

## 16 PRESERVATION OF ENGINE

The engine preservation is the basic method of protection of the component parts against corrosion, it ensures that the engine remains undamaged during storage and ensures regular operation of the engine in use.

The following preserving materials are recommended:

1. Preservation of internal surfaces of the engine:
  - a) Storage of engine up to one year — oil MS 20+yellow ceresin according to GOST 1013-49 and CSN 65 7111.
  - b) Storage of engine up to 3 months — oil MS 20+yellow ceresin.
  - c) Engines put out of operation for a period of up to 2 months without being dismantled from the aircraft as well as engines sent for repairs — oil MS 20.
2. For preserving the external surfaces of the engine oil MS 20+yellow ceresin are also used.
3. Should the above mentioned materials not be available for preserving the external surfaces for a period of 2 months, the use of OK 1 preserving oil is permitted.

### 16.1 Preserving engine if put out of operation without being dismantled from aircraft

Prior to preserving the engine maintenance work corresponding to the number of flight hours performed before its being put out of operation must be carried out. The extent of maintenance work, however, must correspond at least to that performed after 50 flight hours of the engine.

The engine is to be prepared for preserving as follows:

1. Fill each fuel tank with 20 lit. of fuel.
2. Drain off oil from the oil tank and oil cooler and fill the tank with 8 — 10 lit. of fresh oil (in winter the oil must be heated to 75 — 80 °C prior to filling).
3. Start the engine and keep it running at 1100 to 1200 r.p.m. for 10 to 15 min.
4. Drain oil from tank and cooler.
5. At the cylinder head temperature of 40 to 70 °C unscrew the forward spark plugs and turn the propeller 8 to 10 times in order to remove the combustion products from the cylinders. Turn the propeller with the magnetos switched off and the throttle opened.
6. For preservation of propeller — see handbook "The V 520 Propeller — Technical description and Operation Instructions".

### 16.2 Preserving engine when putting it out of operation for 15 days

1. Inject 150 to 200 c. cm. of pure aircraft oil free of moisture, e.g. MS 20 heated to 40 — 50 °C, into each cylinder with the piston in BDC. Having injected oil into all cylinders turn the propeller through 4 or 5 revolutions with the ignition off and the fuel supply shut off.
2. Clean all accessible parts lacking surface protection as well as all friction surfaces and coat them with a thin layer of technical vaseline.

3. Blind the exhaust ports of the engine with the respective plugs.
4. Provide the engine and the propeller with the protective jacket.
5. Each fourth day of inactivity of the engine turn the propeller through 6 or 8 revolutions. If, however, the temperature drops below  $-5^{\circ}\text{C}$ , the propeller must not be rotated.
6. For preservation of propeller — see the handbook “The V 520 Propeller — Technical Description and Operation Instructions”.

### 16.3 Preserving engine when putting it out of operation for 2 months

1. Using an atomizer, inject 100 c.cm. of preserving mixture, i.e. oil MS 20+yellow ceresin into each cylinder, through the spark plug holes with the piston in BDC.
2. Clean unvarnished details and coat them with a thin layer of technical vaseline, while doing this the lubricant must not come into contact with durite couplings.
3. Clean all accessible component parts that are not provided with surface protection as well as the friction surfaces and cover them with a thin coating of technical vaseline.
4. Preserve the propeller according to the handbook “The V 520 Propeller — Technical Description and Operation Instructions”.
5. Cover the exhaust pipe extensions of the engine with blinds.
6. Provide the engine and the propeller with a protective jacket. Upon expiry of the preservation period the preservation coating must be inevitably renewed.

### 16.4 Preserving engine when sent for repair

1. Dismount the exhaust manifold and unscrew the forward spark plugs.
2. Inject 150 to 200 c.cm. of pure aircraft oil into each cylinder through holes for the forward spark plugs, and 20 to 30 c.cm. through the exhaust ports and simultaneously crank the engine shaft 8 to 10 times (full revolutions).
3. Blind the holes for the spark plugs and the exhaust ports with the respective blinds and wash the engine surface with a mixture of petrol and paraffin (80 % of petrol and 20 % of paraffin).
4. The dismounting of the propeller (and possibly also of the speed regulator, see 8.8), its preservation and dispatch for repair or for inspection is to be carried out according to the handbook “The V 520 Propeller — Technical Description and Operation Instructions”.
5. Dismount the engine from the aircraft, fix it on auxiliary support plate and place it in the packing case.
6. Coat all external steel component parts with the preserving mixture, i.e. oil MS 20 +yellow ceresin. The forward part of the propeller shaft is to be wrapped in paraffin paper and tied with string.
7. Fill-in the documents concerning the engine and its equipment and enclose them to the engine to be dispatched together with a statement indicating the reason why the engine was dismounted.
8. Cover the engine with the lid of the transport case and dispatch it without delay to the place of destination.

## 16.5 Preserving carburetter

- a) Set the throttle lever of the carburetter to the stop of full opening.
- b) Unscrew the preservation plugs 3 (Fig. 10) and 6 (Fig. 9).
- c) Disconnect the pipe from the extension 5 (Fig. 9) supplying fuel to the carburetter and from the threaded union 1 for measuring the fuel pressure in the carburetter (Fig. 10).
- d) Screw down transport plug to extension and connect the pipe from the hand pump filled with MS 20 grade oil (GOST 1013-49) to extension 5 (Fig. 9).
- e) Pump oil heated to 70 — 90 °C into carburetter under a pressure of 0.3 to 0.4 kp per sq. cm, until it appears in the hole for plug 6 (Fig. 9); then screw the plug in position and continue pumping, until oil appears in the hole for plug 3 (Fig. 9).
- f) Unscrew the pipe from the extension 5 (Fig. 9), unscrew plug 6 (Fig. 9) and drain oil from the carburetter through all open holes.
- g) Screw the plugs 3 (Fig. 10) and 6 (Fig. 9) in position, connect the fuel pipes to extensions 5 (Fig. 9) and 1 (Fig. 10) and secure the plugs with wire.

## 17 DEPRESERVATION OF ENGINE

Depreserving is to be understood as the removal of preserving materials from the parts and equipment of the engine, necessary for securing regular starting and operation of the engine.

The depreserving must be carried out in environment, which ensures that the temperature of all engine component parts will not drop below +10 °C. At ambient air temperature below +10 °C the engine must be warmed up prior to depreserving in order to attain a certain degree of fluidity of oil inside the engine.

### 17.1 Procedure of depreservation

1. Inject with a special syringe 150 to 200 c.c. of aircraft oil heated to 80 — 100 °C into each cylinder with the piston at BCD, rotate the crankshaft for at least 10 complete revolutions.
2. Pour 7 to 8 lit. of oil heated to 80 — 100 °C into the forward and rear engine breather by means of a funnel with a screen.
3. After 5 to 10 minutes dismount the filter from the oil sump and, by rotating the crankshaft, drain the oil from the crank case. Drain oil from all cylinders. From the top cylinders the oil must be removed through holes for spark plugs by means of a special syringe. The removal of oil from the cylinders must be carried out thoroughly, in order to prevent hydraulic hammer during engine starting.
4. Unscrew the plugs from the suction manifolds of cylinders No. 5 and 6 and drain oil from the suction manifold space. It is not recommended to reuse oil drained from the engine without previous checking for water content.
5. The depreservation of the carburetter is to be carried out as stated in 17.2.
6. The fuel pump is to be depreserved as follows: Connect a source of fuel to the supply extension and turn the propeller shaft 3 or 4 times until pure fuel appears at the discharge extension.

7. Wash the engine with a brush dipped in petrol. Wipe all external surfaces of the engine with a clean rag, which may be slightly wetted with petrol.
8. The propeller is to be depreserved by cleaning the external surfaces with a clean rag dipped in pure technical petrol. The propeller blades are depreserved in the same manner. When wiping the propeller blade bushes take utmost care not to allow petrol to flow into the slot between the bush and the outside ring of fitting, i.e. to the place, where the rubber packing ring is situated.
9. Enter the date of preservation of engine, propeller, speed regulator and carburetter into the respective documents.
10. Prepare the engine for starting, start same and test.

### 17.2 Depreserving the carburetter

- a) Remove the external preserving vaseline with a brush dipped in petrol.
- b) Unscrew the preservation plugs 3 (Fig. 10) and 6 (Fig. 9).
- c) Remove the cover plugs from extension 5 (Fig. 9) of fuel supply to the carburetter and from extension 1 for measuring fuel pressure in the carburetter (Fig. 10).
- d) Connect the fuel pipe from the hand pump to the extension 5 (Fig. 9).
- e) Set the throttle lever against the full-open stop.
- f) Pump pure petrol under pressure of 0.4 to 0.5 kp per sq. cm. through the extension 5, until appears in the pressure gauge hole in the atomizer, then screw down the preservation plug into this hole and keep on pumping, until clear petrol with no oil admixture flows from the preservation hole 6 (Fig. 9).
- g) Replace and secure the preservation plug 6 (Fig. 9), tighten and secure the plug 3 (Fig. 10), disconnect the petrol pipe from the extension 5 (Fig. 9), mount transport plugs on this extension and on extension 1 (Fig. 10).
- h) Wipe the carburetter externally and clean the grooves of the diffuser leading to the space behind it, if oil has penetrated there (the grooves are not submitted to preservation).

## 18 DEFECTS OF ENGINE AND THEIR REMEDY

No.	Defect	Cause	Remedy
1	Great force is required for turning of propeller	<ol style="list-style-type: none"> <li>1. Insufficient depreservation of engine</li> <li>2. Heavily congealed oil (by cold)</li> <li>3. Accumulated oil and fuel in lower cylinders.</li> </ol>	<ol style="list-style-type: none"> <li>1. Depreserve the engine.</li> <li>2. Heat the engine and pour 2 to 3 lit. of hot oil into crank case.</li> <li>3. Unscrew one plug from each of cylinders No. 4, 5, 6 and 7, unscrew plugs in suction manifold of cylinders No. 5 and 6 and turn the propeller through 3 or 4 revolutions to drain oil and fuel.</li> </ol>

No.	Defect	Cause	Remedy
2	The engine does not rotate when started by pressure air	<ol style="list-style-type: none"> <li>1. Low air pressure in steel cylinder</li> <li>2. Pressure air losses by leakage in starting system</li> <li>2. Incorrectly adjusted slide valve of pressure air distributor</li> <li>4. Wrong mounting of tubes of starting system on distributor (tubes interchanged)</li> </ol>	<ol style="list-style-type: none"> <li>1. Fill steel cylinder to a pressure of <math>50 \pm 5</math> kg per sq. cm.</li> <li>2. Check and remove any leakage in starting system.</li> <li>3. Adjust slide valve correctly.</li> <li>4. Rearrange tubes.</li> </ol>
3	The cylinder is without compression	<ol style="list-style-type: none"> <li>1. Improper closing of valves</li> <li>2. Leakage at spark plugs or starting valves</li> </ol>	<ol style="list-style-type: none"> <li>1. Check clearances between the rocker arm roller and valve shank. Adjust clearance to 0.3—0.4 mm.</li> <li>2. Tighten spark plugs or starting valves.</li> </ol>
4	The engine fails to start	<ol style="list-style-type: none"> <li>1. Large or small throttle opening</li> <li>2. The engine is insufficiently supplied with fuel</li> <li>3. The engine is flooded</li> <li>4. Oiled or damp spark plugs</li> <li>5. The starting coil or the starting magneto out of order</li> <li>6. Insufficiently warmed-up engine (in winter)</li> </ol>	<ol style="list-style-type: none"> <li>1. Set the throttle to a position corresponding to 700—900 r.p.m.</li> <li>2. Use the injection system to deliver fuel to engine.</li> <li>3. Turn the propeller 3 or 4 times against the direction of rotation with full-open throttle and repeat starting operation.</li> <li>4. Clean spark plugs, wash in petrol and dry.</li> <li>5. Check conductors, replace starting coil or magneto.</li> <li>6. Warm up engine by means of an outside heat source.</li> </ol>
5	The engine fires back, becomes flooded and fails	<ol style="list-style-type: none"> <li>1. No fuel in carburetter or presence of water in fuel</li> </ol>	<ol style="list-style-type: none"> <li>1. Unscrew plug of fuel chamber and check if fuel is in carburetter. Repair leakage in fuel system. Drain condensate from settling trap.</li> </ol>

No.	Defect	Cause	Remedy
5		<ol style="list-style-type: none"> <li>2. Clogged fuel filter of carburetter</li> <li>3. No clearance in contact breakers of magnetos, oil or foreign objects in contact breakers</li> <li>4. Incorrectly connected or interchanged magneto cables</li> <li>5. Cold engine</li> <li>6. Clogged fuel piping or fuel filter</li> <li>7. Inlet of dead air to mixing chamber</li> <li>8. No fuel pressure at inlet to carburetter</li> </ol>	<ol style="list-style-type: none"> <li>2. Unscrew and wash filter</li> <li>3. Adjust clearances of contact breakers (0.25 to 0.35 mm), clean and wash contact breaker.</li> <li>4. Check correct connection and condition of contacts in ignition circuit.</li> <li>5. Warm up engine.</li> <li>6. Blow fuel piping, wash filter.</li> <li>7. Repair leaking threaded union on mixture collector and suction manifold.</li> <li>8. Adjust fuel pressure by pressure reduction valve on fuel pump.</li> </ol>
6	During starting the engine rotates several revolutions against the direction of rotation	<ol style="list-style-type: none"> <li>1. Excessively advanced ignition</li> <li>2. Too hot engine</li> </ol>	<ol style="list-style-type: none"> <li>1. Reset magneto, reduce angle of advance.</li> <li>2. Cool engine.</li> </ol>
<b>During engine operation</b>			
7	The engine fails at small throttle opening	<ol style="list-style-type: none"> <li>1. Incorrect adjustment of idle-run throttle on carburetter</li> <li>2. Wrong adjustment of mixture quality at idle-run throttle</li> <li>3. Dead air in inlet system, untight nuts of suction manifold, missing gaskets, leaking threaded union</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust throttle opening by means of the screw of stop.</li> <li>2. Adjust mixture quality by means of the idle run screw.</li> <li>3. Check all joints of the inlet system, their tightening and use new gaskets.</li> </ol>
8	Backfiring into carburetter at idle-run throttle	<ol style="list-style-type: none"> <li>1. Excessive opening of throttle during starting (particularly in cold weather)</li> <li>2. Lean mixture</li> <li>3. Dead air in inlet system</li> </ol>	<ol style="list-style-type: none"> <li>1. Partly close the throttle.</li> <li>2. Enrich mixture by means of idle run screw.</li> <li>3. Remove air leakage (as under point 7).</li> </ol>

No.	Defect	Cause	Remedy
9	High speed at idle-run throttle	<ol style="list-style-type: none"> <li>1. Wrong adjustment of idle-run stop on carburetter</li> <li>2. Excessive throttle opening due to wrong adjustment of pull-rod lengths</li> <li>3. Backlash in throttle lever system of aircraft</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the stop screw of throttle opening.</li> <li>2. Adjust length of pull-rods.</li> <li>3. Take-up backlash.</li> </ol>
10	The engine knocks	<ol style="list-style-type: none"> <li>1. Excessively advanced ignition</li> </ol>	<ol style="list-style-type: none"> <li>1. Check adjustment of ignition system and set correct ignition advance</li> </ol>
11	Poor acceleration	<ol style="list-style-type: none"> <li>1. Insufficiently warmed up or undercooled engine</li> <li>2. Lean mixture at idle-run throttle</li> <li>3. Poor adjustment of pull-rods controlling the throttle</li> </ol>	<ol style="list-style-type: none"> <li>1. Warm up engine to temperature of cylinder heads of at least 100 °C.</li> <li>2. Adjust mixture at idle-run throttle.</li> <li>3. Adjust pull-rods to ensure smooth opening and closing at throttle without backlash and jamming.</li> </ol>
12	The engine operates irregularly or vibrates	<ol style="list-style-type: none"> <li>1. Damaged cables, wrong connection, insufficient securing to spark plugs</li> <li>2. Damaged or oiled spark plugs</li> <li>3. Leaking valves</li> <li>4. Water in fuel</li> <li>5. Water or oil in magneto distributor</li> <li>6. Lean mixture</li> <li>7. Rich mixture</li> <li>8. Incorrectly adjusted contact breaker magneto</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace damaged cable, check securing of cables to spark plugs.</li> <li>2. Check spark plugs under pressure, replace faulty ones. If spark plugs are oiled, check compression of cylinders; in case of low compression inspect cylinder, piston, piston rings, replace defective component parts.</li> <li>3. See point 3.</li> <li>4. Drain water from fuel slurry trap.</li> <li>5. Remove water or oil from distributor.</li> <li>6. Enrich mixture.</li> <li>7. Weaken mixture.</li> <li>8. Adjust clearances (0.25 to 0.35 mm)</li> </ol>

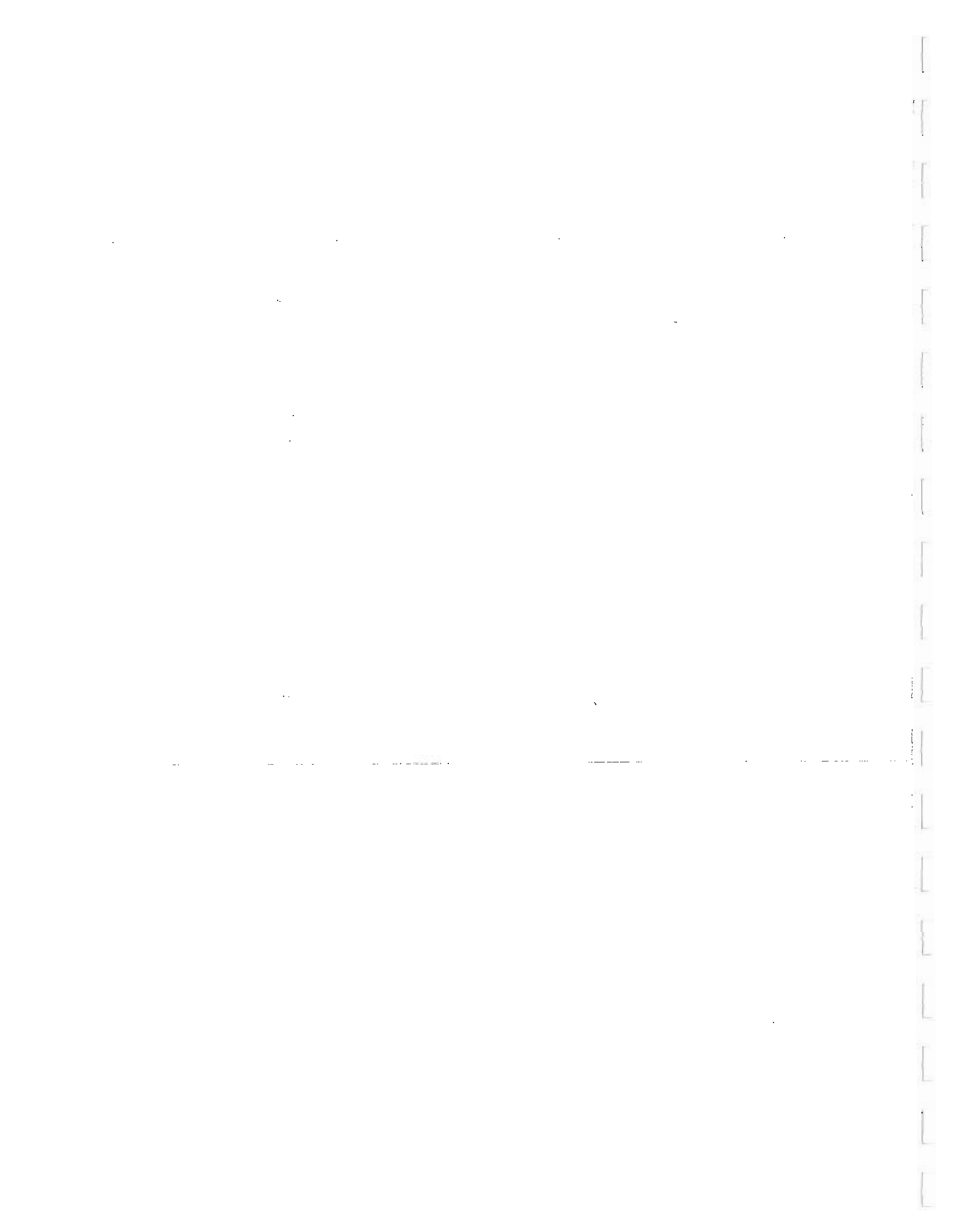
No.	Defect	Cause	Remedy
12		9. Ice accretion in diffuser and fuel jet of carburetter (in winter) 10. Low fuel pressure, varying fuel pressure 11. Clogged fuel filter and piping 12. Incorrect mounting of engine in the engine aircraft 13. Unbalanced propeller or incorrectly mounted propeller blades 14. Loose screws fastening contact breaker or sliding contact of magneto, worn carbon brush 15. Damaged magneto 16. Incorrectly connected ignition cables, burnt cables, faulty contacts in conduit etc.	9. Readjust preheating. 10. Adjust fuel pressure to 0.2—0.5 kp per sq. cm, remedy leakage. 11. Check and clean piping and fuel filter. 12. Check engine mounting and fastening. 13. Check the balancing of propeller, fastening, assembly and out-of-true (see handbook V 520). 14. Tighten screws, replace carbon brush 15. Check magneto and replace. 16. Check ignition cables
13	Overheating of oil	1. Dirt in gills of oil cooler from outside 2. Congealed oil in oil cooler (in winter) 3. Low level of oil in oil tank 4. Poor quality of oil foaming of oil 5. Poor draw-off of oil from engine	1. Clean gills from dirt. 2. Preheat oil cooler. 3. Refill oil in tank to normal quantity. 4. Change oil and flush oil system. 5. Remedy as described under point 15.
14	Low oil pressure	1. Insufficient oil pressure during starting (air pocket in supply pipe to oil pump), congealed oil (in winter), clogged breathing pipe of oil tank	1. Unscrew air-venting plug, warm up oil piping and oil. Clean breathing pipe of oil tank.



No.	Defect	Cause	Remedy
14		<ol style="list-style-type: none"> <li>2. Wrong adjustment of pressure reduction valve of oil pump</li> <li>3. Excessive oil dilution with fuel</li> <li>4. Clogging of filters in circuit from tank to engine</li> <li>5. Low level of oil in oil tank</li> </ol>	<ol style="list-style-type: none"> <li>2. Adjust pressure reduction valve.</li> <li>3. Change oil and check the dilution cock for leakage.</li> <li>4. Check oil installation, wash filters.</li> <li>5. Refill oil to normal level.</li> </ol>
15	Bad oil draw-off	<ol style="list-style-type: none"> <li>1. Clogged or dirty draw-off pipe</li> <li>2. Excessive dilution of oil with fuel, unsatisfactory oil, foamed oil</li> </ol>	<ol style="list-style-type: none"> <li>1. Check draw-off pipe (filter of oil slurry trap, pipe, oil cooler).</li> <li>2. Change oil, flush oil circuit, shut off diluting cock.</li> </ol>
16	Overheating of cylinder heads	<ol style="list-style-type: none"> <li>1. Mixture too lean</li> <li>2. Dead air in inlet system</li> <li>3. Blowing of exhaust gases over cylinder heads from exhaust collector</li> <li>4. Insufficient air cooling passing the engine</li> <li>5. Overheated air at inlet to carburettor owing to incorrect function of heater</li> </ol>	<ol style="list-style-type: none"> <li>1. Enrich mixture.</li> <li>2. Remedy as under points 5 and 7.</li> <li>3. Remove blowing.</li> <li>4. Check cowling.</li> <li>5. Reduce preheating, or switch off air preheating.</li> </ol>
17	Engine smokes	<ol style="list-style-type: none"> <li>1. Rich mixture</li> <li>2. Too much oil in engine</li> </ol>	<ol style="list-style-type: none"> <li>1. Weaken mixture.</li> <li>2. Remedy as instructed under point 15.</li> </ol>
18	Engine does not yield full output. It does not reach max. specified speed at full throttle with propeller control lever in position "Take off"	<ol style="list-style-type: none"> <li>1. Heavy propeller. Badly adjusted speed regulator.</li> <li>2. Congealed oil in propeller operating cylinder</li> <li>3. Excessive or insufficient ignition advance</li> <li>4. Poor ignition</li> </ol>	<ol style="list-style-type: none"> <li>1. Check adjustment of propeller blades and/or adjust the regulator (see handbook V 524).</li> <li>2. Warm up propeller operating cylinder.</li> <li>3. Adjust ignition as specified.</li> <li>4. Check spark plugs, cables and magnetos as instructed under point 12.</li> </ol>

No.	Defect	Cause	Remedy
		5. Insufficient fuel supply to carburetter 6. Unsatisfactory regulation of carburetter or seizing of needle 7. Admixture of air to suction system 8. Not fully opened throttle or backlash in throttle control 9. Clogged dust separating screen and carburetter screens 10. Too high or too low clearance between the rocker arm roller and valve shank 11. Incorrectly adjusted timing gear	5. Check the fuel piping and pressure of fuel at carburetter. 6. Check the carburetter regulation, smoothness of needle operation. 7. Remedy according to points 5 and 7. 8. Remedy defects. 9. Clean and wash screens. 10. Take up clearances. 11. Check timing gear.
19	A substantially reduced propeller blade pitch changing rate while decreasing the engine r.p.m.	A fault of the propeller or defective oil sealing rings of the reduction gear unit hydraulic oil distributor	If there is attained no remedy of this defect after having carried out the operations specified for this case in the "Operating Instructions of the V 520 Propeller", the oil sealing rings of the reduction gear unit oil distributor should be then inspected and, if found as being defective they should be replaced with new ones.

Note: The possible defects of the V 520 propeller, their causes and removal are described in the handbook "The V 520 Propeller — Technical Description and Operating Instructions".



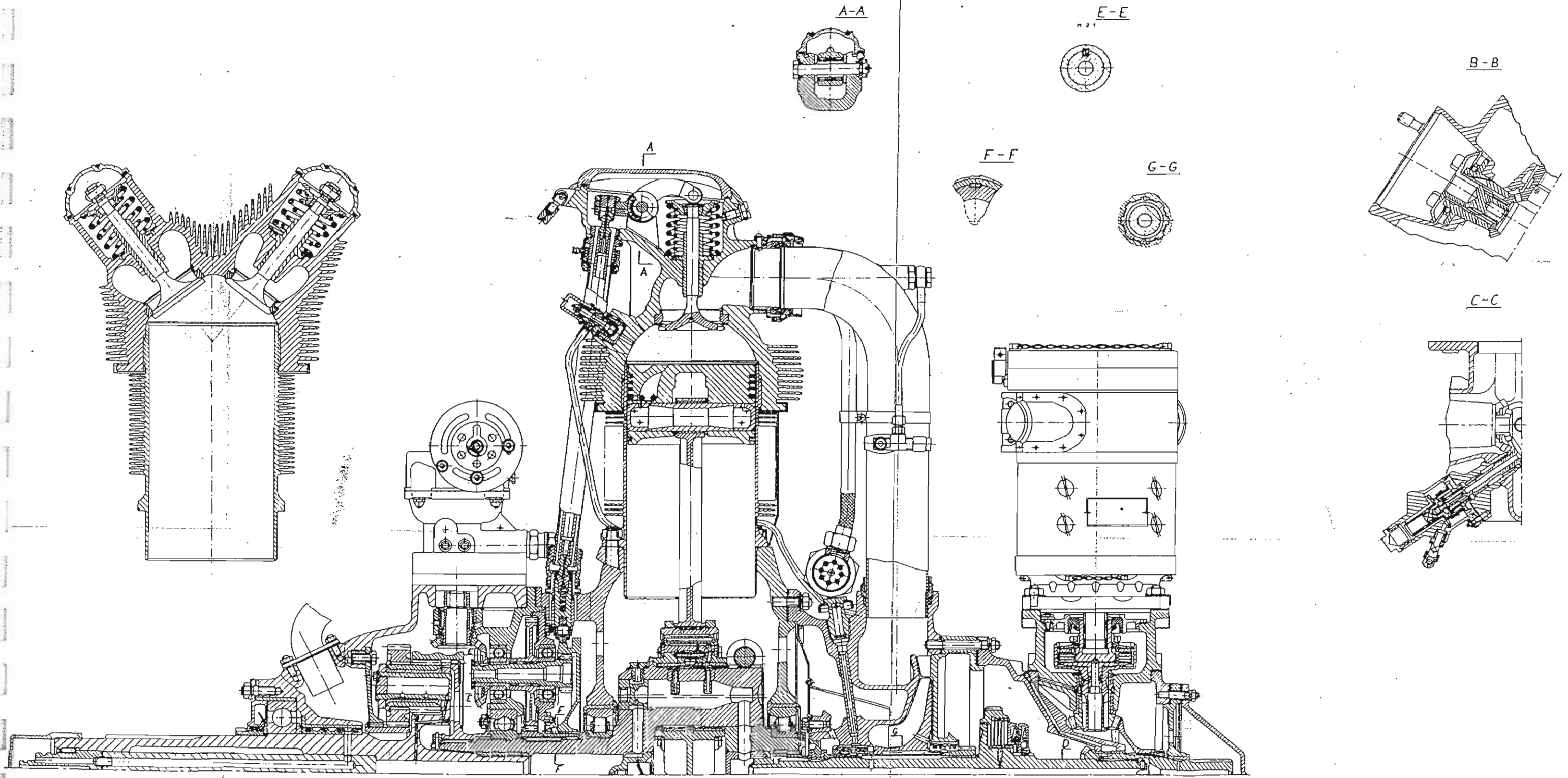


Fig. 2a — Longitudinal section of the M 462-RF aircraft engine (upper part)



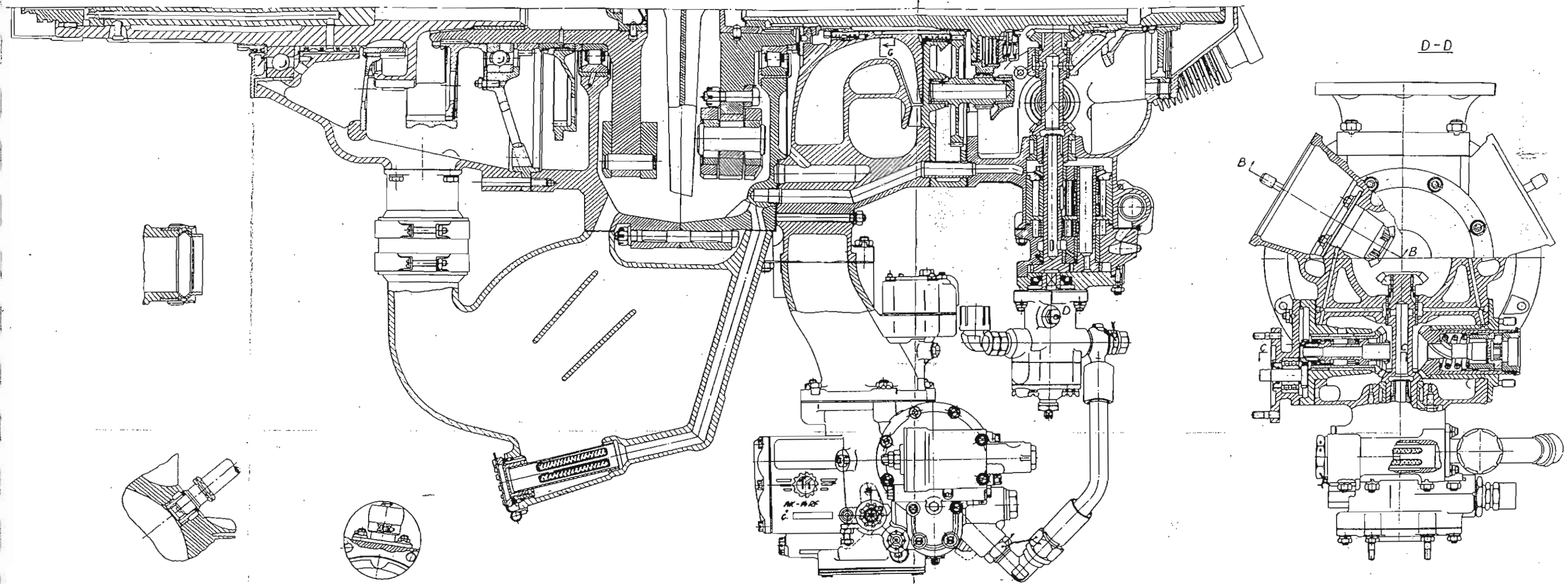


Fig. 2b — Longitudinal section of the M 462-RF aircraft engine (lower part)

