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AIR PUBLICATION 2379A

Volume I

September, 1942

CIRRUS MINOR AERO-ENGINE

LIST OF SECTIONS

SECTION 1—Operational Instructions

SECTION 2—Tuning and Maintenance

SECTION 3—Installation

SECTION 4—Description *(to be issued later)*

Note.—A list of contents appears at the beginning of each section.

AIR MINISTRY

F.S./1

SPECIAL NOTES

Certain points relating to the Cirrus Minor aero-engine may cause some confusion to the operator. In order that these points may be clearly understood, the following information is emphasized.

(i) *Dead centre positions.*—As this engine is of the inverted type, it should be particularly noted that throughout this publication the term "top dead centre" (T.D.C.) refers to the position of the piston when it is at the beginning of either the power or the induction stroke, as the case may be. Similarly, "bottom dead centre" (B.D.C.) refers to the position of the piston at the end of the same stroke.

(ii) *Fuel.*—It should be specially noted that this engine is not designed for the use of leaded fuels, therefore care should be taken to ascertain that fuel containing tetra-ethyl of lead is not used.

INTRODUCTION

1. The Cirrus Minor is an inverted in-line, four-cylinder, air-cooled aero-engine. It is basically similar to the civil type Minor but incorporates several changes in design. These include a new induction system which comprises a cast induction pipe and later type carburettor together with an Amal combined air intake and flame trap element, redesigned rockers incorporating a hardened steel pad to contact the valve stem, improved type of engine bearer foot rubber mounting and the fitting of screened ignition harness.

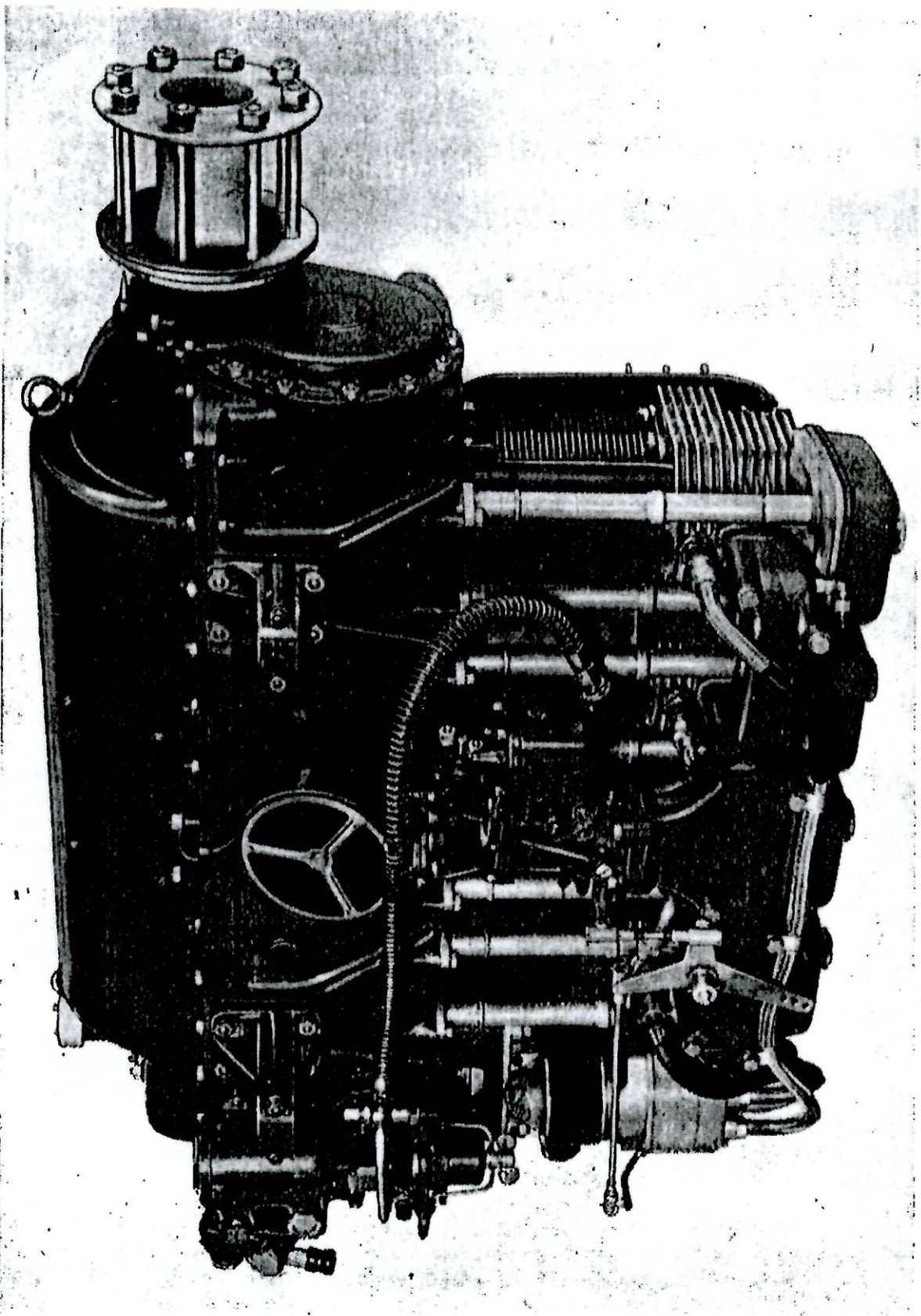
2. The engine is designed to operate satisfactorily on fuel to Specification D.T.D.224 or any good grade non-leaded fuel of not less than 73 octane. (Fuels containing tetra-ethyl of lead must not be used).

3. The detachable cylinder heads are of "Y" alloy and fitted with screwed in phosphor-bronze valve seats and sparking-plug adapters. In order to eliminate distortion of the cylinder head due to unequal tightening, the head is spigoted on to the cylinder and clamped by eight nuts to a flange on the cylinder, a gas-tight joint being ensured by laminated copper washers. The rocker mechanism is mounted on the cylinder heads and the valves are operated by overhead rockers which are actuated by means of push rods and tappets from a single camshaft contained within the crankcase. The rockers are of conventional design, one end having an adjustable screwed socket for setting the valve clearances and the opposite end a hardened steel pad which makes contact with the valve stems, the ends of which are stellite to resist wear.

4. The lubrication system is on the dry sump principle and is served by a small piston type pressure pump, with which a gauze type suction filter is incorporated. The pressure feed from the pump, which is controlled by a piston relief valve, passes through a pressure filter composed of flat conical gauze elements threaded on to a perforated central tube, and thence to the main oil gallery pipe which is pressed in the crankcase. This gallery feeds the main bearings and also passes through oil-ways in the crankshaft to the connecting rod big-end bearings. All other internal components are lubricated either by splash oil or oil mist. There is no scavenge pump; the oil returns by gravity from the forward and rear ends of the crankcase through large diameter pipes to the tank. Each pair of rockers is encased within a detachable cover which acts as an oil reservoir for the rocker mechanism.

5. One single choke Claudel-Hobson A.I.40D down-draught carburettor is fitted. The carburettor is mounted upon a four branch cast induction manifold, and is fitted with an Amal air intake which is provided with an element which serves as an air filter and flame trap.

6. Dual ignition is provided by two screened B.T.H. magnetos, type SG.4-2 which are mounted vertically at the rear end of the crankcase and driven by two vertical layshafts actuated by a skew gear wheel on the crankshaft. The starboard magneto is fitted with an impulse starter coupling. The variable timing device for both magnetos is inter-connected to the throttle control. Each magneto supplies its individual set of sparking plugs through a separate screened ignition harness. Additional accessories include two inter-connected fuel pumps, an alternative R.P.M. indicator drive adapter which can be used for operating special instruments and Ki-gass primer connections on the induction manifold. Provision is also made for fitting a B.T.H. electric inertia starter.



FRONTISPIECE—CIRRUS MINOR AERO-ENGINE

*This leaf issued with A.L. No. 4
March, 1944*

**AIR PUBLICATION 2379 A
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LEADING PARTICULARS

(1) General

Type	Four-cylinder, inverted in-line, air-cooled, direct drive, dry sump
Bore	95 mm.
Stroke	127 mm.
Swept volume	3.601 litres
Compression ratio	5.87 to 1
Numbering of cylinders	Propeller—4, 3, 2, 1
Direction of rotation	Left-hand
Weight (nett dry)	229 lb.

(2) Performance

International power rating	79/82 b.h.p. at 2,300 r.p.m. at sea level; full throttle
Maximum power rating	87.90 b.h.p. at 2,600 r.p.m.

(3) Limiting operational conditions

(i) Take off	
Minimum r.p.m.	2,185
(ii) Maximum climbing	
r.p.m.	2,300
Cylinder temperature	200° C.
(iii) Maximum level flight (5 minute limitation)	
r.p.m.	2,600
Cylinder temperature	200° C.
(iv) Cruising	
r.p.m.	2,200 to 2,300
Cylinder temperature	200° C.

(4) Fuel

Type	To be not less than 73 octane and contain no tetra-ethyl of lead
Pressure required at carburettor inlet	0.5 lb. per sq. in. minimum
Consumptions—	
(i) Full throttle	
Normal r.p.m.	6.25 gallons per hour
(ii) Cruising at 2,300 r.p.m.	
80 per cent. full power	4.59 gallons per hour
70 per cent. full power	4.34 gallons per hour
60 per cent. full power	3.96 gallons per hour

- (iii) Cruising at 2,200 r.p.m.
 80 per cent. full power ... 4.46 gallons per hour
 70 per cent. full power ... 4.18 gallons per hour
 60 per cent. full power ... 3.84 gallons per hour
 The above figures are for sea level conditions with the mixture control in the fully RICH position.

(5) Oil

Type ...	...	...	...	Specification D.T.D.472, see Vol. II leaflet, A.P.1464/C.37—W
Oil pressure ...	...	...	...	30 to 35 lb. per sq. in.
Consumption at maximum cruising ...	...	...	...	1 to 2 pints per hour
Oil inlet temperature—				
Minimum for take-off ...	...	...	...	30° C.
Maximum for cruising ...	...	...	...	80° C.
Maximum for climbing ...	...	...	...	90° C.
Maximum level flight ...	...	...	...	90° C.

(6) Ignition

Firing order ...	...	...	...	1, 3, 4, 2
Magnetos ...	...	...	...	Two screened B.T.H.
Type ...	...	...	...	SG.4—2
Direction of rotation ...	...	...	...	Port—clockwise
(Viewed at coupling end)				Starboard—anti-clockwise
Speed of rotation... ..	...	...	...	Engine speed
Sparking plugs ...	...	...	...	K.L.G.
Type ...	...	...	...	RV.14-5
Sparking plug gap ...	...	...	...	0.012 in. to 0.015 in.
Ignition harness ...	...	...	...	Breeze
Type ...	...	...	...	B.87
Impulse starter coupling (fitted on starboard magneto) ...	...	...	...	One—B.T.H. type L2C

(7) Ignition timing

The movable contact breaker cams, by means of which the ignition is varied, are coupled together and interconnected with the cockpit throttle lever by means of linkwork which is arranged to provide automatically the following settings:—

- (i) Before T.D.C. at start and
 idling 0° to 10°
 (ii) Before T.D.C. at full throttle 30°

(8) Valves

Valve timing—This is approximate and is only intended for use as a check.

Inlet valve opens ...	...	...	52° before T.D.C.
Inlet valve closes ...	...	...	92° after B.D.C.
Exhaust valve opens ...	...	...	80° before B.D.C.
Exhaust valve closes ...	...	...	53° after T.D.C.
Valve clearances (cold)—			
Inlet valve ...	...	...	0.004 in.
Exhaust valve ...	...	...	0.004 in.

*This leaf issued with A.L. No. 4
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**AIR PUBLICATION 2379 A
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CIRRUS MINOR AERO-ENGINE

SECTION 1

OPERATING INSTRUCTIONS

This Chapter issued Sept., 1942
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March, 1944

AIR PUBLICATION 2379 A
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SECTION 1

OPERATING INSTRUCTIONS

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SECTION 1

OPERATING INSTRUCTIONS

Starting and preliminary running

Preliminary instructions

1. With new engines or those which have been standing for prolonged periods, the oil which has been injected into the cylinders for maintenance during storage should be drained. To do this the exhaust valve to each cylinder should be opened for a short time, otherwise an oil lock will probably occur when the engine is turned, with resultant damage to the engine.

2. Before starting the engine, ensure that there is sufficient fuel and oil in the tanks and that the rocker casings are filled with oil to the correct level. In addition, prime the suction filter by removing the cap and filter element and pouring in clean engine oil (*see* Leading Particulars).

3. The following points should also be observed:—

- (i) Check the tightness and locking of all external bolts, nuts, etc., on the engine mountings.
- (ii) Check the operation of all engine controls to ensure that they work freely and give full movement of the throttle, magneto advance and retard mechanism and the mixture control unit.
*Note:—*On Auster I aircraft the mixture control is locked in the RICH position.
- (iii) Check the magneto low-tension earthing wires and switches for continuity, correct connections and functioning by using the magneto synchronizer (Stores Ref. 5A/1113) as a continuity tester. During this operation it will be necessary to remove the magneto contact breaker covers; this renders the earthing switches inoperative which produces a dangerous condition, since the magnetos are switched on permanently. After completing the test, replace the magneto contact breaker covers and leave both switches in the OFF position.
- (iv) Check the connection of the oil pressure gauge and pipe.
- (v) Check the connections of the r.p.m. indicator cable.
- (vi) Check all cowling components and their fixings, together with the locking of the draw wires.
- (vii) See that propeller bolt nuts are tight and that the locking plate is properly positioned.

Key to fig. 1

- | | |
|------------------------------|--------------------------|
| 1.—Propeller hub | 10.—Oil return pipe |
| 2.—Timing plate | 11.—Cooling air scoop |
| 3.—Timing pointer | 12.—Ignition harness box |
| 4.—Front lifting eyebolt | 13.—Exhaust port |
| 5.—Top cover | 14.—Rocker cover |
| 6.—Rear mounting foot | 15.—Cylinder head |
| 7.—Fuel pump | 16.—Cylinder |
| 8.—Magneto | 17.—Bonding strip |
| 9.—Screened ignition harness | 18.—Front cover |

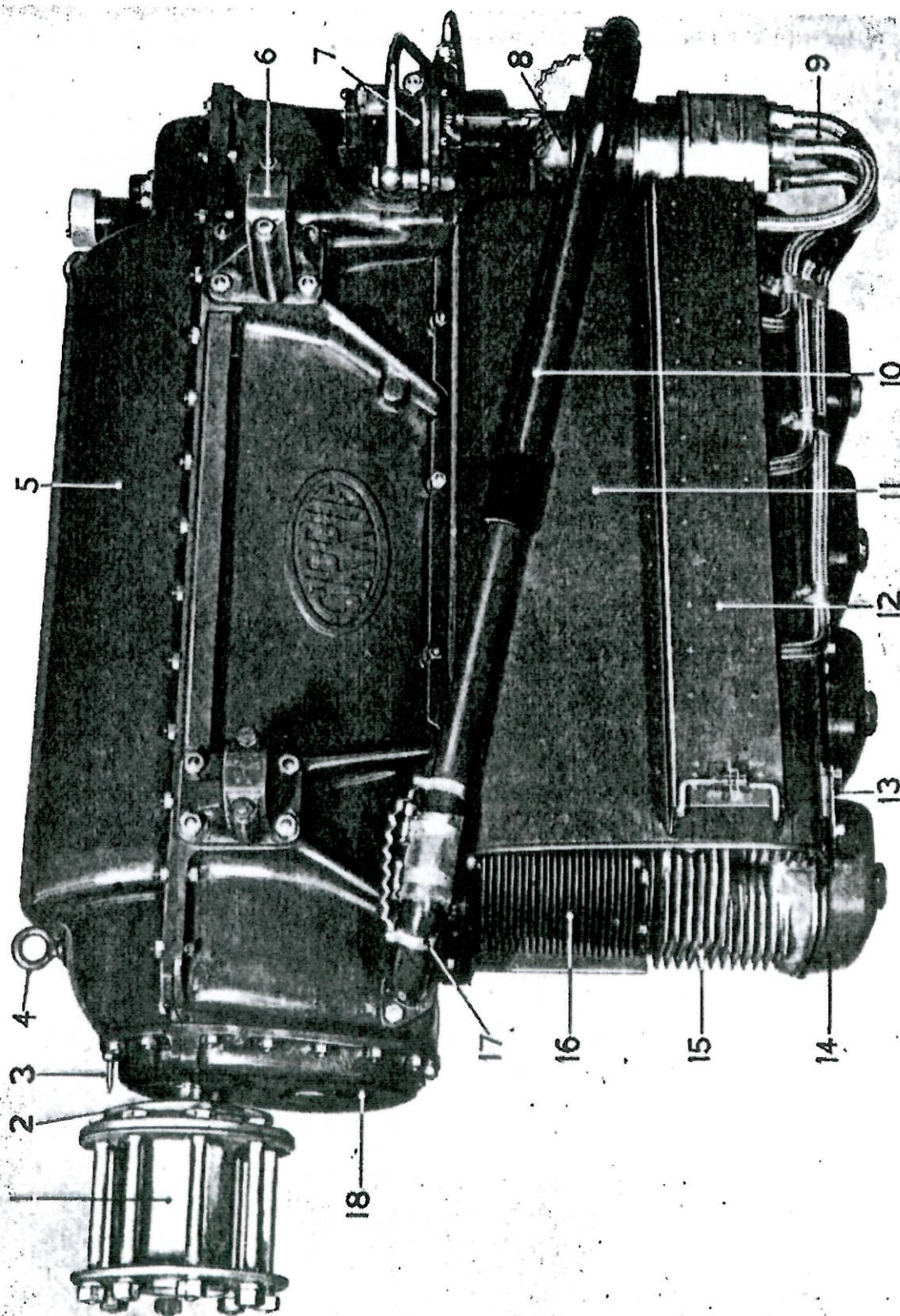


FIG. 1.-CIRRUS MINOR AERO-ENGINE (PORT VIEW)

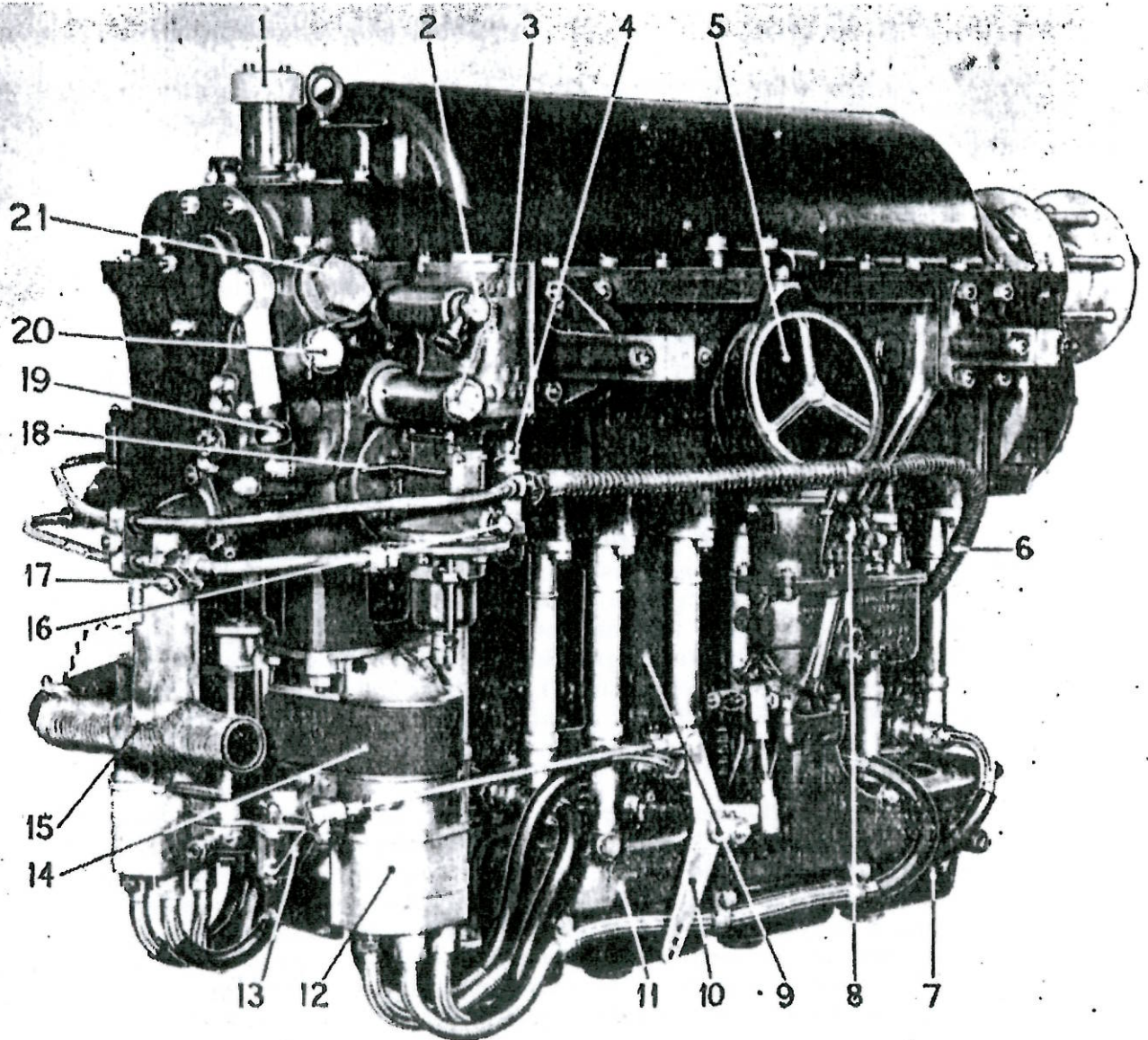


FIG. 2.—CIRRUS MINOR AERO-ENGINE (THREE-QUARTER REAR VIEW) (STARBOARD)

- | | |
|--|-------------------------------------|
| 1.—Crankcase breather | 12.—Distributor cover |
| 2.—Oil pressure gauge connection | 13.—Ignition control lever |
| 3.—Pressure oil filter | 14.—Magneto |
| 4.—Fuel pressure gauge connection | 15.—Oil return pipe to tank |
| 5.—Carburettor air intake and flame trap | 16.—Fuel pump drain pipe connection |
| 6.—Fuel pipe to carburettor | 17.—Fuel supply pipe connection |
| 7.—Fuel priming pipe connection | 18.—Fuel pump priming handle |
| 8.—Mixture control | 19.—Oil inlet pipe connection |
| 9.—Cooling air baffle | 20.—Oil pressure relief valve |
| 10.—Throttle control lever | 21.—Oil system suction filter |
| 11.—Induction manifold | |

- (viii) Check and, if necessary, adjust the tappet clearances.
- (ix) Examine the sparking plugs for cleanliness and the gaps in accordance with the instructions contained in the relevant section of A.P.1374.
- (x) Rotate the crankshaft to check the clearance between the propeller and engine cowling.

4. After the preliminary run examine all joints, etc. for leaks and check the propeller bolt nuts for tightness. Check over all external nuts for tightness, particularly those securing the engine feet to the crankcase and to the engine bearer frame.

Preliminaries

Starting the engine

5. Before starting the engine observe the following sequences of operations.
 - (i) Under tropical conditions it should be ascertained that there is no restriction in the opened-up air intake.
 - (ii) Turn on the fuel cocks.
 - (iii) Prime the carburettor by means of the carburettor flooding device, at the same time operating the priming levers on the fuel pumps.
 - (iv) In cold weather, or if the engine fails to start by priming as in sub-para. (iii) of this paragraph, turn on the priming system cock and operate the priming pump. In connection with the use of the priming pump care should be taken not to overprime. See that the priming cock is returned to the OFF position.
 - (v) Turn the propeller vigorously in its direction of rotation to carry the engine over four compressions with the magneto switches in the OFF position. Switch on the magnetos. Set the cockpit throttle lever in the recommended starting position. On engines which are fitted with the mixture control operative (i.e. not locked in the RICH position) the mixture control should be at RICH for starting.

By electric starter

6. When starting the engine with electrical starting gear the following sequence of operations should be adopted:—Turn the engine by means of the starter and at the same time prime the induction system as rapidly and as vigorously as possible. The quantity of priming given should not exceed that defined in para. 8 of this Section. At temperatures below 0 deg. C. the priming will probably need to be continued to assist the engine to pick up on the carburettor, and it may be necessary to make at least two attempts to start to ensure that the necessary quantity of atomized fuel reaches the cylinders. In addition it will be found that an easier start can be obtained if the turning period is prolonged to 20 seconds with a 30 seconds wait between each attempt.

7. Under normal weather conditions the engine should start within three seconds. If, however, the engine refuses to start with an adequate turning speed after four attempts have been made, investigation should be made to ensure that:—

- (i) The sparking plugs are firing efficiently.
- (ii) The cylinders are correctly primed. Black smoke emitting from the exhaust indicates over-priming and is accompanied by intermittent firing on each cylinder; while if the cylinder sparking plugs are functioning efficiently, but there is no indication of a cylinder firing, under-priming is indicated, and it should be ascertained that the priming nozzles are not choked.

Priming procedure

8. The following tabulation relates to starting a cold engine and gives an approximation of the amount of priming that will probably be required for different atmospheric temperatures before the correct mixture is obtained within the cylinders and the engine may be expected to fire. An additional quantity of fuel will be required to fill the pipeline between the priming pump and the engine and this must be determined beforehand for the installation under consideration.

Air temp.	Priming in c.cs. of fuel	No. of strokes*
+30° C.	0	
+20° C.	10	
+10° C.	20	
0° C.	30	
-10° C.	40	
-20° C.	60	

* Two types of Kigass priming units are in use having the following delivery capacities.

Type	Approximate capacity per stroke in c.cs.	Dia. of plunger rod in.
AM type B	10	0.563
K40	45	0.870

The type of priming unit may be recognized by the diameter of the plunger rod if this information is not given in the appropriate aircraft Air Publication. A simple estimate with the aid of the tabulation will give the number of pumpfuls necessary. The blank column may be filled in by the operator, after the precise number of strokes for the particular installation under consideration has been ascertained. With a warm engine in winter about 20 c.cs. of priming fuel will be required. Do not "suck in".

By swinging the propeller

9. When starting up by swinging the propeller the same instructions detailed in para. 5 of this Section will apply generally. When starting the engine by this method, switch on the starboard (impulse) magneto and swing the propeller smartly. When the engine is running, switch on the port magneto. The instructions and procedure detailed in A.P.129, Part 1, should be observed.

After starting

10. After the engine has been started the following points should be observed:—

- (i) If the oil pressure does not rise to between 30 to 35 lb. per sq. in. within one minute the engine must be stopped and the cause investigated. (See para. 35, sub-para. (iv) of this Section).
- (ii) If the oil pressure is correct the engine should be run at 800 to 900 r.p.m. for at least four minutes to allow the oil to warm up and circulate freely.
- (iii) The oil inlet temperatures will probably not be recorded on the thermometer immediately, but it may be assumed that, after the run specified in sub-para. (ii) of this paragraph, the oil temperature and circulation are satisfactory and the engine can be safely opened up to full throttle.

- (iv) The running of the engine on the ground at full throttle must be carried out with discretion; in no circumstances should it exceed a period of 30 seconds. Under tropical conditions, this period should be proportionately less.

Initial ground test

11. After the engine has been warmed up in the manner described in para. 10 of this Section, so that satisfactory circulation of fuel and oil is ensured, the engine should be throttled down and the slow-running stop for the throttle control lever on the carburettor adjusted to the required position. This adjustment should be carried out to give a practical engine speed, commensurate with picking up and steady even firing, which will ensure the minimum vibration at low r.p.m. (see also Sect. 2, para. 10 to 14).

12 The engine should be stopped (see para. 15 of this Section) for the purpose of inspecting for fuel and oil leaks. If this inspection is satisfactory, start the engine and continue to run at 1,000 r.p.m. until steady running and settled oil pressures and temperatures are obtained.

13 Check that the mixture control position is at full RICH in the case of variable mixture control (see para. 3, sub-para. (ii) of this Section) and then accelerate the engine steadily until the full throttle position is reached, paying special attention to any engine vibration that may become apparent. The r.p.m. obtained should be between 2,180 and 2,300, and will depend upon the propeller and the barometric pressure.

Testing magnetos

14. With the engine running steadily at full throttle under conditions detailed in para. 13 of this Section, the magnetos should be tested. Each magneto should be switched OFF alternately and the resulting drop in r.p.m. noted. This drop should not exceed 115 r.p.m. at full throttle.

Stopping the engine

15. The engine should be stopped in accordance with the following sequence:—

- (i) Move the throttle back to slow-running position and allow the engine to idle for a few moments in order to allow it to cool.
- (ii) Turn OFF the fuel cock.
- (iii) Switch OFF the magnetos.

Oil pressures

In flight

16. The normal working pressure (see Leading Particulars), should be steadily maintained under normal flying conditions. At idling and low speeds the pressure may fall slightly. If, during flight the oil pressure falls below 25 lb. per sq. in., the engine must be throttled down and a landing effected as soon as possible to investigate the cause.

Oil inlet temperatures

17. Oil inlet temperatures should not exceed those given in the Leading Particulars. The throttle must not be opened nor the aircraft take off until the oil temperature has reached the minimum figure of 30 deg. C.

Cylinder temperatures

18. The cylinder temperatures stated in the Leading Particulars must not be exceeded. Any indication of high cylinder temperatures must be immediately investigated.

Engine operation during flight

Take-off and climb

19. The throttle control lever should be moved to the fully open position which should give approximately 2,180 r.p.m. The climb can be continued at 2,300 r.p.m. The mixture control, (when not locked in the RICH position) when climbing or in level flight at full throttle, must be set to give the richest possible mixture that will maintain the appropriate r.p.m. and to ensure that there is no possibility of a weak mixture at full throttle.

Cruising and level flight

20. The maximum cruising r.p.m. of 2,300 is based on a propeller which will not allow the engine to exceed 2,600 r.p.m. at full throttle at sea level. The minimum cruising r.p.m. should not be less than 2,200, based on the previously defined conditions, as a low crankshaft speed is likely to impose excessive mechanical wear and to induce dangerous conditions. When cruising, the mixture control should be set so as to maintain an economic mixture commensurate with satisfactory running of the engine.

Diving speed

21. The engine r.p.m. in the dive must not exceed the maximum permissible r.p.m., i.e., 2,600 at full throttle for five minutes duration.

Landing

22. When coming in to land care should be taken to see that the mixture control lever has been returned to the fully RICH position if it is not already locked in this position. This will ensure immediate pick-up from the normal throttle position for landing to full throttle in case of emergency.

Running defects

23. In the following paragraphs are detailed the more common causes of faulty running that may be experienced in the operation of the engine.

Failure to start

24. Failure to start may be due to disregard of precautions regarding priming and flooding mentioned in para. 5 to 8 of this Section. In cold weather it is almost impossible to have too rich a starting mixture; in hot weather, however, or with a hot engine, a rich mixture is likely to cause failure to start. In this case switch "OFF", open the throttle fully, and turn the engine backwards (i.e. opposite to direction of rotation) to expel the rich gases. Then set the throttle to the best starting position and with the switches "ON" swing the propeller in the direction of rotation, the engine should then start up.

25. Incorrect functioning of the impulse starter coupling may also cause failure to start. To check these items, the propeller should be turned slowly with the ignition switched OFF, whereupon, if the mechanism is in order, a distinctly audible click will be heard from the impulse starter coupling near the top dead centre position of any piston. The actual arrest and rotation of the magneto armature after release can be observed by removing the starboard

magneto contact breaker cover. With the cover removed, it is most important to note that the earthing switch for this magneto will be inoperative so that the magneto is permanently switched ON, creating a potentially dangerous situation since the engine is liable to kick when the propeller is turned.

26. Probable causes of failure of the impulse starter coupling, together with their treatment, are dealt with in A.P.1374, Vol. I.

27. Failure to start may also be due to the presence of water in the carburettor, in which case the main and power jets should be removed and the carburettor flushed through by turning on the fuel cock. See that the slow-running jet is not choked. Special precautions are necessary when assembling the piping connecting the fuel pump units since air leaks, which are difficult to detect, are a possible cause of engine failure.

28. If the engine has been standing in a damp atmosphere, it may be necessary to wipe the insulators of the sparking plugs and the distributors of the magnetos in order to reduce the possibility of high-tension leakage which might otherwise take place under these conditions.

Faults in the ignition system

29. After installing a new engine, or before running an engine which has been idle for a prolonged period it is essential that the ignition system should be tested. Check the magneto low-tension earthing brushes, the wires and switches for continuity, correct connections and functioning, using the magneto synchronizer (Stores Ref. 5A/1113), in accordance with the instructions contained in A.P.1095, Vol. I.

30. When using the synchronizer it is necessary to remove the contact breaker covers, thus rendering the earthing switches inoperative. Before carrying out the test, it is therefore essential that the high-tension leads are disconnected from the sparking plugs in order to prevent accidental starting of the engine whilst turning the propeller. As an alternative, the distributors may be removed from the magnetos. After the test has been made see that both switches are in the OFF position.

31. Defective ignition provides many symptoms of imperfect running which are difficult to diagnose and are similar in certain cases to other sources of trouble. The first check that should be made in cases where the ignition is suspected, is to test each magneto separately and see whether one magneto gives a better result than the other. If either magneto causes an excessive drop in r.p.m. or rough running when the other is switched off, it may be assumed that the trouble lies in that magneto, the leads, or the plugs that it serves.

32. Sparking plugs which are suspected of being faulty should be removed and tested in the approved manner on a tester as detailed in A.P.1374. The condition of the high-tension leads should be checked. If there are any signs of deterioration of the rubber, the lead should be replaced by a new one. The ignition harness and metal-braided cables should also be carefully examined for defects and the condition of the braiding should be observed. Ensure that all connections are in good condition and are making good contact.

33. The magneto distributors, high-tension lead terminals and the sparking plug insulators must be kept clean and dry. Any moisture present on these parts may lead to failure to start as stated in para. 28 of this Section.

34. Care must be taken to ensure that the magneto contact breakers are not dirty or out of adjustment. An excessively small gap may produce defective

or rough running and may cause a complete cut-out of the magneto. The presence of dirt or oxidation on the points will produce similar symptoms. See that the contact breaker arm is working freely in its bush. Damp atmosphere may cause the bush to swell; in this case the arm should be removed and the bush carefully eased out, using a fine grade of emery cloth. Apart from the above-mentioned adjustments, no repairs should be attempted on magnetos; defective units should be returned to Stores for examination and rectification.

Possible engine faults.

35. The following is a list of the possible engine faults:—

- (i) *Misfiring*.—Should any one cylinder misfire or cut-out when running, locate the defective sparking plug and clean and test it, or fit a new one.
- (ii) *Engine misfiring on one magneto*.—Check and test all plugs and magnetos. If the trouble is traced to the magneto or distributor and no fault can be detected which can readily be rectified, fit a new magneto. If the engine cuts right out on one magneto, examine the switches and low-tension wiring (see para. 3, sub-para. (iii) of this Section) as well as the magneto; also ensure that the high-tension leads are connected to their correct terminals on the distributors.
- (iii) *Engine cutting out in flight*.—Make sure that the switches have not been inadvertently switched OFF. Test the engine on separate magnetos since a fault in one magneto or distributor may upset the running of the engine.
- (iv) *Low oil pressure*.—This may be due to air leaks or air locks in the suction pipes, choked filters, stuck release valve, defective pressure gauge or defective pipe-line to gauge.
- (v) *Carburettor flooding*.—Possible causes may be as follows:—Dirt under the needle, worn needle and seating or sluggish toggle mechanism. If the needle face or seat is worn, both should be renewed.
- (vi) *Engine runs slowly but will not open up*.—Possible causes are—water in the carburettor, main or power jets blocked, air lock in the fuel pipe-lines, or choked filter. Check the jets for stoppages by removing them and flushing out the jet chambers, ensuring that all orifices are clear. Sharp edged articles must not be used for clearing obstructions or the calibration may be upset. If there is any reason to suspect faulty calibration fit new jets.

Rough running

36. Apart from defective ignition, rough running may also be due to the following:—

- (i) *Propeller loose or out of balance*.—Check the hub nut and flange nuts for tightness and the propeller for track and balance.
- (ii) *Valve tappets incorrectly adjusted*.—Reset the tappets to the required clearances as detailed in the Leading Particulars.
- (iii) *Engine mounting or holding down bolts loose*.—It is essential that the rubber mounting blocks are correctly fitted.
- (iv) *Weak compression*.—If the compression of any cylinder is found to be weak, first check the tappet clearances and, if these are in order, or their adjustment does not rectify the trouble, remove the cylinder head in question and investigate the cause. Faulty compression may be due to defective valves, stuck piston rings or a faulty joint between the cylinder head and barrel.
- (v) *Induction manifold leakage*.—Inspect and test the induction manifold for leakage. Note that the joints between the carburettor and the induction manifold and also those between the induction manifold and the cylinders are in good condition.

*This leaf issued with A.L. No. 4
March, 1944*

**AIR PUBLICATION 2379 A
Volume I**

CIRRUS MINOR AERO-ENGINE

SECTION 2

SERVICING THE ENGINE