GENERAL ARRANGEMENT

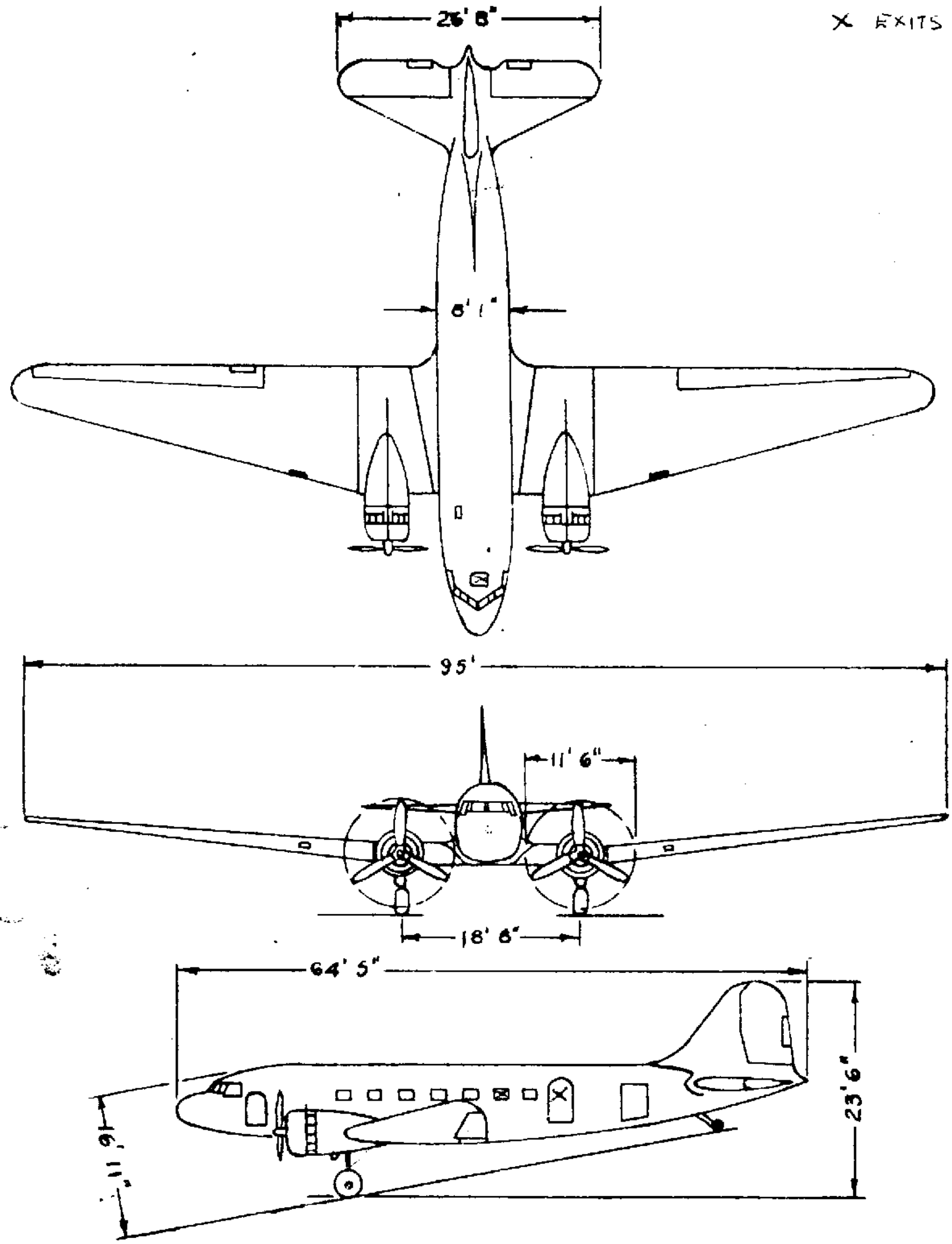
Contents

Sfbject

(cont'd) GENERAL ARRANGEMENT

GENERAL ARRANGEMENT

ENGINE AND AERONAUTICAL INSTRUMENTS



DIMENSIONS OF DC-3

R-1830-S1C3G(-92)ENGINES

DESIGN CHARACTERISTICS

Dimensions

Overall Span	95'
Overall Length	64' - 5½
Overall Height (3 - Point Position)	17'
Overall Height (Level Position)	23' - 6"
Landing Gear Tread	18' - 6"

Weights

Weight Empty (I.C.A.N.)	18,190
Gross Weight	26,200

Areas and Loading

Area of Center Section	335 sq. ft.
Area of Outer Panels - 2 a 326 sq. ft.	652 " "
Total Wing Area - including Ailerons	987 " "
Aileron Area - incl. 51.4 sq. ft.	102.8 " "
Wing Flap area	82 " "
Wing Flap Span	41' - 7 "
Rudder Area	46.7 sq. ft.
Fin Area	37.9 " "
Total Vertical Surface Area	84.6 " "
Elevator Area - 2 a 41.7 sq. ft.	83.4 " "
Stabilizer Area	95.8 " "
Total Horizontal Surface Area	179.2 "
Wing Loading - 26200# Gross Weight	26.5 psf
Take-off Power Loading - 26200# Gross Weight	10.8 lbs. per hp.

Miscellaneous

Airfoil Section of Wing	(Root NACA	2215
	(Joint NACA	2215
	(Tip NACA	2206
Center Section Thickness		15%
Tip Section Thickness		6%
Plan Taper Ratio - Outer Panels		3.3
Dihedral Angle - Outer Panels		5%
Angle of Incidence - Entire Wing		2%
Aspect Ratio of Entire Wing		9.15

Spar Locations

Front	17,65% Root Chord
Center	38.8% " "
Rear	60.0% " "

Flaps - Downward Movement		45%
Increase in lift coefficient with maximum flap (deflection		35%
Increase in Parasite Drag with maximum flap (deflection		300%
Ailerons - Angular Movement	- Up	27%
	-Down	18%
- Tab Angular Movement	- Up	12½%
	-Down	12½%
Elevator - Angular Movement	- Up	30%
	-Down	20%
-Tab Movement	-Up	12%
	-Down	12%
Rudder - Angular Movement	-Left	30%
	-Right	30%
-Tab Movement	-Left	12%
	-Right	12%

Mean Aerodynamic Chord (MAC)	138.1"
L.E. of MAC aft of L. E. of Center Section	31.9"
Max. Forward position of C.G.	11% MAC
Locations aft of L.E. of Center Section	47.1"
Max. Rear Position of C.G.	28% MAC
Locations aft of L.E. of Center Section	70.6 "

x Max. safe accelerations in Flight a 24,400 Lbs. 3.24g
x Max. safe accelerations during landing at 24,400 p. 3.12g

General

1. The Douglas DC-3 is an all metal, low wing transport monoplane with fully retractable landing gear utilizing a tail wheel. The aeroplane is powered by Pratt and Whitney Twin Wasp, model R1830-S1C3G (-92) engines with Hamilton Standard Hydromatic Constant Speed Quick Feathering Propellers installed. The maximum crew consists of four persons, a Captain, a First Officer, a Cabin Attendant and an Observer.

Fuselage

2. The fuselage is of semi-monocoque construction consisting essentially of transverse frames and longitudinal members covered with a metal skin rivetted to the frames and stringers. The covering is 24ST Alclad sheet protected from corrosion by a coating of pure aluminum on both sides. The vertical fin and horizontal stabilizer are built as integral parts of the fuselage and are not readily removable.

Wing

3. The wing is full cantilever, multi-cellular stressed skin construction, built in three main sections; a center section and two outer panels. The outer panels are built with three metal spars running lengthwise from root to tip with transverse bulkheads rivetted to the spars to form a framework. The center wing section and outer panels inboard of the ailerons are fitted with hydraulically operated split trailing edge flaps for reducing the landing speed and landing run and for increasing the gliding angle. The ailerons are ~~fabric covered and for~~ increasing the gliding angle. The ailerons are fabric covered and balanced statically and aerodynamically. A trimming tab controllable in flight is provided on the right aileron for maintaining lateral trim.

Empennage

4. The empennage affords a large vertical stabilizer and rudder areas ideal for bad weather flying or landing under difficult cross wind conditions. The horizontal and vertical stabilizers are full cantilever, metal skin multi-cellular construction. The elevators and rudder are full fabric cover, metal frame construction, mounted on ball bearing hinges and balanced statically and aerodynamically. The elevators are interchangeable. Trimming tabs, controllable in flight, are fitted in the trailing edge of the rudder and elevators.

Landing Gear

5. The landing gear consists of two independent units, one mounted under each nacelle, and retracts into the nacelles leaving only the bottom of the wheels projecting. Each wheel is mounted on two shock absorber struts of the oleo type. The retracting mechanism is hydraulically operated employing the constant flow system actuated by an engine driven pump. An indicating system consisting of a warning horn and four warning lights is provided to enable the pilot to ascertain the position of the landing gear.

6. Safety latches are provided to lock the wheels in the safe landing position. The retracting gear operates positively in both directions and requires less than 30 seconds to fully retract or extend. Automatically engaging flight wheel brakes are incorporated to prevent the wheels from rotating after they are retracted so that it is not necessary for the pilot to brake on the brake pedals during retraction.

Passenger Accommodation and Cabin Equipment

7. The DC-3 is a twenty-eight passenger airplane. The passenger seats are arranged in seven rows, with four seats to a row, two on the left hand side of the cabin aisle and two on the right. The backs of the seats are adjustable by pressing the release buttons provided. Overhead package and coat racks are provided on either side of the cabin. Coat storage is also provided near the main cabin door. Individual ashtrays, individually controlled cold air outlets, reading lamps and literature pockets are installed for the passengers comfort.

8. A buffet is installed either in front compartment or rear of cabin. The buffet consists of a serving shelf, storage compartments and a thermos bottle rack. A folding seat is provided for the Stewardess.

9. The lavatory is located just to the rear of the main cabin door which contains a wash basin and chemical toilet. Water is provided from a metal container mounted in the rear cargo compartment.

10. (Unassigned)

Compartments

11. The aeroplane is partitioned into the following major compartments.

(1) Flight compartment in the nose.

(2) Three compartments on the right side of a corridor between the flight compartment and the cabin, consisting of one cargo, one radio and one cabin heater compartment.

(3) One cargo compartment on the left side of the corridor. In some aircraft, one buffet.

(4) A cabin aft of the above compartments.

(5) A toilet.

(6) A baggage compartment aft of the cabin.

12. Two cargo loading doors are provided, one for the front cargo compartment loading, which is located on the left hand side of the aeroplane just aft of the flight compartment, and the other for the rear cargo compartment, located on the left hand side to the rear of the main cabin door.

13. (Unassigned)

14. The flight compartment is equipped with an emergency hatch located in the ceiling. The release handles are located in the forward edge of the hatch. The door of the emergency hatch is not hinged and it is necessary only to turn the release handles and push the door upward to completely clear the opening.

15. The main cabin has three emergency exits; two on the right side and one on the left hand side. These exits are constructed by incorporating a window in a large panel which may be released from the inside of the cabin. To release the emergency exit panels, it is only necessary to turn the handle to the right and push outward on the panel at the same time. The panel is hinged at the top and must be pushed upward to clear the opening.

FLYING CONTROLS

General Description

1. The surface controls are actuated by conventional dual column wheel and rudder peddle assemblies from the flight compartment through suitable cables, torque tubes, chains, push-pull tubes and bellcranks. A system of drums, pulleys and cables operate the trim tabs which are controlled by cranks and wheel on the pedestal.

Aileron Controls

2. Aileron movement is controlled by means of dual control wheels mounted on the dual control columns. A sprocket and chain transmits the wheel motion tothe aileron through cables and pulleys to the aileron master bellcrank in the centre wing section. From the master bellcrank, cables extend outboard through each wing and connect to the aileron actuating bellcranks. The bellcranks are linked to the ailerons by means of push-pull tubes. Aileron movement is limited by stops provided on the chains which strike against slotted plates in the control column elbows.

Elevator Controls

3. Elevator movement is transmitted by the dual control columns through a torque tube and four control cables. The elevator "UP" cables are routed directly aft through the lower part of the fuselage to the empennage where they are attached to the upper arm of the elevator torque tube horn. The elevator "DOWN" cables are routed forward from the control column horn to two pulleys and then aft to the empennage where they are attached to the lower arm of the elevator torque tube horn. The forward travel of the column is limited by an adjustable stop located on the fuselage structure in the path of the torque tube horn.

Rudder Controls

4. Rudder movement is controlled by rudder pedals which are connected to two torque tubes, to each of which a horn is attached. Cables extend aft from the horns to the empennage, where they connect to the rudder torque tube. A special pulley and cable assembly synchronizes rudder pedal action. Movement of the rudder pedals is limited by adjustable bolts on the horns, which strike against stops on the fuselage structure. Rudder movement is limited by a rudder stop cable assembly located in the fuselage aft section. In the event of a stop cable breakage, the clevis fittings at the ends of the broken stop cable are lockwired to the end fittings of the rudder cables to prevent jamming against the airplane structure. Under these conditions full rudder control is still maintained.

Aileron Trim

5. The right aileron is equipped with amoveable trim tab, which is operated through a sytem of cables, drums, pulleys and stops by a crank, located on the art face of the control pedestal. A graduated dial, located beside the control crank indicates the degree and affect of tab movement.

Elevator Trim

6. The elevator trim tabs are controlled through a system of cables, pulleys and drums, by a wheel installed on the left side of the control pedestal. A graduated scale beside the tab control wheel on the pedestal, indicates the degree and effect of tab movement.

Rudder Trim

7. A system of cables, pulleys and drums operate the rudder tab movement and is controlled by a crank located on the aft face of the control pedestal. A graduated dial beside the crank indicates the degree and affect of rudder tab movement.

POWER PLANT

Characteristics of Engines

1. The Twin Wasp "C" series engine is a two row radial, air cooled engine having a displacement of 1830 cu. in. and incorporating a single speed supercharger. From front to rear the major assembly groups of the engine are the front section, the crankcase section, and the rear section.

The following definitions form the basis for all directional references: The propeller end of the engine will be referred to as the front of the engine. The sides of the engine will be considered left and right as viewed from the rear. The normal direction of rotation of the propeller shaft and the crankshaft is clockwise as viewed from the rear of the engine. The terms clockwise and counterclockwise are applied to the direction of rotation of any accessory drive from a position facing the drive.

The cylinders are numbered consecutively in a clockwise direction when viewed from the rear of the engine. The top cylinder in the rear row is the No. 1 cylinder ; and the bottom cylinder in the front row is the No. 8 cylinder when the engine is in the horizontal (flight) position. The rear row cylinders are add numbered, and the front row cylinders are even numbered.

ENGINE DATA

2.

Model	Twin Wasp (R-1830) SIC3-G
Type	Two Row, Radial, Air Cooled
Number of Cylinders	14
Bore	5.5 inches
Stroke	5.5 inches
Piston Displacement in Cubic Inches	1830
Compression Ratio	6.70:1
Impeller Gear Ratio	7.15:1
Diameter of Impeller	11 inches
Crankshaft Rotation	Clockwise
Propeller Rotation	Clockwise
Propeller Reduction Gear Ratio	5625:1 (16:9) Spline Coupled
Propeller Shaft Spline Size	SAE No. 50
Diameter of Mounting Bolt Circle	27 inches
Number of Mounting Bolts	8
Average Dry Weight of Engine	1467 pounds
Overall Diameter of Engine	48.19 inches
Overall Length of Engine	61.67 inches

IGNITION

3. Magneto Type.............................SF14Lu or SF14LN-3
Rotation of Magneto Drive..................Clockwise
Magneto Speed in Multiples of Crankshaft Speed.......875:1
Sparkplug Gap................................ .011-.014 inch
Sparkplug Type.................................. R-37S-1
Spark Advance.................................. 25 degrees

VALVES AND TIMING

4. Intake Opens Before Top Center.................... 20 degrees
Intake Closes After Bottom Center...................... 76 degrees
Exhaust Opens Before Bottom Center................ 76 degrees
Exhaust Closes After Top Center................... 20 degrees
Intake Remains Open............................276 degrees
Exhaust Remains Open...........................276 degrees
Valve Adjusting Clearance (cold)...................020 inch
Valve Timing Clearance (cold).......................060 inch

FUEL SYSTEM

5. Carburetor Type...................................PD1-F5 - PD-12-H11
Fuel...Grade 91/98

FUEL CONSUMPTION

6.

	Operating Spec. Fuel Cons. Lbs:/bhp-hr.
At take-off power	.750
At rated power (METO)	.720

LUBRICATION SYSTEM

X7. Grade of Oil.. 100 w
Oil Pump Speed in Multiples of Crankshaft Speed..... .875:1

OIL CONSUMPTION

8.

	lbs./bhp-hr.
At normal rated power	.025
At 70% normal rated power & 89% normal rated speed	.020

POWER RATINGS

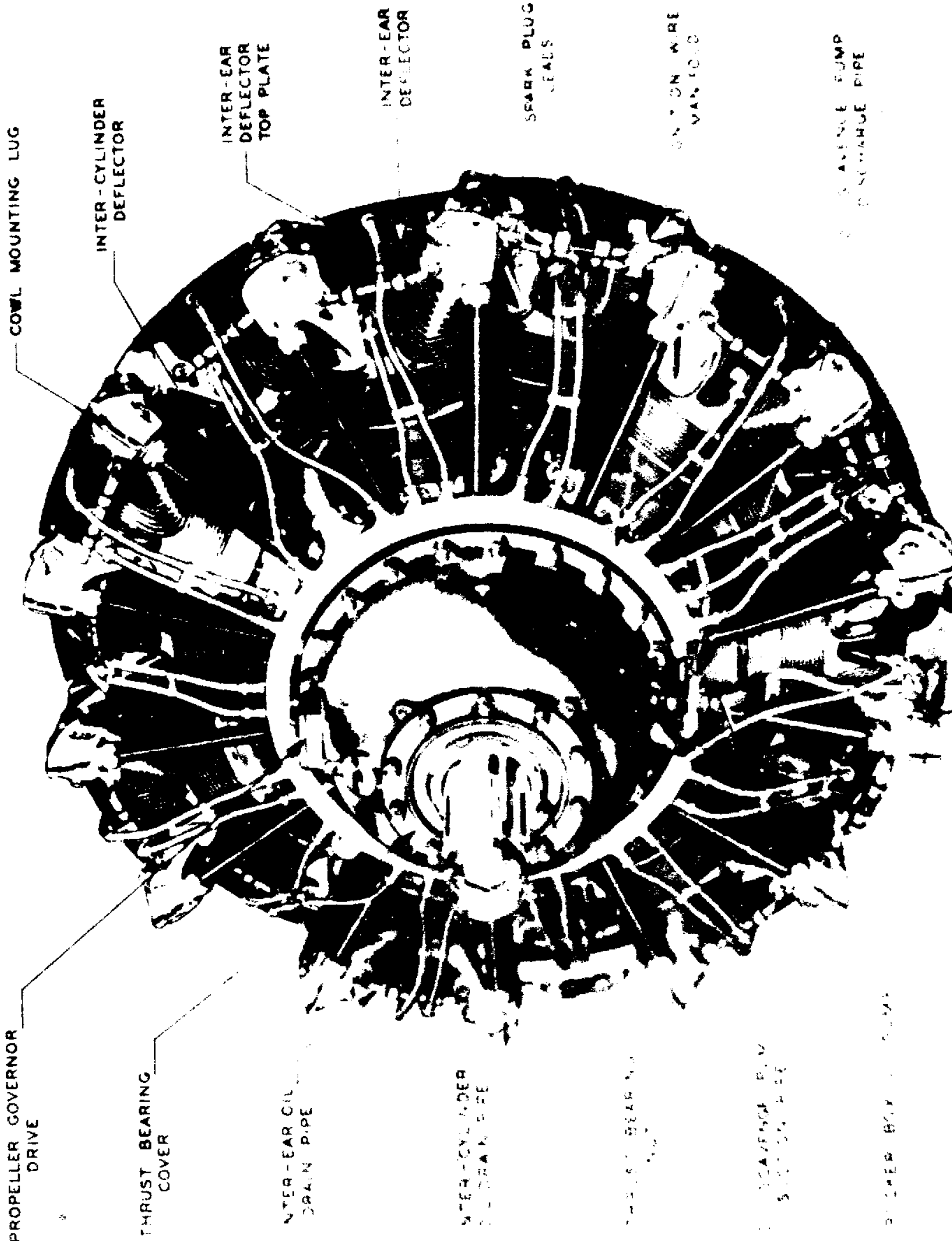
9. Maximum Take-Off 48" - 2700 RPM........ 1200 BHP
Normal Rated (M.E.T.O.) 41" - 2550 RPM........ 1050 BHP

ACCESSORY DRIVES

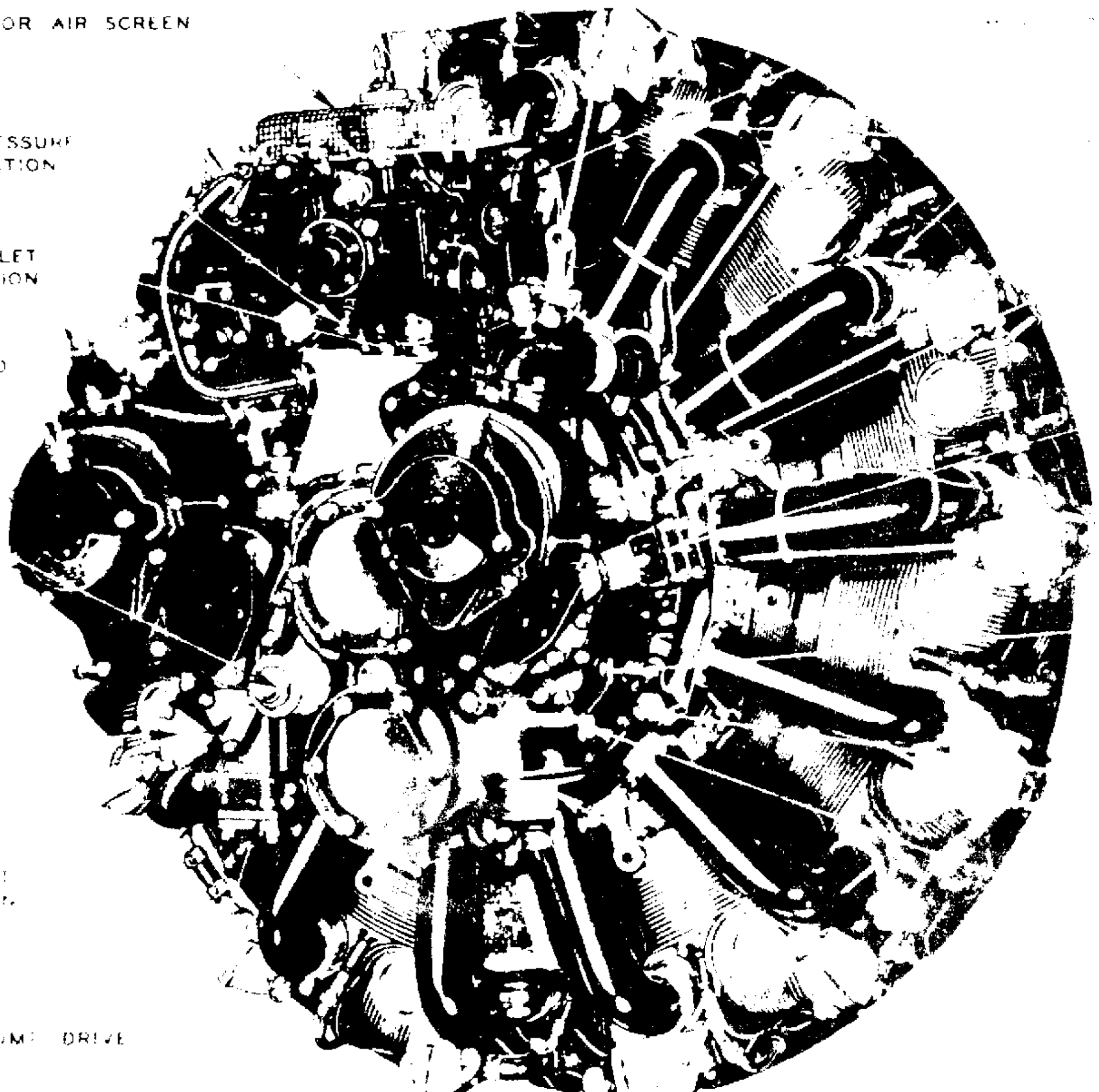
10. Generator Drive................. 16 Int. Splines, 1.40:1 Clockwise
Starter Drive.................... 3 Tooth Jaw, 1.00:1 Clockwise
Fuel Pump Drive................. 11 Int. Inv. Splines, 875:1 Counterclockwise
Tachometer Drive................ 7/8 in. -18NS-3 Coupling, 500:1 Clockwise (Right Side), Counterclockwise (Left Side)
Vacuum Pump Drive................ 12 Int. Inv. Splines, 1.40:1 Clockwise
Propeller Governor Drive......... 12 Int. Inv. Splines, 958:1 Clockwise

ACCESSORY AND INSTRUMENT CONNECTIONS

11. Manifold Pressure Gage - Oil Pressure Gage - Oil Tank Vent - Oil Inlet Thermometer - Vacuum Pump Oil Separator Discharge - Fuel Drain - Accessory Oil Return - Air Blast Covers.



R1830- S1C3G (-92) Engine
Left Front View



R1830 - S1C3G (-92) Engine
Right Rear View

POWER PLANT

Engine Description

1. The R1830-S1C3G (-92) engine operates on the conventional four stroke cycle principle. For descriptive purposes its major assembly groups are dealt with from front to rear.

Reduction Gear Housing (Front Section)

2. The reduction gear housing supports and houses the propeller reduction gear assembly and has provision for mounting and driving the hydraulically operating propeller governor. It also houses the front oil pump which scavenges oil from the rocker box oil sump attached to the head of No. 8 cylinder, and from the front part of the engine. The thrust bearing, a deep groove ball bearing, is mounted in the front of the reduction gear housing, supporting the forward end of the propeller shaft.

Reduction Gearing (Front Section)

3. The engine is equipped with a 5625:1 or 16:9 propeller reduction gear ratio. It has the spline coupled type of drive wherein the drive gear is coupled to the front end of the crankshaft by a series of three couplings. One of the two roller bearings supporting the propeller shaft at the rear is fitted over the end of the propeller shaft and the other is mounted in a liner shrunk into the support plate, which is located between the reduction gear housing and the front main crankcase. The reduction drive front coupling is supported between the two roller bearings. The front coupling is splined to the intermediate coupling, the intermediate coupling is splined to the front end of the crankshaft.

4. The reduction gearing is of the bevel planetary type. The drive gear meshes with six planetary type pinions which mesh with a fixed gear secured to the front end of the reduction gear housing.

Propeller Shaft (Front Section)

5. The propeller shaft is a short staight shaft of alloy steel having passages through out its length to carry engine and governor oil to the propeller. Integral with the propeller shaft is the pinion cage carrying the shafts of the six bevel pinions of the propeller reduction gearing.

Front Centre and Rear Main Crankcase-Power Sections

6. The cylinders and crankshaft bearings are held in place by a three section main crankcase of aluminum alloy which is forged to give it exceptional strength. Thefront section carries the front main bearing, the front can bearing and houses the front tappets or cam followers and tappet guides. The centre section carries the centre main bearing. The rear section carries the rear main bearing, the rear com bearing, and houses the rear tappets and tappet guides. These sections contain the oil passages which distribute pressure oil to each valve tappet from where, it is distributed to all parts of the valve operating mechanism.

Cylinders - Power Section

7. The cylinders are constructed of case aluminum heads screwed and shrunk tightly upon steel barrels. The cylinder barrels are machined from steel forgings with integral cooling fins. The aluminum head has deep cooling fins and rocker boxes cast integral. Fins of extreme depth are concentrated on the top and exhaust side of the hemispherical head and around the exhaust port where the greatest heat dissipation is required, where as only shallow fins are required on the inlet side. All cylinders are fitted with specially designed baffles which force the cooling air to pass between the fins so as to obtain the most efficient cooling possible. The cylinders are numbered consecutively in the direction of crankshaft rotation (clockwise when viewed from the rear), beginning with the topcylinder in the rear row which is No.1, and continuing with No. 2 cylinder, which is located in the front row immediately to the right of the vertical centre line. By this designation, all odd numbered cylinders are located in the rear row and all even numbered cylinders in the front row.

Valves - Power Section

8. The inlet valves are of the tulip type. The exhaust valves are of hollow head and stem design and are sodium cooled. Two concentric valve springs are secured to each valve stem by a split cone and washer. Inlet and exhaust springs are interchangeable. All valve operating parts are enclosed and pressure lubricated, oil entering the tappets through the guides and passing through the push rods and rockers.

9. (Unassigned)

10. (Unassigned)

Valves Timing Gears - Power Section

11. The valves are operated by two single piece double track cams having external teeth. The front cam, mounted on its bearing in the front main crankcase, actuates the valves for the front cylinders and the rear cam mounted on its bearing in the rear main crankcase, actuates the valves for the rear cylinders. The front cam is driven through the cam reduction gear by the reduction drive intermediate coupling. The rear cam is driven through the rear cam reduction gear by the crankshaft rear gear which is secured to the rear end of the crank shaft by cap screws.

Crankshaft - Power Section

12. The crankshaft is a solid, one piece steel forging which has its main support in three roller bearings mounted in the front, centre and rear main crankcase sections. The weights of reciprocating and rotating parts connected to the crankpin are counterbalanced by weights secured to the cheeks of the crankshaft. A torsional vibration damper of very simple construction is incorporated in the rear counterweight.

Pistons - Power Section

13. The pistons are machined from aluminum alloy forgings. Recesses in the head allow clearance for the heads of inlet and exhaust valves. Each piston incorporates five rings. Three compression rings are installed in the three top grooves. The fourth groove holds dual oil rings. The oil scraper ring is installed in the fifth groove, which is located below the bore of the piston pin boss.

Connecting Rods - Power Section

14. The master rods are of the two piece type and are located in cylinders No. 5 and No. 12. A steel backed, leaded silver master rod bearing is used in the large end of the master rod. Six "I" section articulated rods are attached to each master rod assembly by knuckle pins. The cylinder end of each master and articulated rod is provided with a bronze bushing for the piston pin and the opposite and of each articulated rod has a bronze bushing for the knuckle pin.

Supercharger or Blower Section

15. Blower Case:

The blower case is a magnesium alloy casting which houses the impeller and attaches to the rear of the main crankcase, supporting the engine in the aeroplane. Engine mounting bracket pads are machined on the outer circumference to accommodate mounting brackets which are secured by studs and nuts. A diffuser is incorporated which directs the mixture from the impeller to fourteen inlet pipe ports in the outer circumference of the case.

16. Impeller:

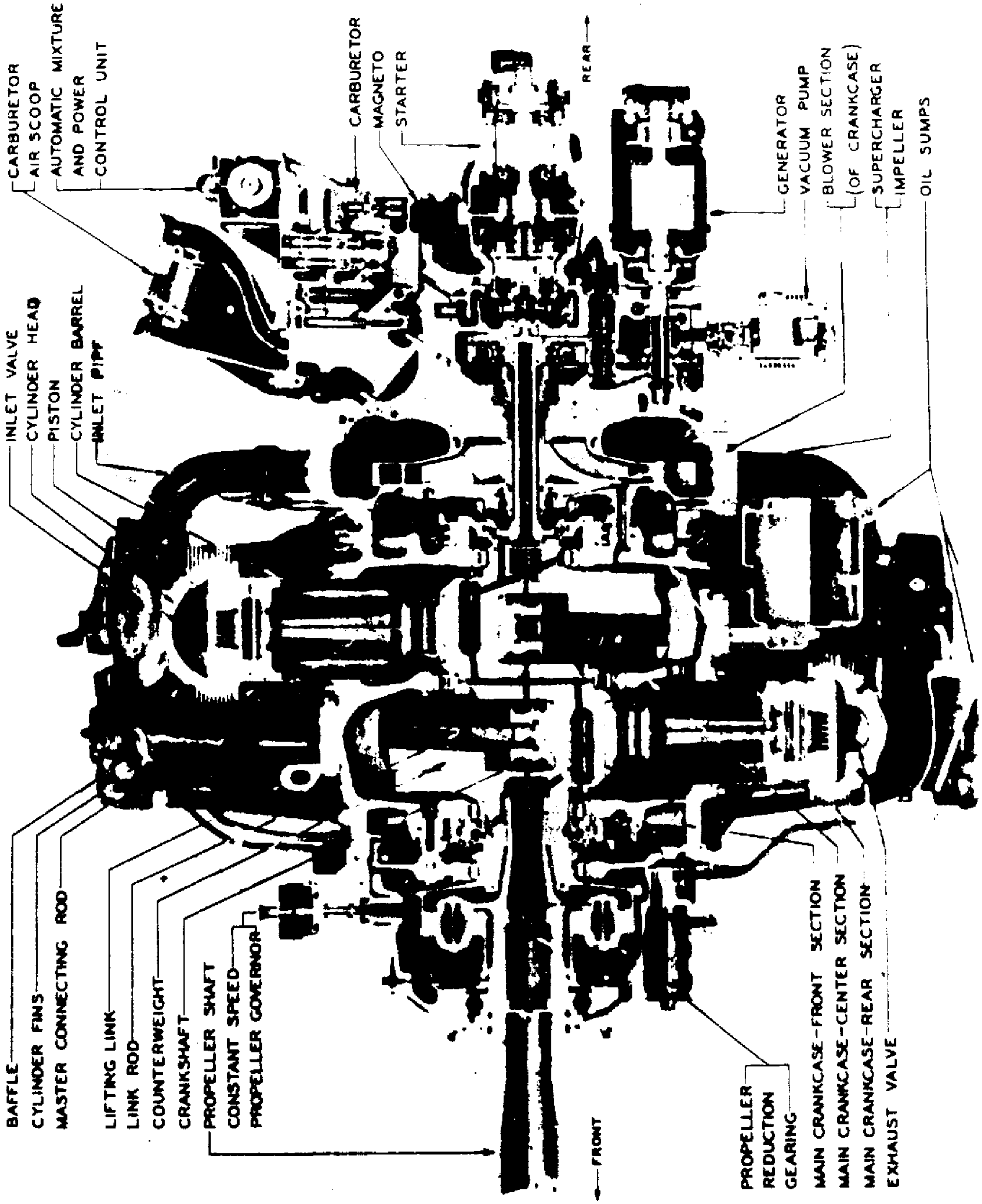
The impeller is of the centrifugal type and is driven at 7.15 times crank-shaft speed through a series of spur gears. The impeller shaft is hollow to permit the accessory drive shaft to pass through it.

Intermediate Rear Section Case and Diffuser

17. The intermediate rear case is a magnesium alloy casting which attaches to the rear of the blower case. It houses the impeller drive gear train and supports the vaned diffuser plate at its forward face. A flange at the top of the case provides a mounting surface for a down draft carburetor. Leading from the flange is a duct which carries the mixture to the impeller through a series of entering vanes at its throat.

Rear Section Case

18. The rear case is a magnesium alloy casting which attaches to the rear of the intermediate rear case. It houses the accessory; impeller and generator gear trains. It incorporates flanges for mounting the starter, the generator, two magnetos, the vacuum pump and two tachometers. With the exception of the generator and vacuum pump, all accessories are driven through two impeller intermediate drive pinions which are driven by the accessory drive gear. The hub of the accessory drive gear is internally splined to accommodate the starter jaw which is coupled to the accessory drive shaft by a stud anchored in the rear of the shaft. The rear case also houses a three section oil pump, one section of which supplies pressure oil to the engine, the other two sections scavenging oil from the main oil sump, located between No. 7 and No. 9 cylinders, and from the rear section.



PRATT & WHITNEY AIRCRAFT SERIES C TWIN WASP
R1830-S1C3G (-92)

PROPELLERS

Description of Propeller

1. Each engine is equipped with a Hamilton Standard Hydromatic. Quick Feathering, constant speed, controllable pitch propeller, eleven feet, six inches in diameter. The full low pitch is 16°, the constant speed operation range approximately 29°., and the full feathered position is 84°. All settings are taken at the 42-inch blade station.

Propeller Mechanism

2. The centrifugal force acting on the blades, and engine oil under normal pressure acting on the forward face of the piston in the propeller hub, tends to cause the blades to go into low pitch. Engine oil which has been boosted to a higher pressure by the constant speed governor pump is used to overcome this centrifugal twisting moment when it is necessary to increase the pitch. When the feathering pump is put in operation the oil pressure is increased and the piston overcomes the twisting moment, increasing the pitch until the adjustable mechanical stops are reached where the feathering pump is automatically stopped. About nine seconds are required for the entire feathering operation. When the feathering pump is started again and the blades are in the feathered position, the oil pressure increases to a point where it operates the distributor valve in the propeller hub, allowing the oil to pass to the dome on the forward side of the piston and unfeather the blades.

Propellers Governors

3. The governors are of the flyball type, operating a pilot valve which opens and closes a port through which oil is admitted to, and released from, the propeller cylinder. As the speed of the engine starts to increase, the flyballs move out against the governor spring, raising the pilot valve, which allows high pressure oil to pass to the cylinder, forcing the blades to a higher pitch. This prevents the engine from running faster. If the engine starts to slow down, the flyballs move in and drop the pilot valve which allows oil to drain from the propeller cylinder, moving the blades into a lower pitch and preventing the engine from slowing down. Engine oil at 75 pounds per square inch pressure is boosted to 400 pounds per square inch by a small gear pump in the base of the governor. This high pressure oil works against the centrifugal twisting moment of the blades and engine oil pressure on the forward face of the piston, when forcing the blade into higher pitch.

(continued) PROPELLERS

4. The feathering pump takes oil from the engine oil tank and delivers it to the propeller causing the piston to move out to the feathered position; the pressure being less than 400 pounds per square inch. The unfeathering pressure in slightly more than 750 pounds per square inch. The distributor valve is always in the position for feathering until the oil pressure reaches 750 pounds which moves it to the unfeathering position.

5. Speed selection is attained by moving the Propeller Controls on the Control Pedestal which compress or release the governor spring. The amount of compression of the governor spring determines the speed at which the governor will allow the engine to run, and the more this spring is compressed, the faster will be the engine rpm.

Feathering Operation

6. Feathering is the term applied when the blades of a propeller are turned to such a high pitch that they lie in the direction of flight. In this position they act as powerful brakes to stop engine rotation and at the same time offer the least possible drag on the airplane.

7. Feathering is accomplished by supplying oil from an independent source, not controlled by the governor but by a separate feathering motor, to the inboard end of the propeller dome.

8. This feathering operation is started by depressing the red handled push button switch in the cockpit. This switch is then held closed by its own Solenoid, and operates the feathering pump motor Solenoid which starts the feathering oil pump operating.

9. (Unassigned)

10. (Unassigned)

11. At a pressure of 365 lb. per square inch, the governor valve automatically disconnects the governor from the system by closing the governor port and connects the pump with the inboard end of the propeller cylinder. After the propeller blades have rotated to the full feathered position, the oil pressure builds up to 500 lb. per square inch on the inboard side of the propeller dome, at which point the pressure cut-out switch operates. This switch breaks the circuit to the cockpit Solenoid switch causing the switch handle to snap out, there by breaking the circuit to the feathering pump motor. The feathering operation is then completed.

12. It should be noted that the feathering operation may be stopped instantaneously as long as the speed of rotation has not fallen below 600 RPM by pulling out the Feathering Button. This, as described above, breaks the circuit to the feathering pump motor and stops it. If the engine RPM are 600 or more at the time the switch handle is pulled, the centrifugal forces on the blades will rotate them towards low pitch. When the rotating speed reaches 800 RPM the governor will take control and the propeller will assume its normal pitch setting.

13. If the engine speed has fallen below 600 RPM when the feathering operation is stopped, the aerodynamic forces on the blades may exceed the centrifugal forces so that the blades may continue to move towards the full feather position or may windmill in a balanced position. If power is applied, the propeller may be driven at a rotative speed almost up to that at which the governor takes over, depending on the blade angle, when power is applied. If the engine becomes rough or will not continue to respond to an advance of the throttle, it indicates that the blades have assumed an angle too close to their feathered position to permit centrifugal forces and the governor oil pressure to assume control. In such case the Feathering Button should be depressed again and the propeller permitted to become fully feathered before trying to unfeather.

Unfeathering Operation

14. Unfeathering is the term applied to the return operation from feathering to normal operation. The blades are turned from the high pitch feathered position to a low pitch position where the pressure of the air flow causes the propeller to windmill and rotate the engine.

15. The electrical components for the system include the following:

(1) Solenoid push button switches (cockpit) L.H. & R.H.

(2) Solenoid relay for starting pump motion.

(3) Pressure cut-out switch, located on governor.

(4) Propeller feathering motor and pump.

16. Two each of the above exist, one for the left hand engine and one for the right hand engine.

17. The unfeathering operation is done by holding the red solenoid switch handle in the cockpit in the depressed position. This starts the propeller feathering pump, and as the piston in the propeller dome has reached the forward limits of its travel, the pressure continues to build up until it reaches 600 lbs. per square inch. At this point the distributor valve in the propeller shaft is forced to the unfeathering position and so reverses the passages in the distributor valve in order to permit the high pressure oil to act on the outboard end of the piston. At the same time, the inboard end is opened to the engine lubricating system. As the propeller blades rotate toward low pitch, the enginewill start windmilling and at approximately 600 RPM the centrifugal forces will take over so the feathering switch may be released. At approximately 800 RPM the governor will take over the control and normal engine operation will be obtained.

18. It should be noted that if the unfeathering operation is stopped at a point where the propeller is windmilling at less that 600 RPM the centrifugal forces will not take control andengine operation will not be regained. In this case the distributor valve kicks back to the feathered position and the propeller blades returned to the fully feathered position and unfeathered again.

19. It should also be noted that the engine oil pressure only assists the blade centrifugal twisting moment in moving blades towards low pitch and that the entire control of the propeller during constant speed, feathering and unfeathering is accomplished by means of a single oil passage between the governor base and the propeller. Variations in pressure and volume of oil flowing in this passage are dependant upon to control the propeller.