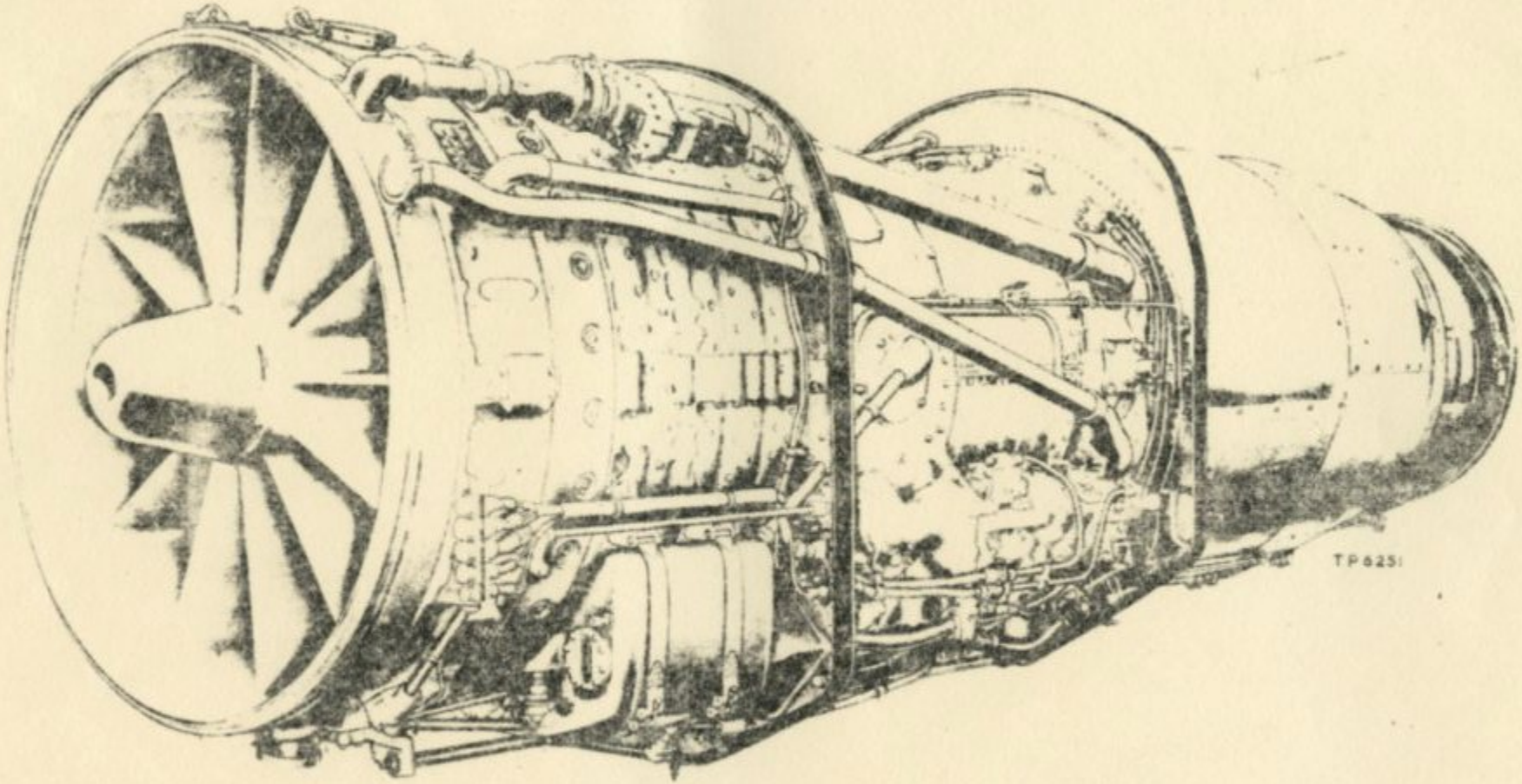
The jet pipe is attached to the exhaust cone by two half clamps which are retained in position by the rear bellows unit surrounding them. This unit is located by the front manacle clamp to the exhaust cone and by the rear seating strap to the jet pipe.

Drainage collectors are provided at the bottom of the bellows seals and are designed to drain away any fuel that may seep through the attachment joints.

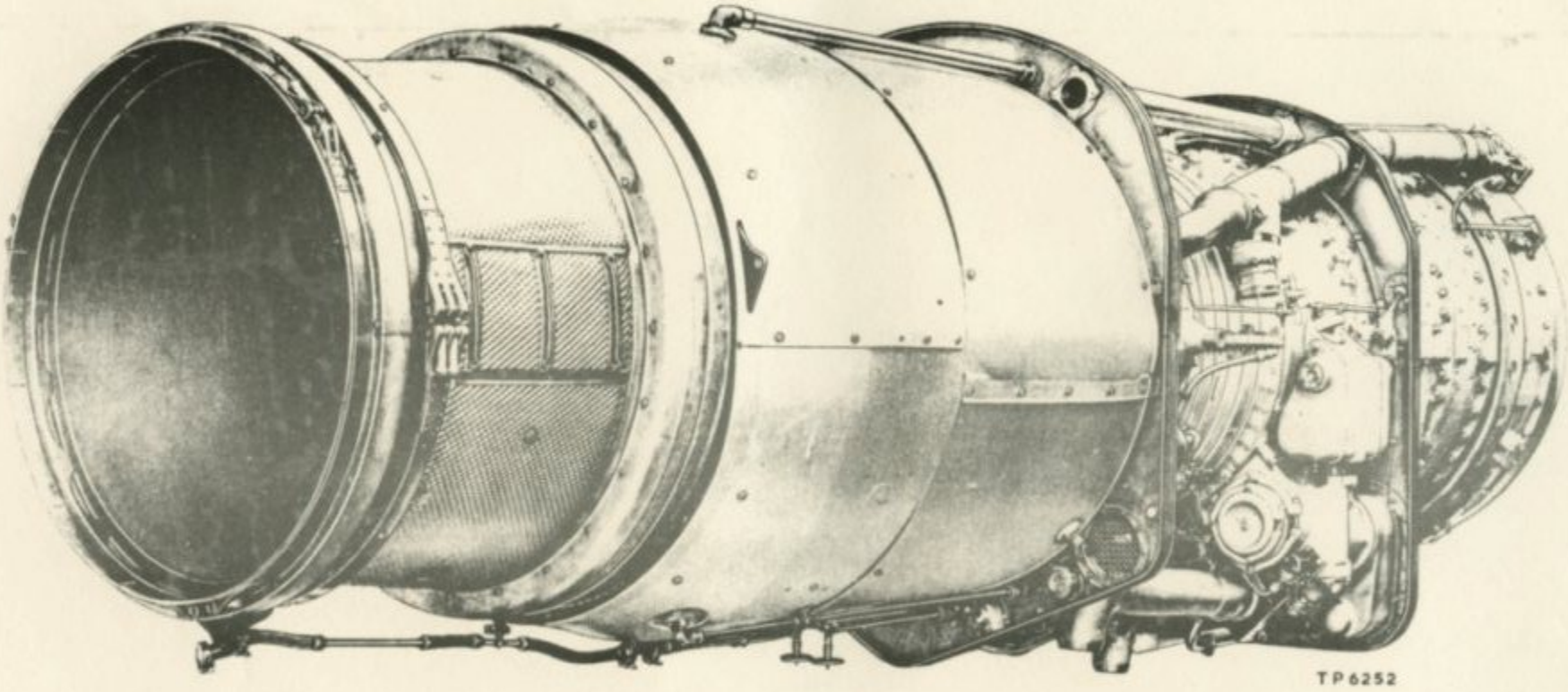
Between the front and rear bellows units, the external surface of the exhaust cone is covered with heat insulating blanket, located by springs on the port and starboard sides.



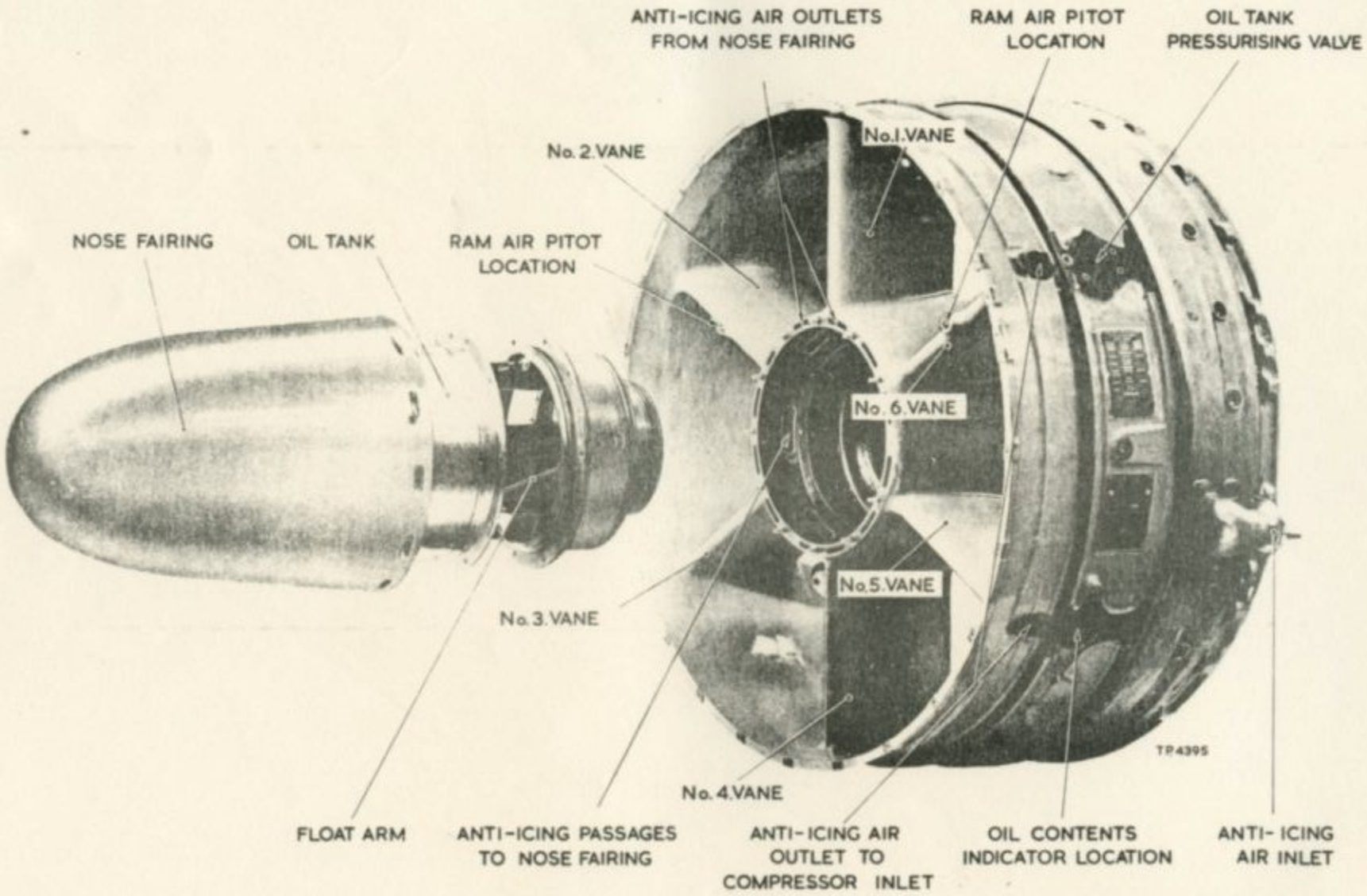
BEARINGS AND AIR SEALS



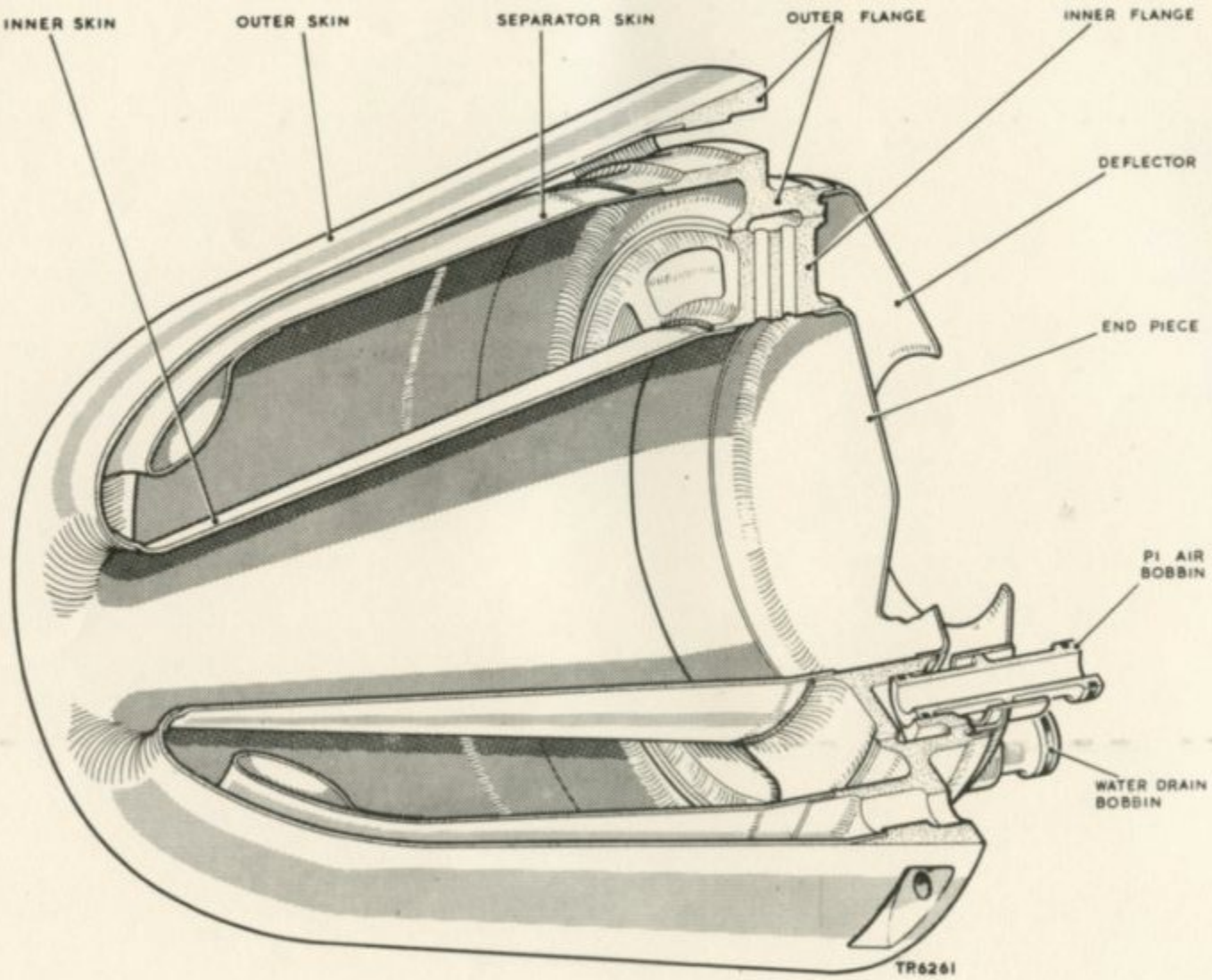
OLYMPUS 301 ENGINE – ¾ PORT VIEW



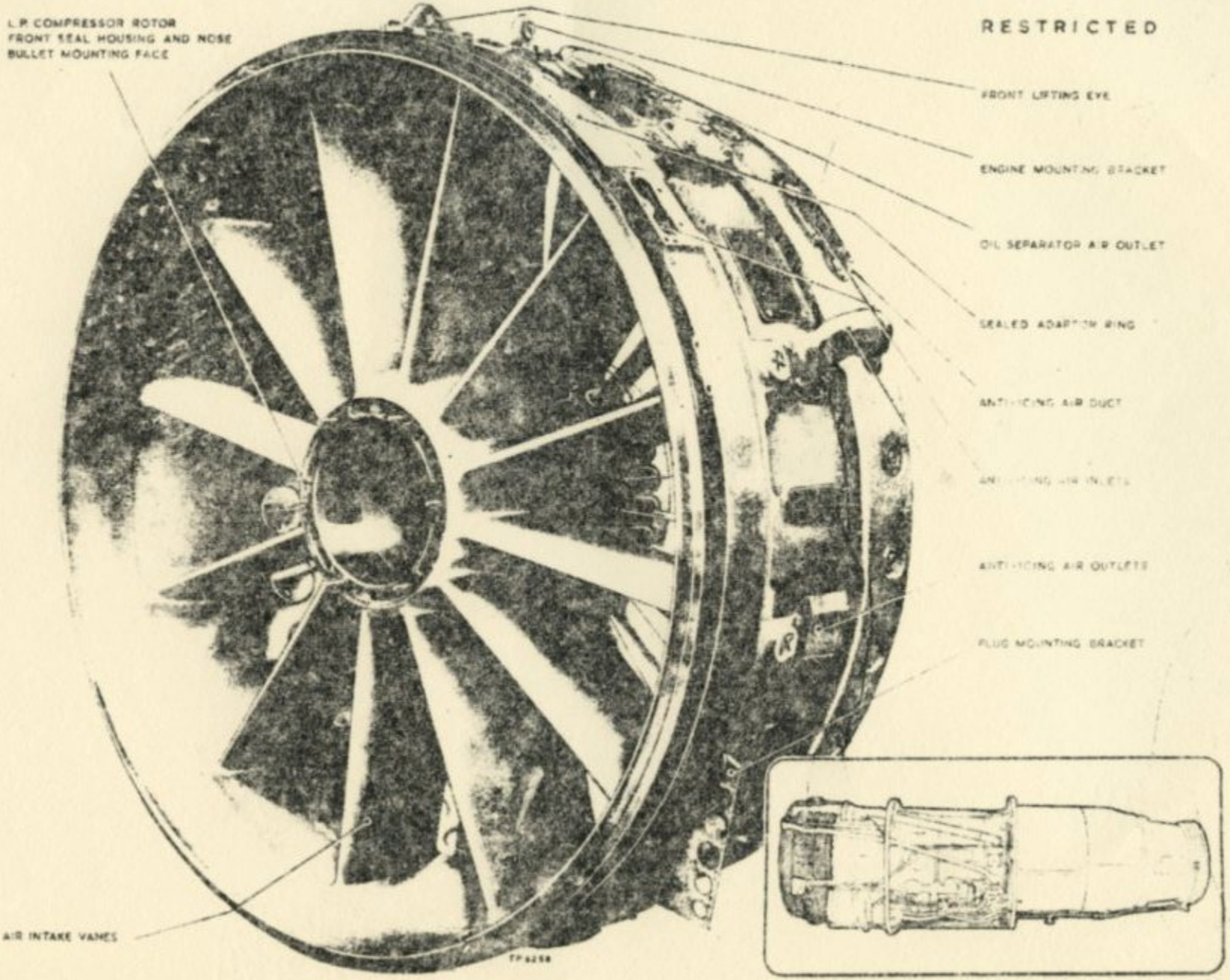
OLYMPUS 301 ENGINE — 3/4 STARBOARD VIEW

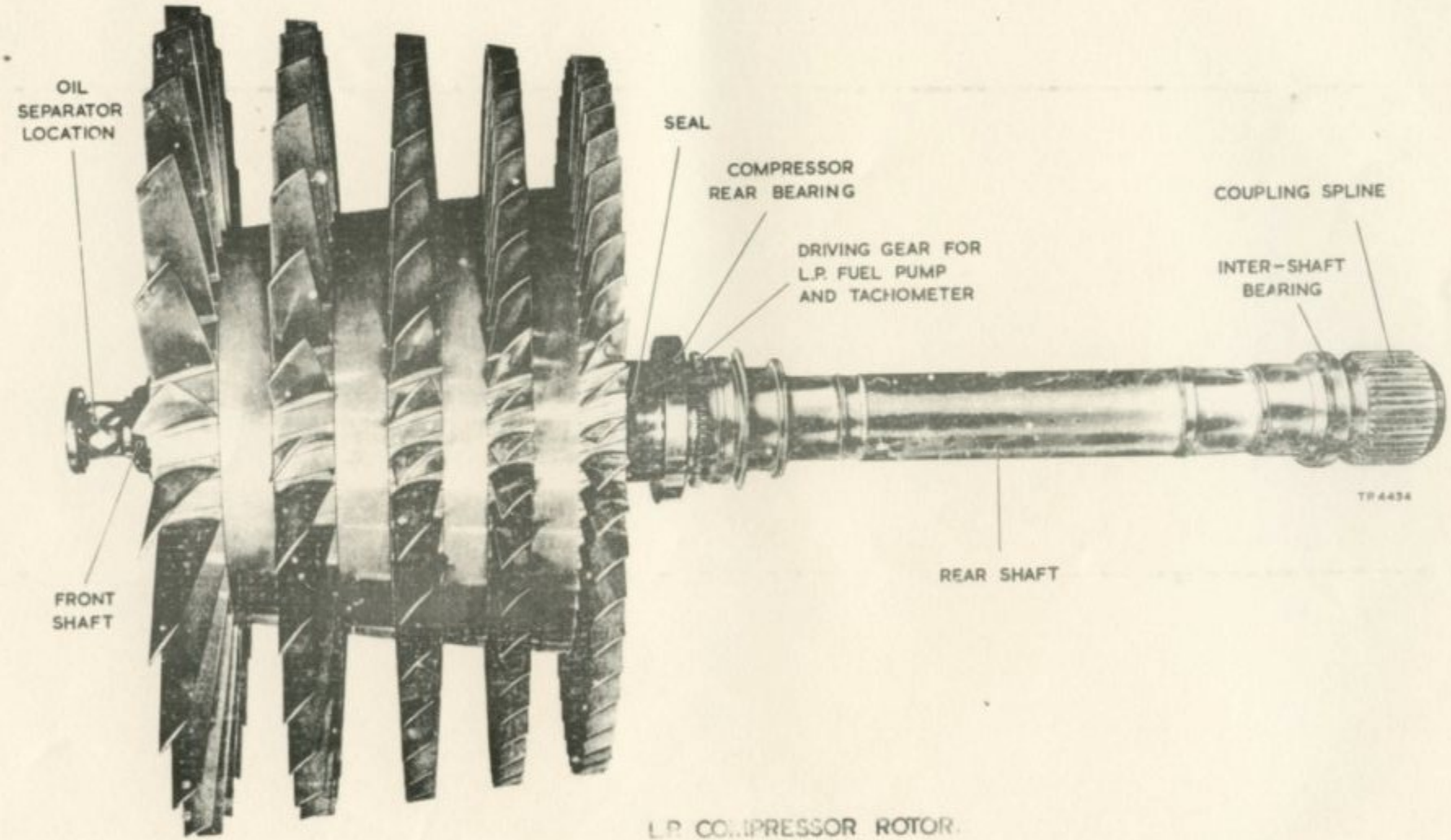


NOSE CONE AND INTAKE CASING

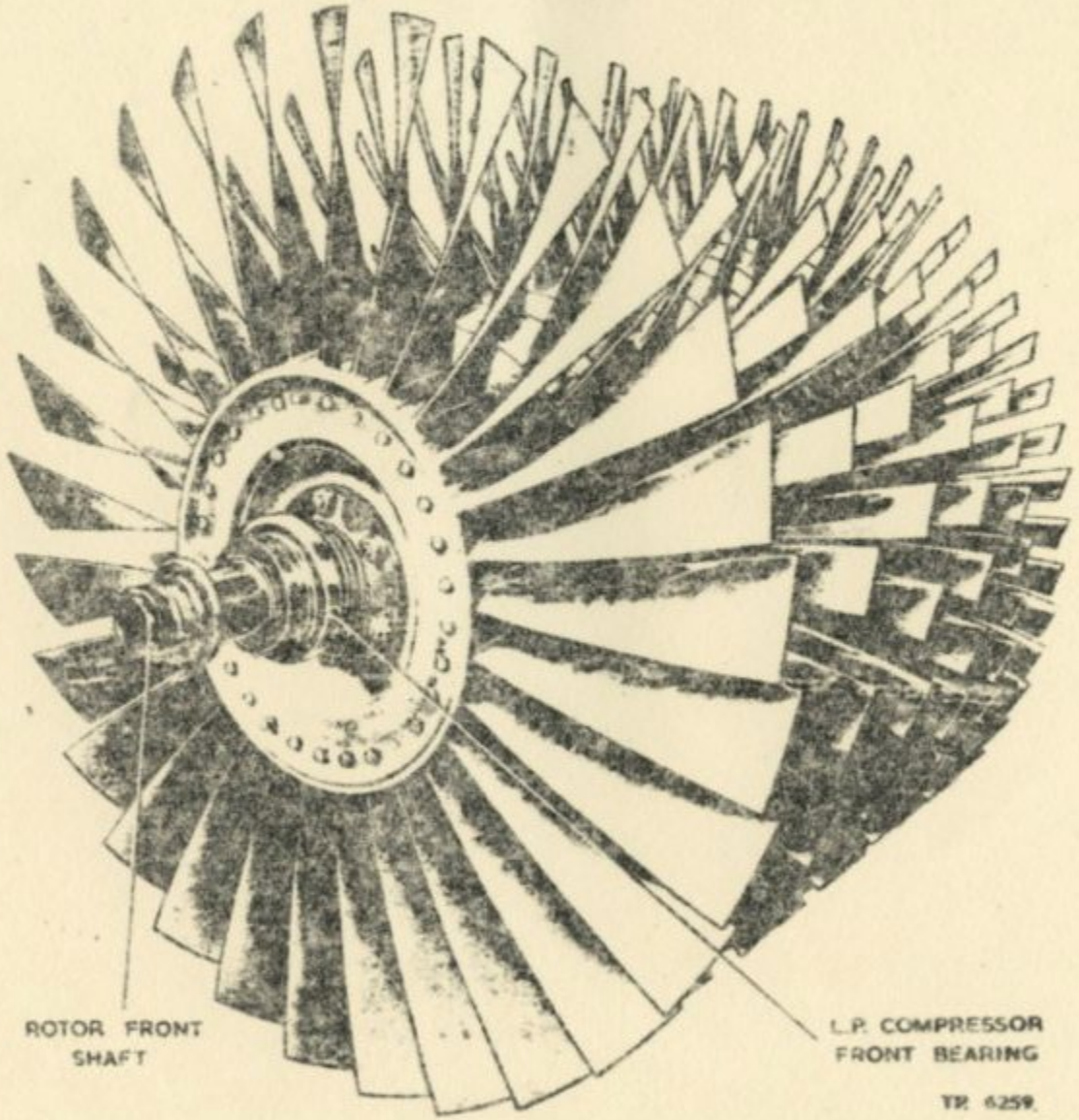

INNER SKIN
OUTER SKIN
SEPARATOR SKIN
OUTER FLANGE
INNER FLANGE
DEFLECTOR
END PIECE
PI AIR BOBBIN
WATER DRAIN BOBBIN
TR6261

NOSE CONE.

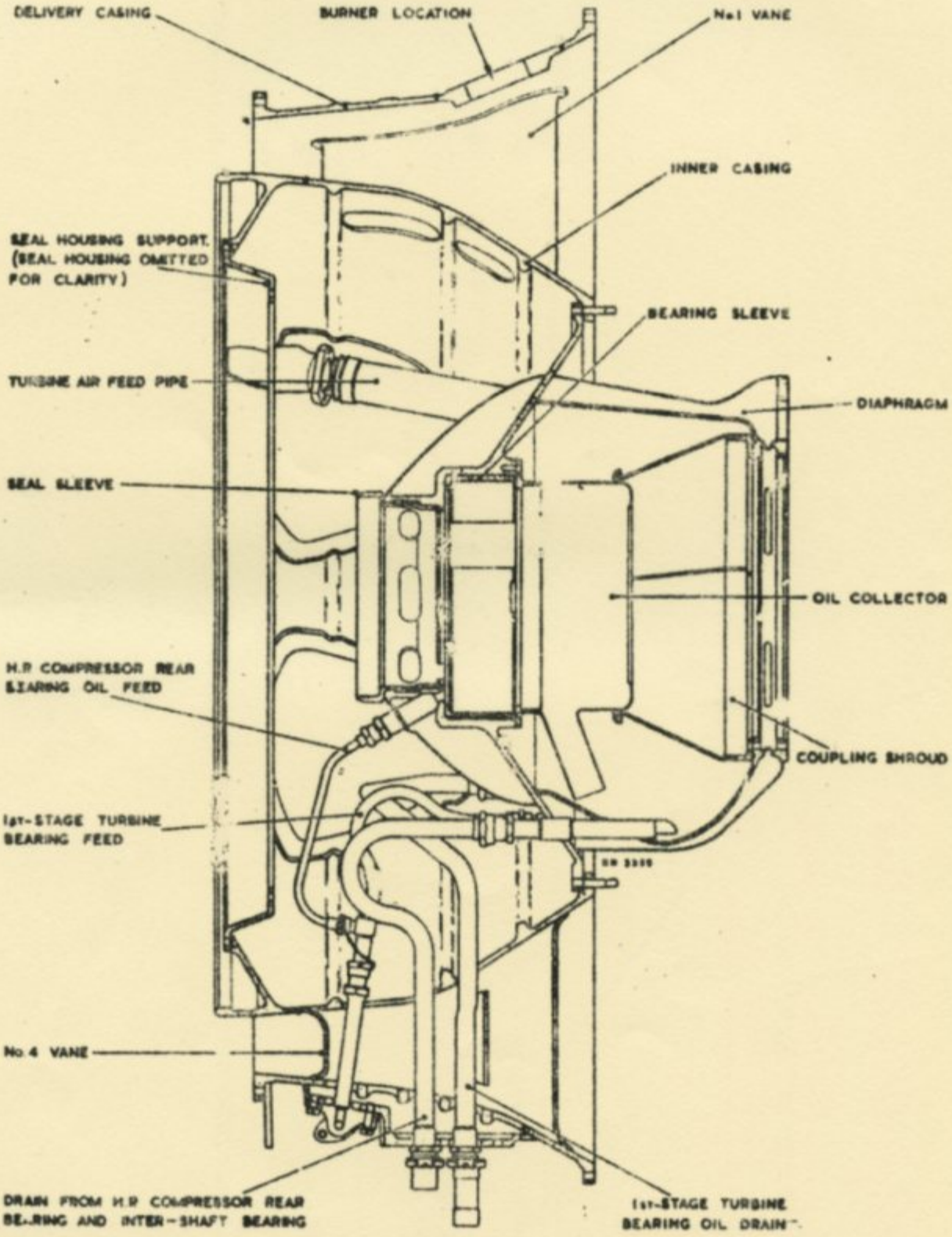

L.P. COMPRESSOR ROTOR
FRONT SEAL HOUSING AND NOSE
BULLET MOUNTING FACE
FRONT LIFTING EYE
ENGINE MOUNTING BRACKET
OIL SEPARATOR AIR OUTLET
SEALED ADAPTOR RING
ANTI-ICING AIR DUCT
ANTI-ICING AIR INLETS
ANTI-ICING AIR OUTLETS
PLUG MOUNTING BRACKET
AIR INTAKE VANES
TP 6258



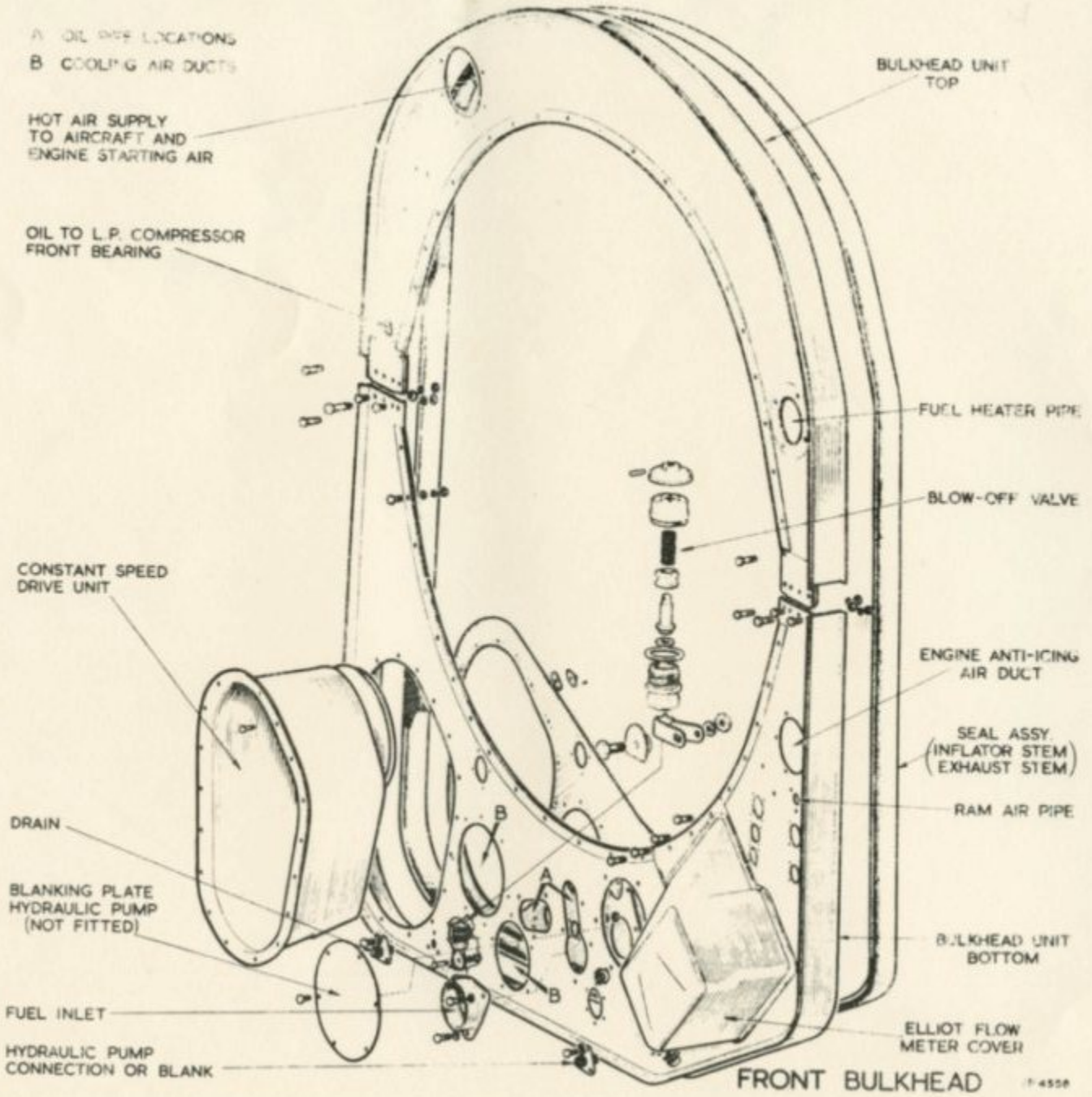
L.P. COMPRESSOR ROTOR.



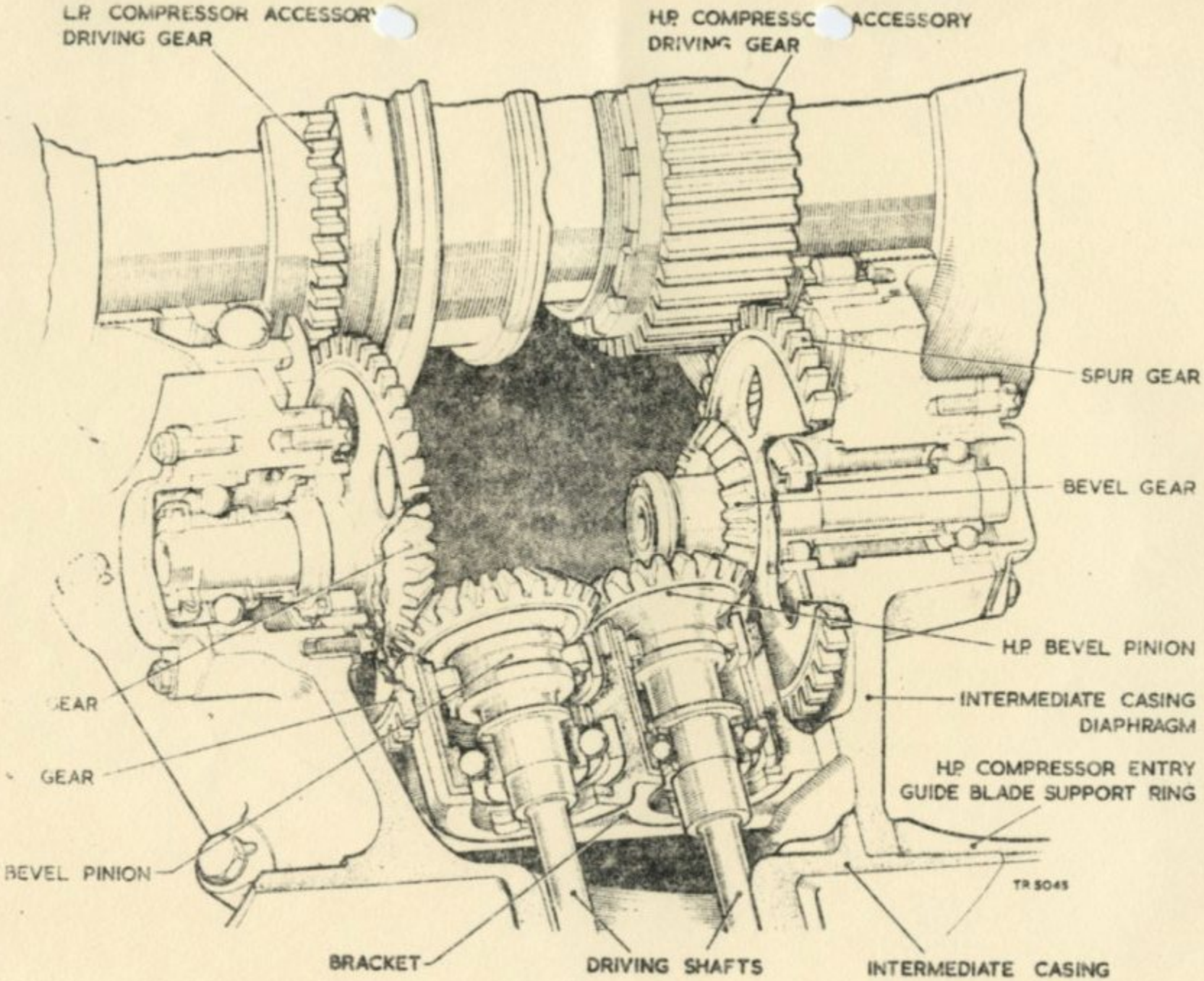
L.P. COMPRESSOR ROTOR.



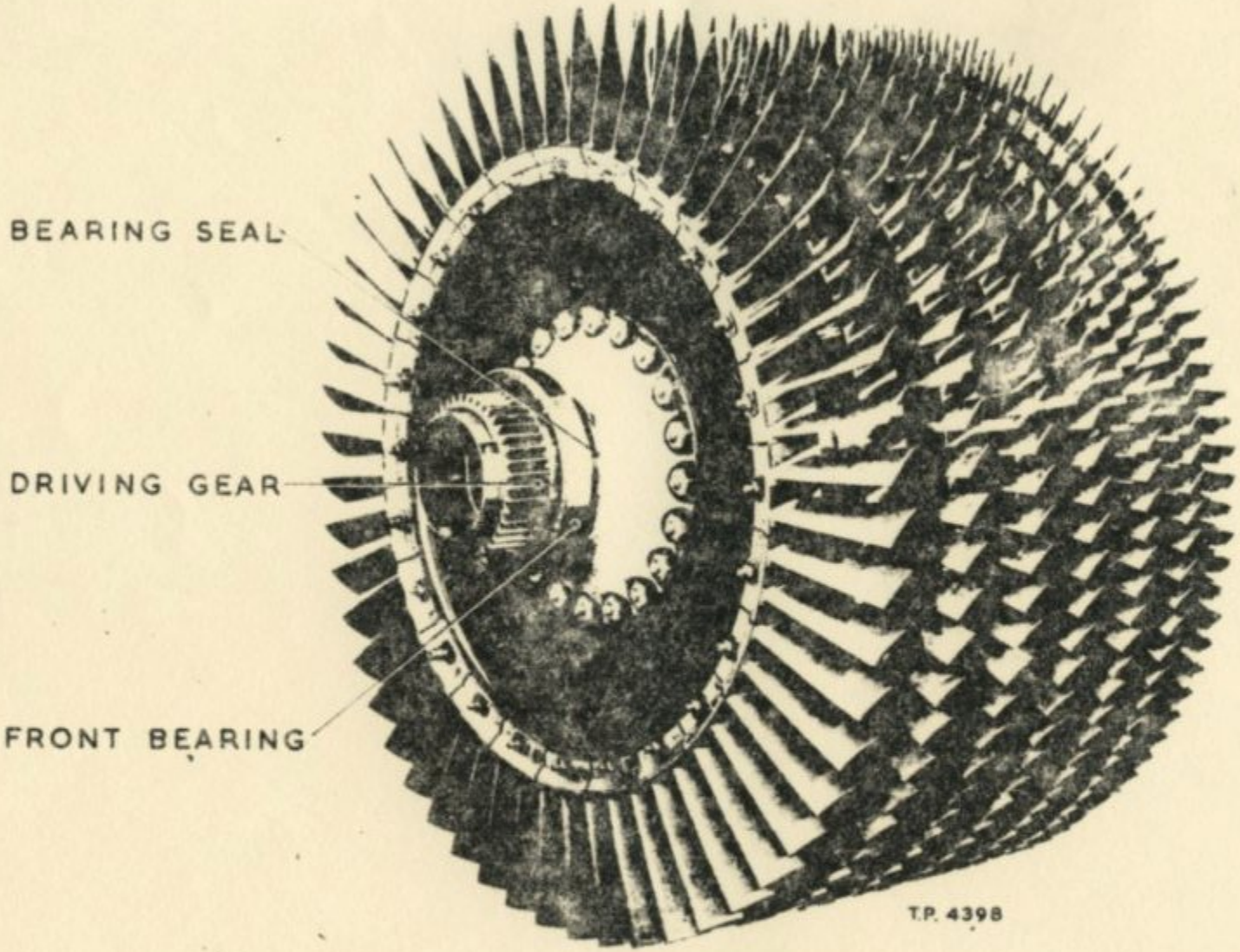
Delivery case details



FRONT BULKHEAD



FUEL PUMP DRIVES.



HIGH PRESSURE COMPRESSOR ROTOR ¾ FRONT VIEW

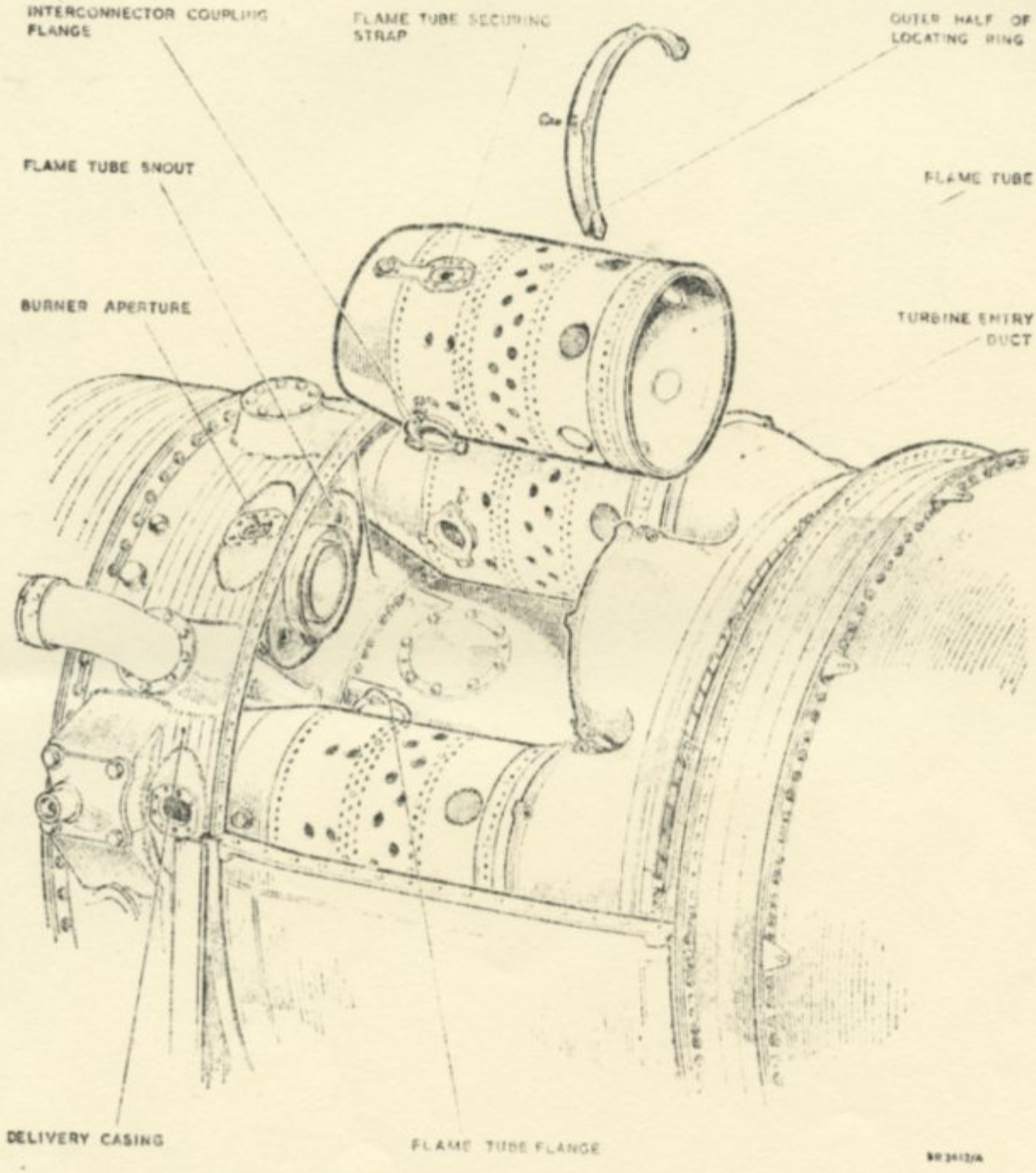
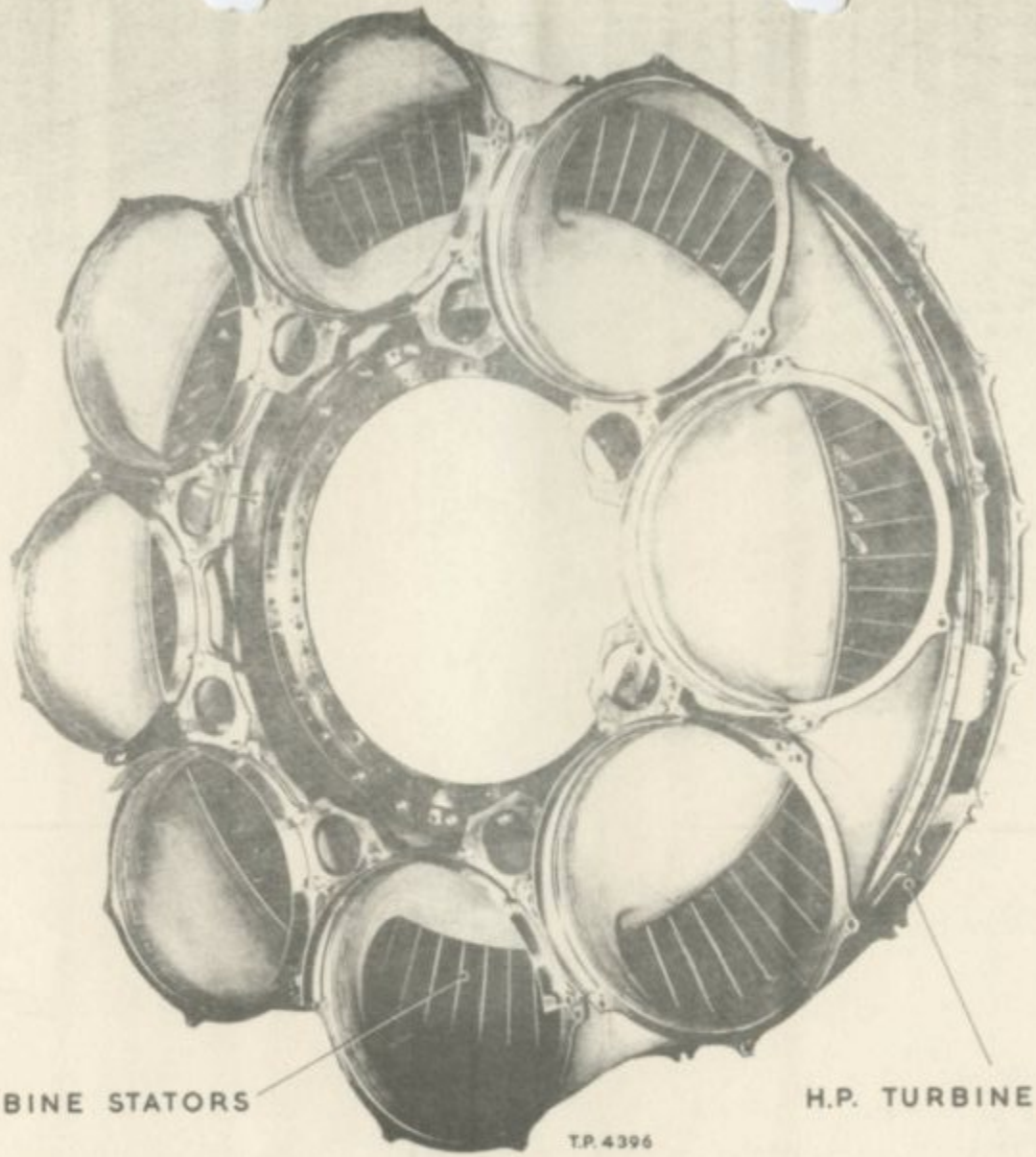
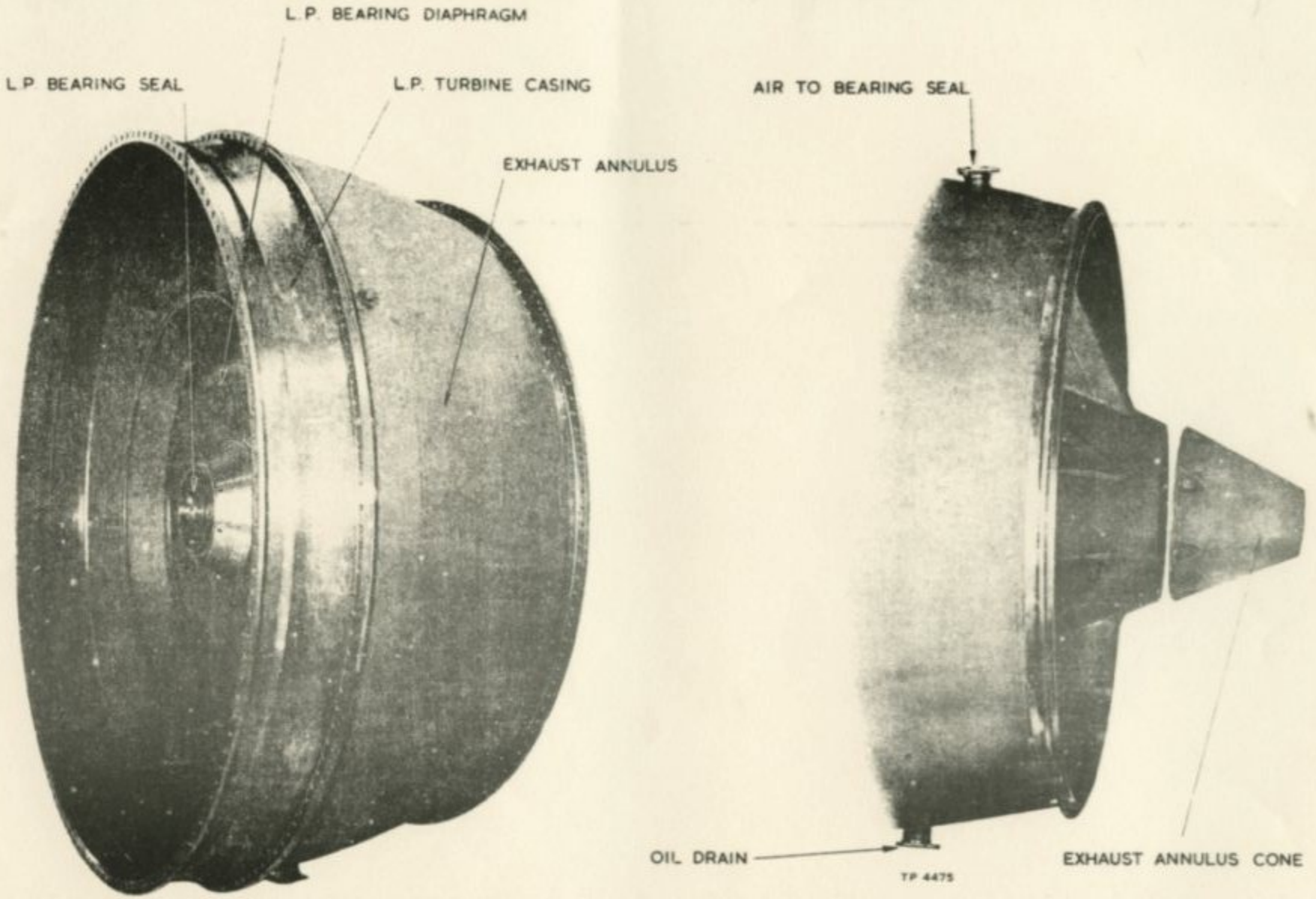


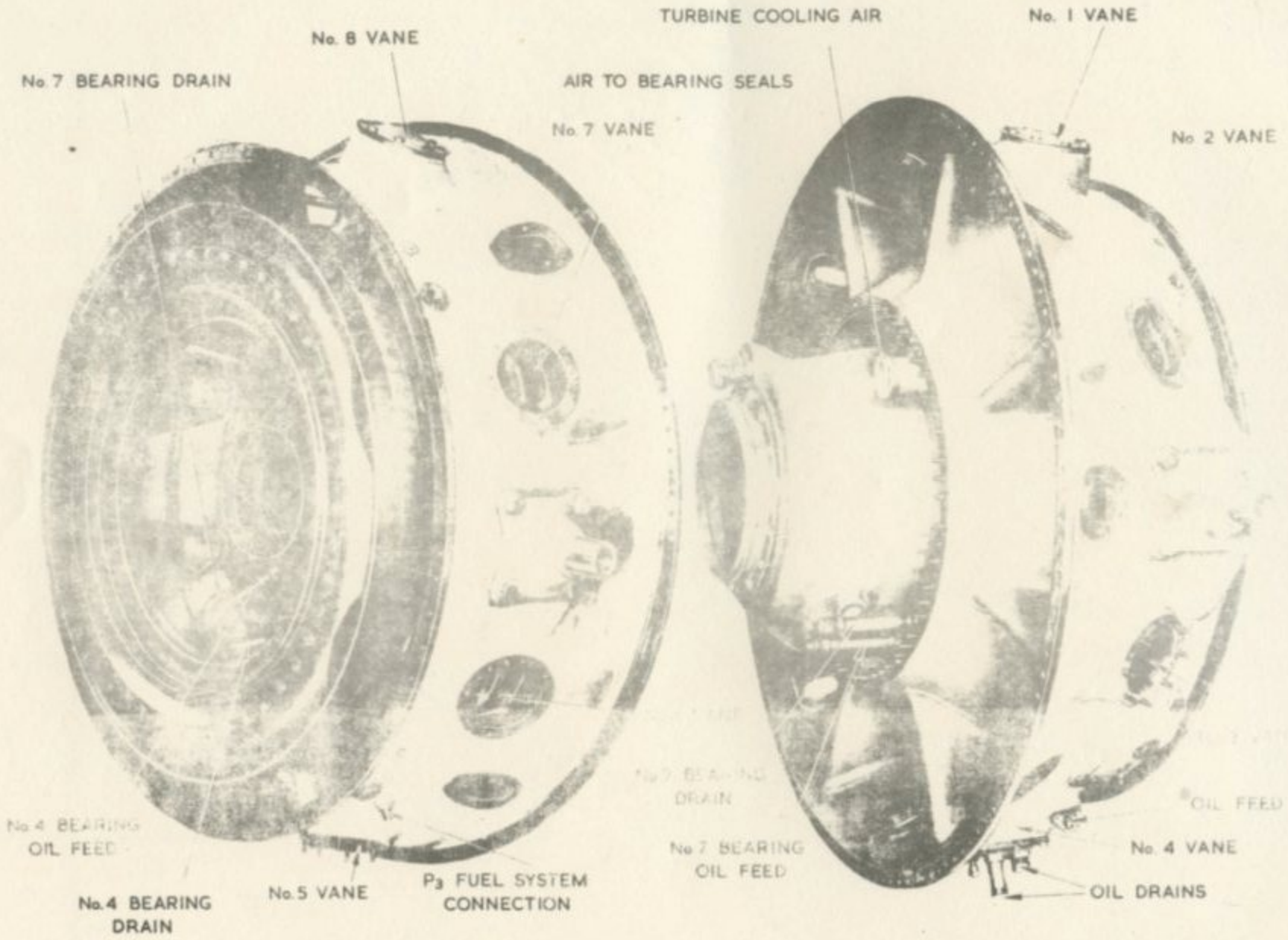
Fig. 5. Combustion system removal—stage 3



TURBINE ENTRY DUCT ¾ FRONT VIEW

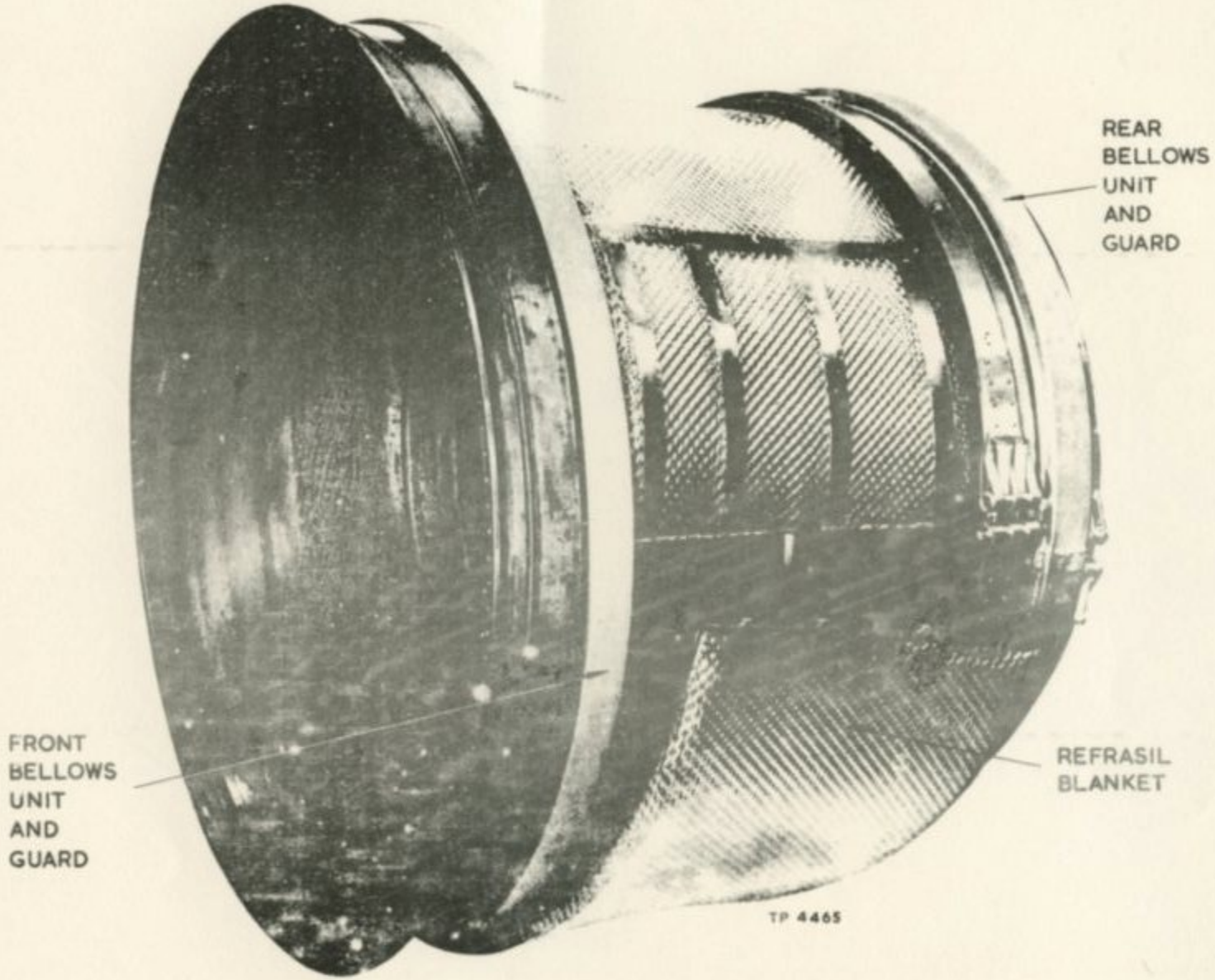


EXHAUST ANNULUS

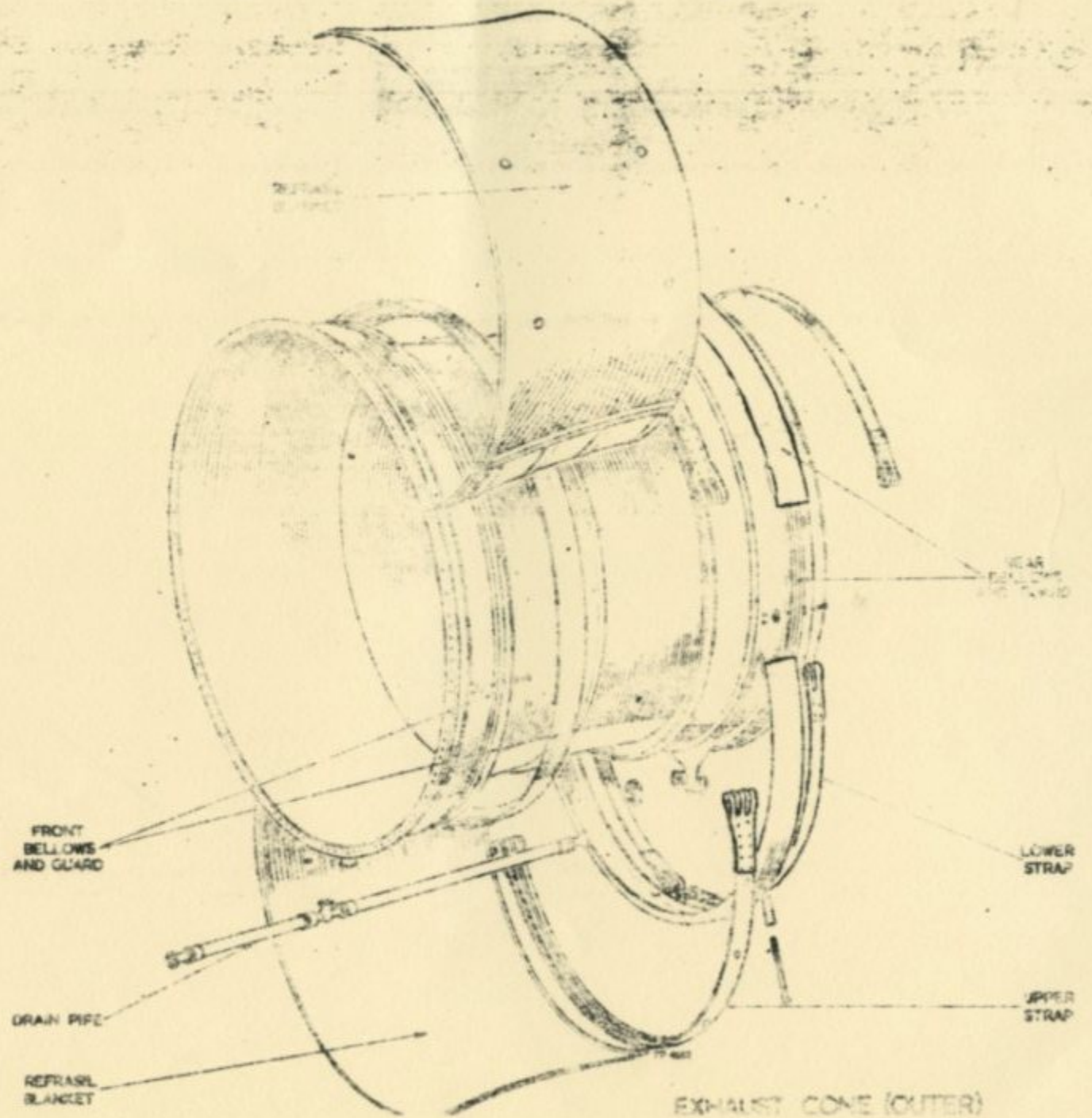


DELIVERY CASING

T.P. 4390



EXHAUST CONE OUTER ¾ FRONT VIEW



EXHAUST CONE (OUTER)

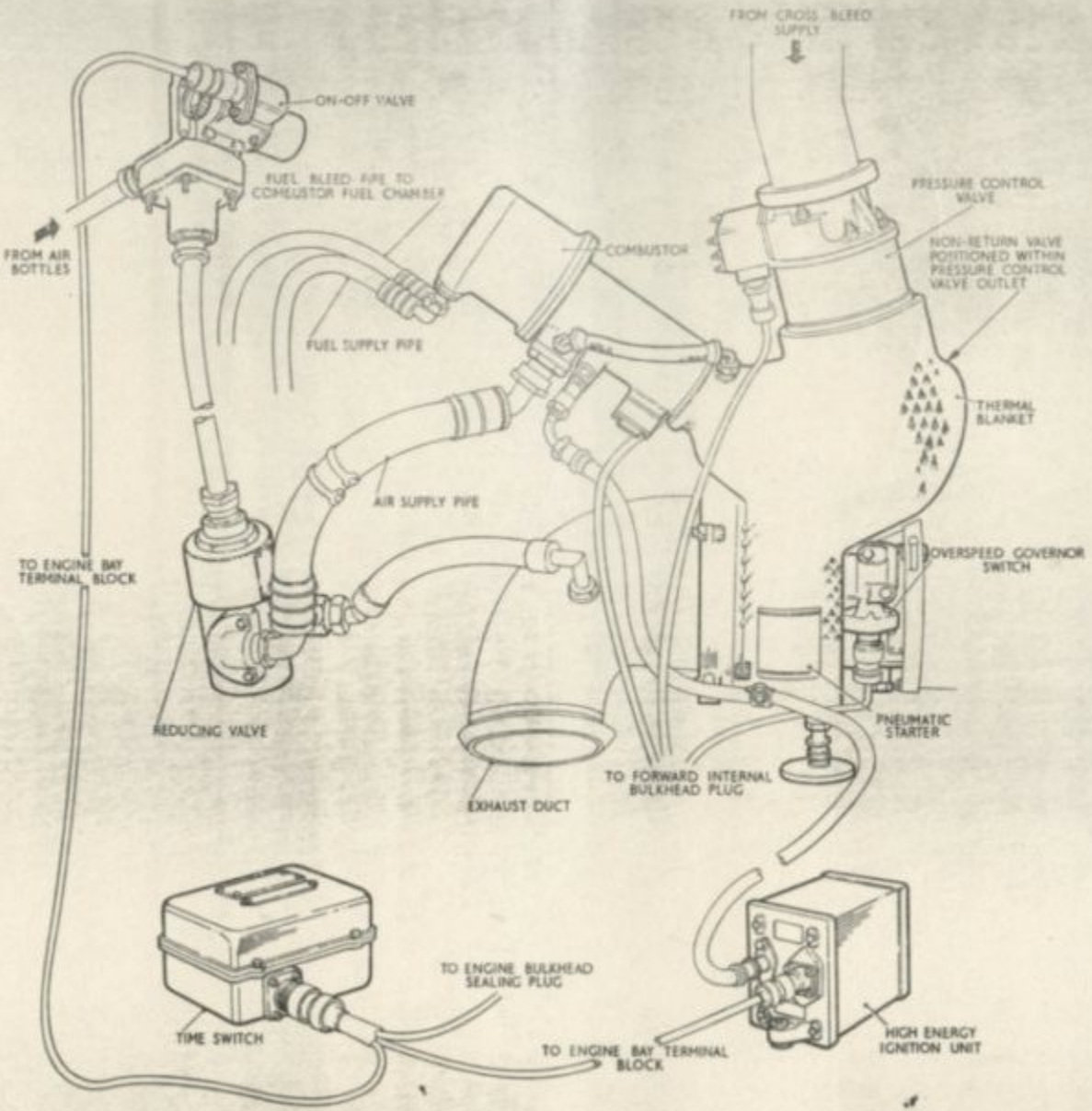


Fig. 1. Arrangement of system components

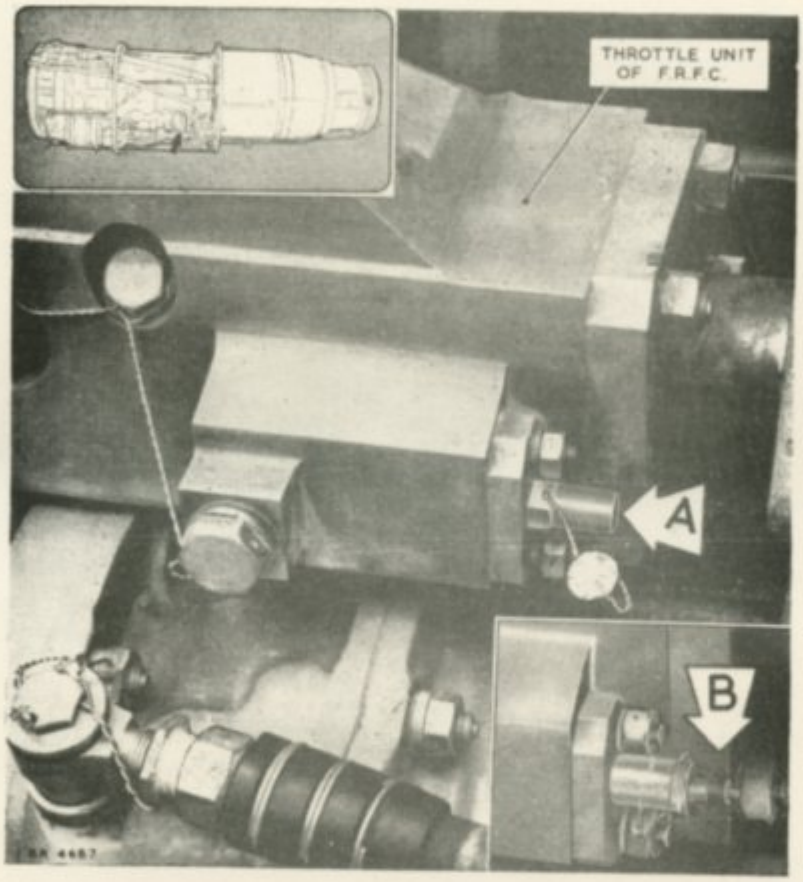
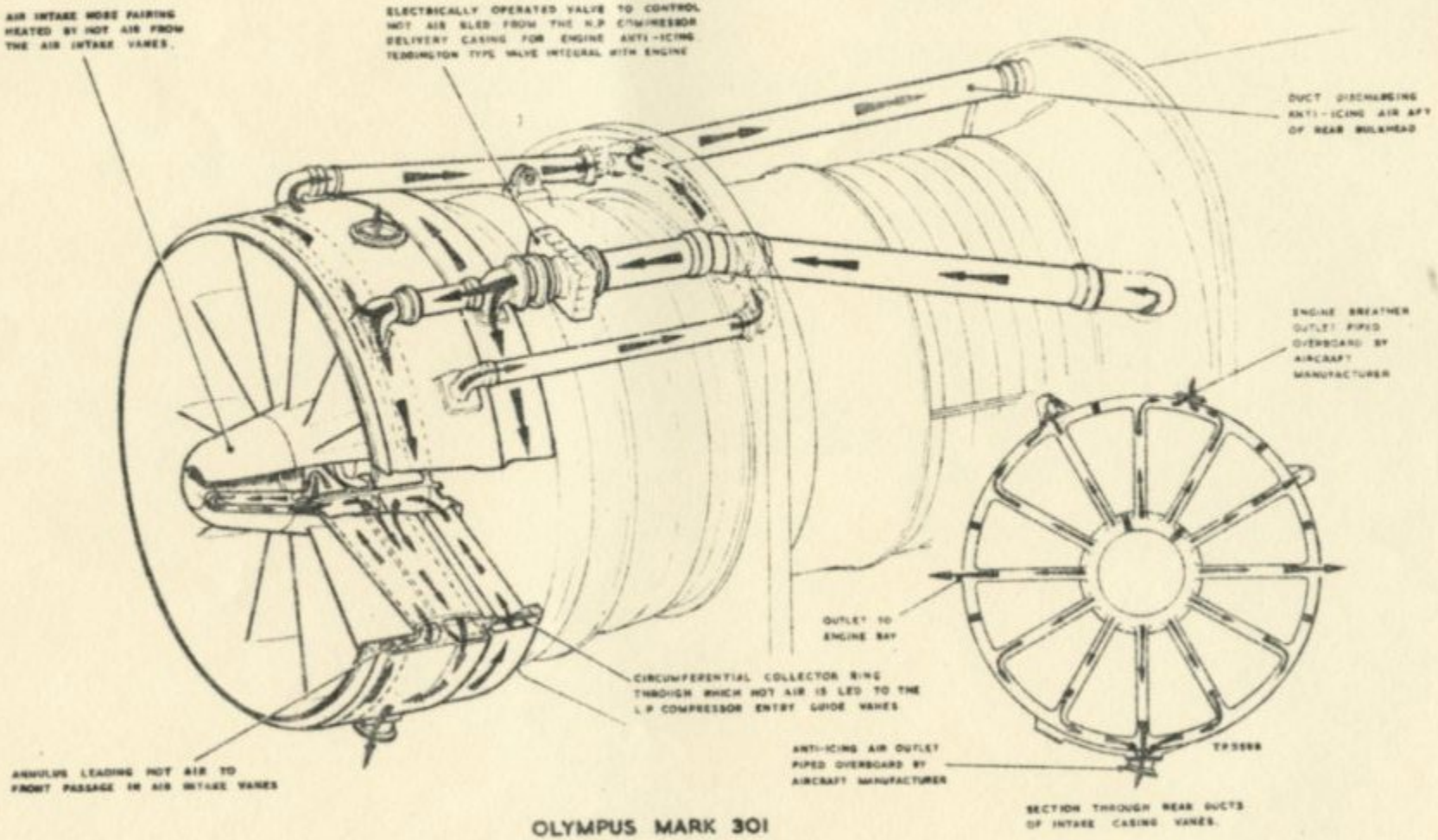
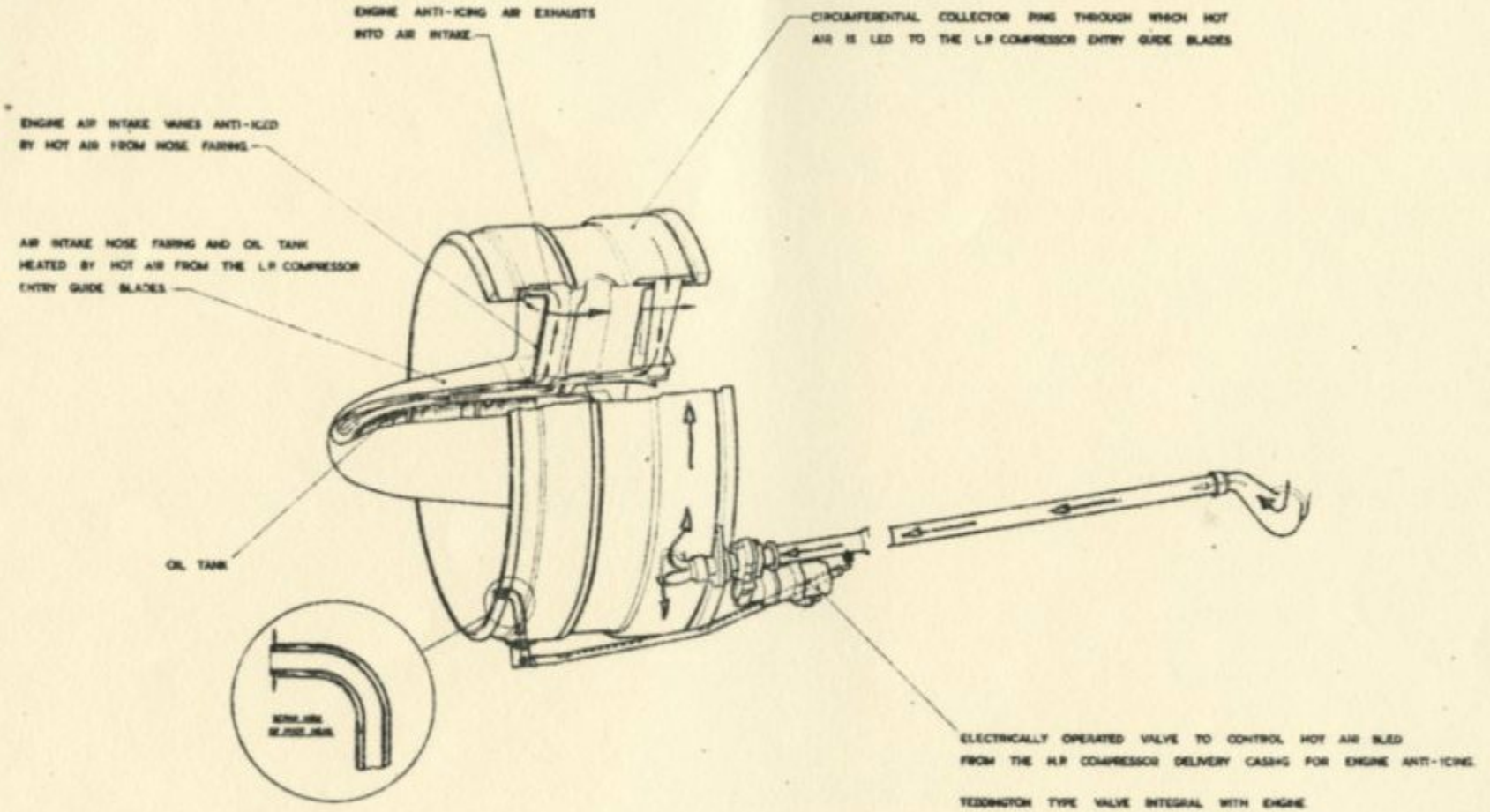


Fig. 15. Idling by-pass adjustment



SECTION THROUGH REAR DUCTS OF INTAKE CASING VANES.

OLYMPUS MARK 301
ENGINE ANTI-ICING SYSTEM



OLYMPUS 200
ENGINE ANTI-ICING SYSTEM

B.153830A

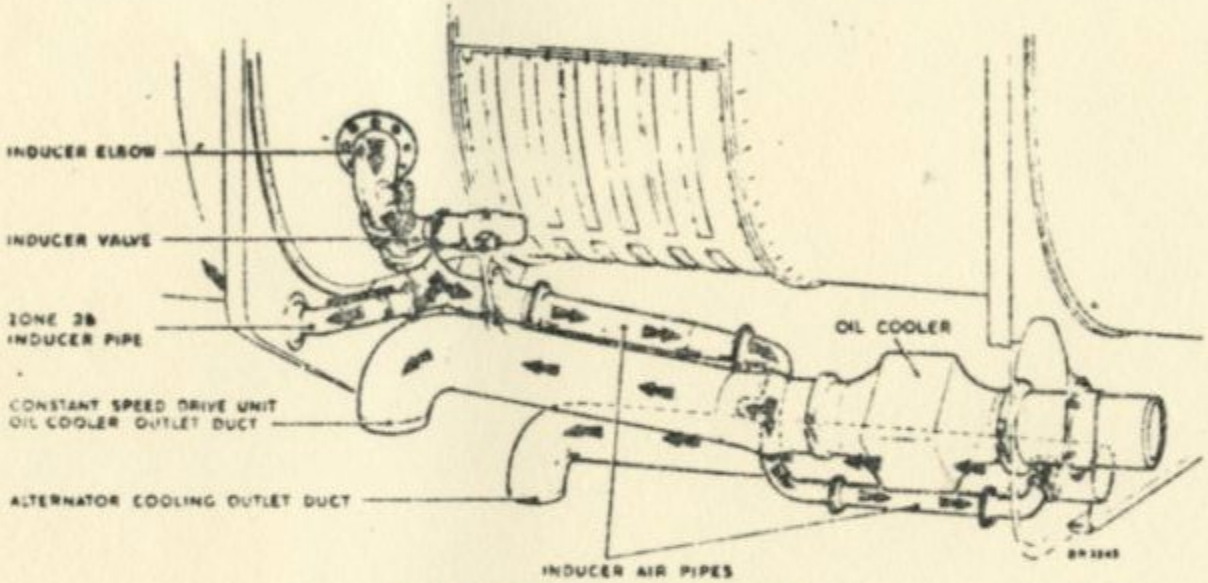
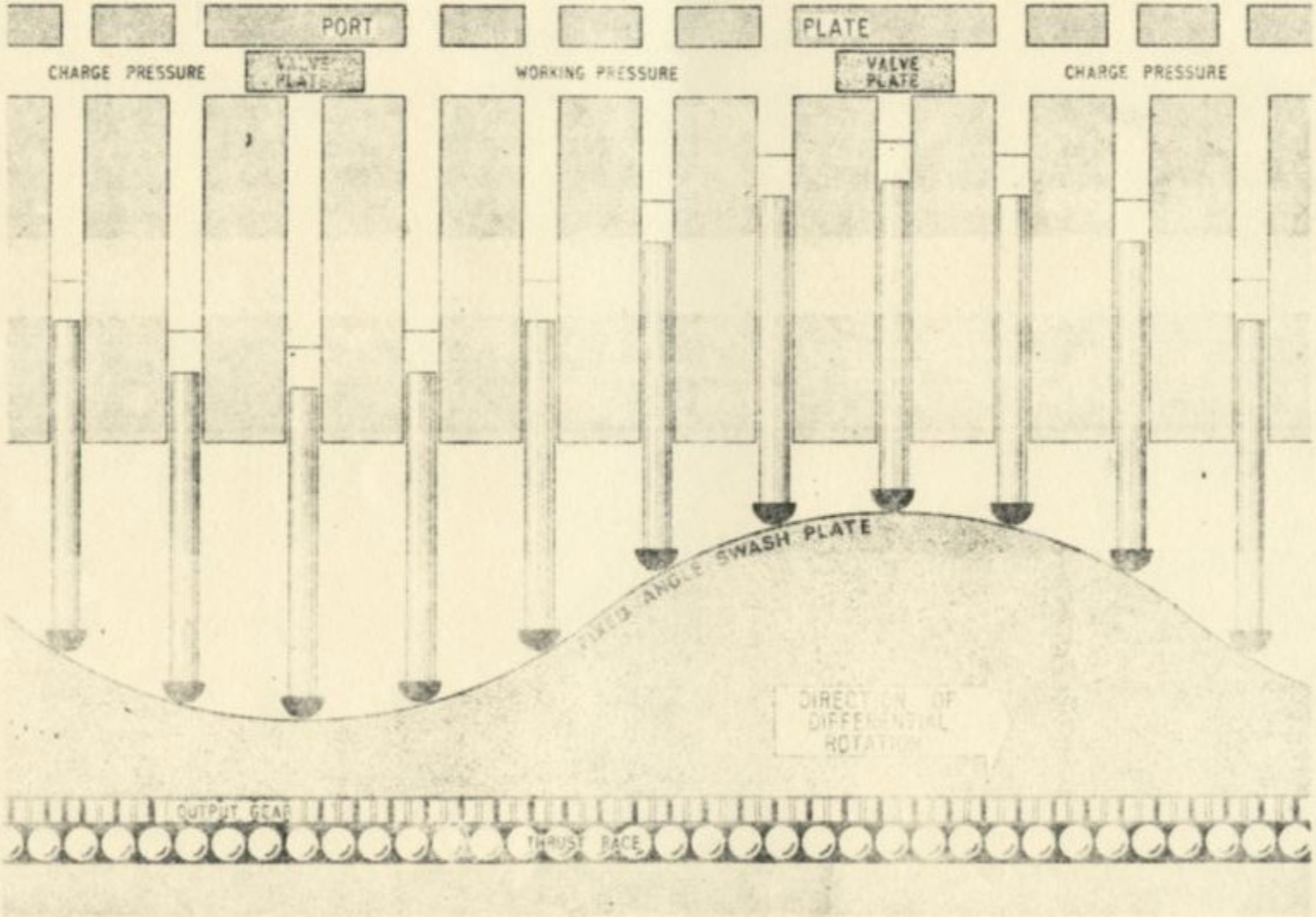
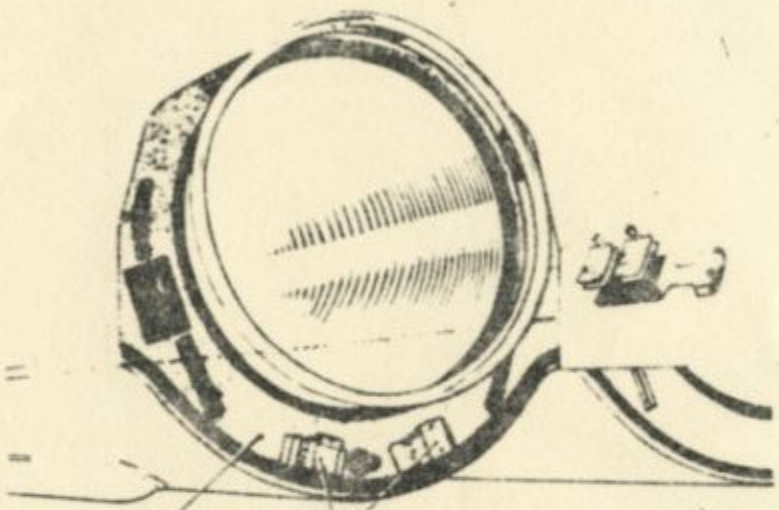


Fig. 5. Cooling air inducer system

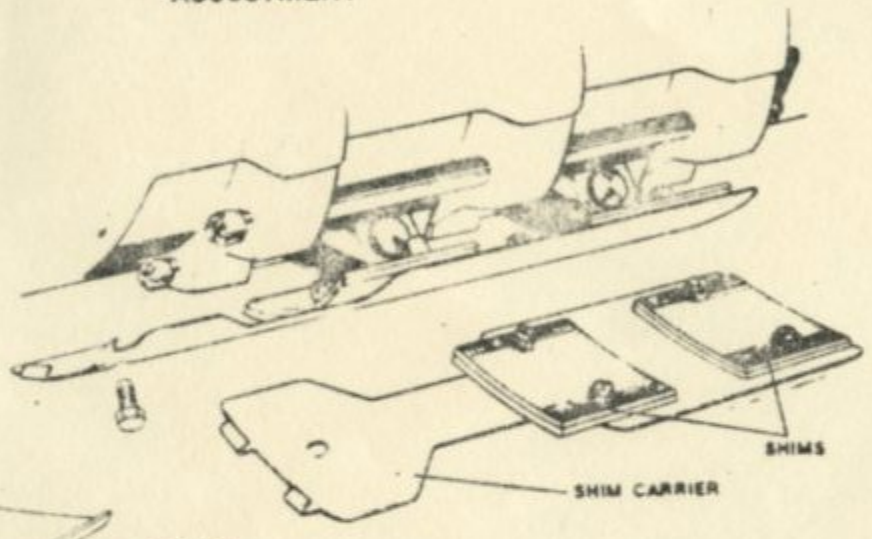


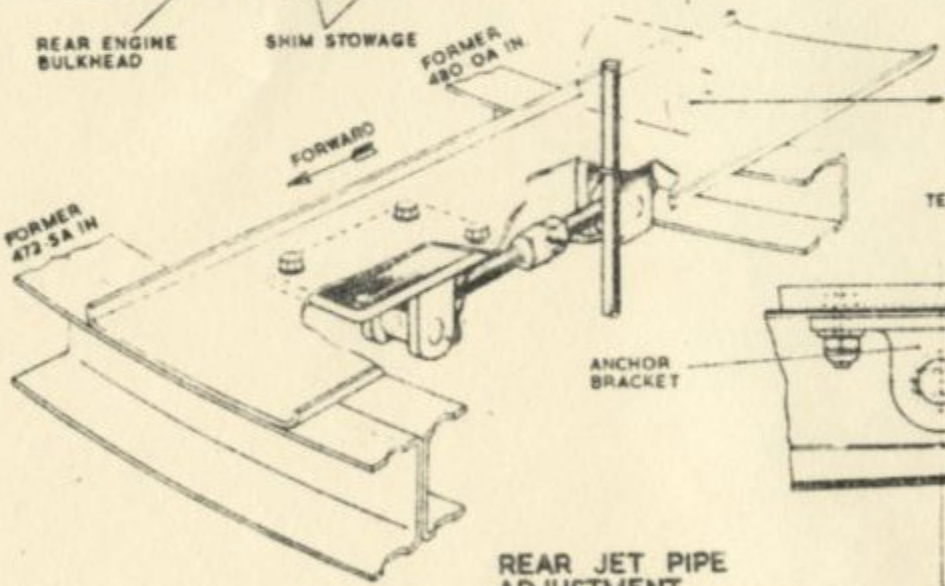
ACTION OF OUTPUT BLOCK - EXPANDED VIEW

DIAGRAM 3 : 4
A.L.3

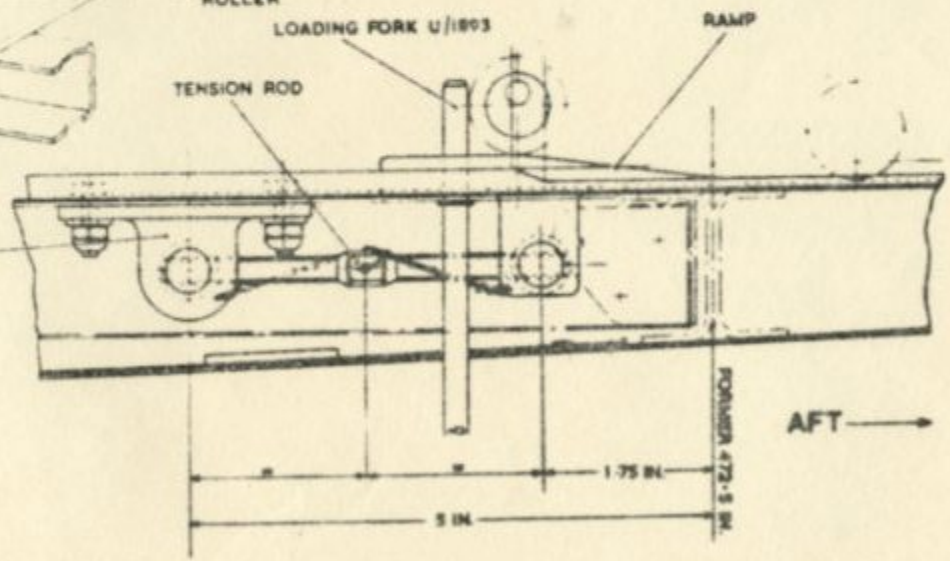


FRONT JET PIPE ADJUSTMENT





REAR JET PIPE ADJUSTMENT



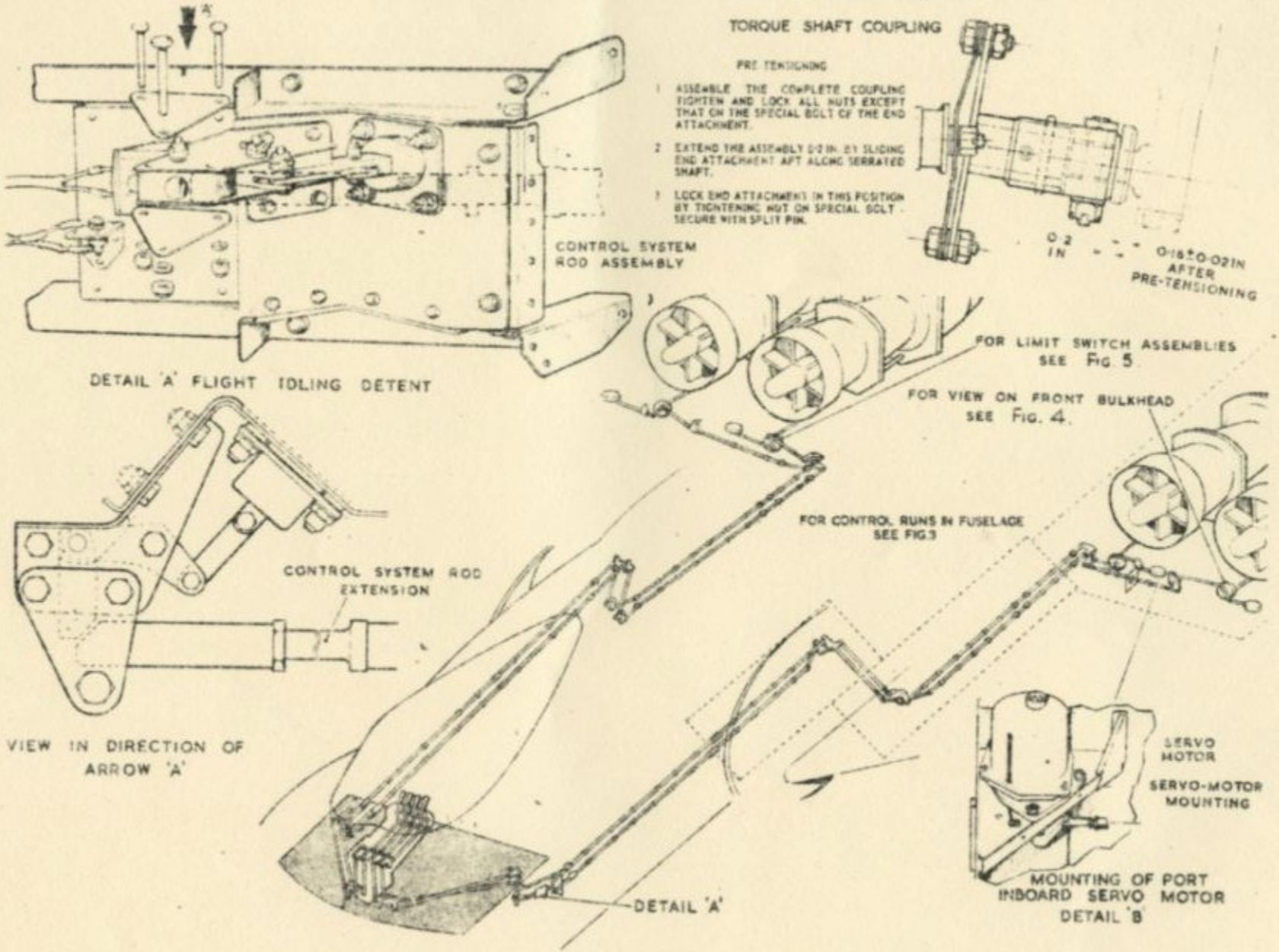


Fig. 2. Engine control system

RESTRICTED