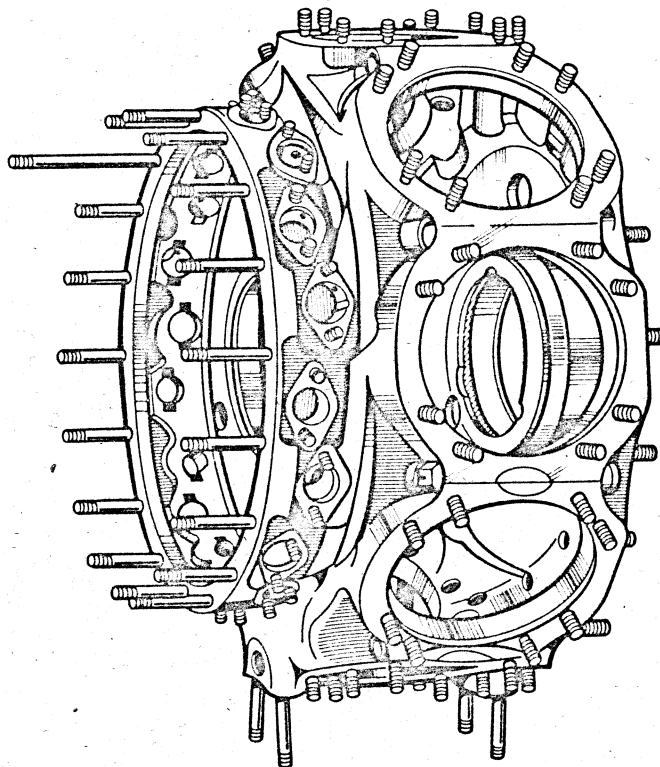


Crankshaft Thrust Ball Bearing Front Cover

Figure 1



Intermediate Crankcase

Figure 2

Three holes provided in the conical wall of the front cover are intended to breath internal spaces of the crankcase and a hole for draining oil from the gearbox housing to the intermediate crankcase.

2.2. INTERMEDIATE CRANKCASE

The engine intermediate crankcase is adapted to accommodate the parts of the crank mechanism, timing mechanism and to mount the cylinders.

The intermediate crankcase (Ref. Fig. 2) also referred to as crankcase main section comprises two sections: front and rear, stamped of aluminium alloy and machined jointly.

The crankcase joint is in the cylinder center line plane. Both sections of the intermediate crankcase are interconnected and mutually aligned by nine coupling bolts extending through the holes in bridges between the cylinder mounting flanges.

Eight coupling bolts are interchangeable. The ninth bolt installed in the crankcase lower hole has a different head, smaller thickness between the aligning collars and greater length than the other bolts.

Nine flanges with eight studs each are uniformly spaced around the crankcase. The studs are intended to attach the cylinders.

The intermediate crankcase has a front flange with studs for mounting the front cover and the gearbox housing and a rear flange with studs for attachment of the mixture collector and two lower flanges with two studs each for mounting the oil sump.

Provided in the lower part of the intermediate crankcase are holes for installing the oil baffle. The baffle decreases bubbling of oil carried by the crankshaft counterweights and decreases drain of oil to the oil sump.

The front portion of the intermediate crankcase (Ref. Fig. 3) has an annular projection with a machined flange. Located on the outer side of the projection are eighteen flanges with holes for installing tappet guide bushings.

Drilled in the holes for the guide bushings of the inlet valve tappets of cylinders Nos 1, 2, 8 and 9 and exhaust valves of cylinders Nos 1, 2, 3, 8 and 9 are passages to supply oil to the tappets and slots for draining oil.

The stepped oil passage connects the main gallery with a hole on the flange of the front cover.

The central hole in the vertical part of intermediate crankcase front portion is intended for pressing in the bronze holder of the front roller bearing of the crankshaft. The holder is secured by three retainers pressed into the central boss of the front portion of the intermediate crankcase.

The roller bearing is precluded against longitudinal displacement by the crankcase holder internal collar at the front and by a spring ring lodged in the crankcase holder recess at the rear.

In addition to the central hole, the vertical wall has four more holes: three holes for breathing and one hole for fixing the cam plate when timing the engine.

Two holes for draining oil to the oil sump, leading to the bored seat for the oil baffle are made in the lower flange of the intermediate crankcase front portion.

Nine inter-flange bridges are made at the intermediate crankcase front portion (Ref. Fig. 3). The bridges have holes for coupling bolts. Nine semi-flanges with four cylinder attachment studs each are also arranged there.

The vertical wall of the intermediate crankcase rear portion (Ref. Fig. 4) has a central hole for pressing in the bronze holder of the rear roller bearing of the crankshaft and three breathing holes. The holder and the bearing are locked likewise in the front portion of the intermediate crankcase.

Two holes are made in a rectangular projection of the rear flange lower part. One hole is used to drain oil from the rear cover to the crankcase and leads to the bored seat for the oil baffle, the other (with oil transfer bushing), for scavenging oil from the oil sump to the oil tank. The oil sump attachment flange has a hole for draining oil from the crankcase and another hole for scavenging oil from the oil sump.

The intermediate crankcase rear portion likewise the front portion has nine inter-flange bridges and nine semi-flanges with four cylinder attachment studs each.

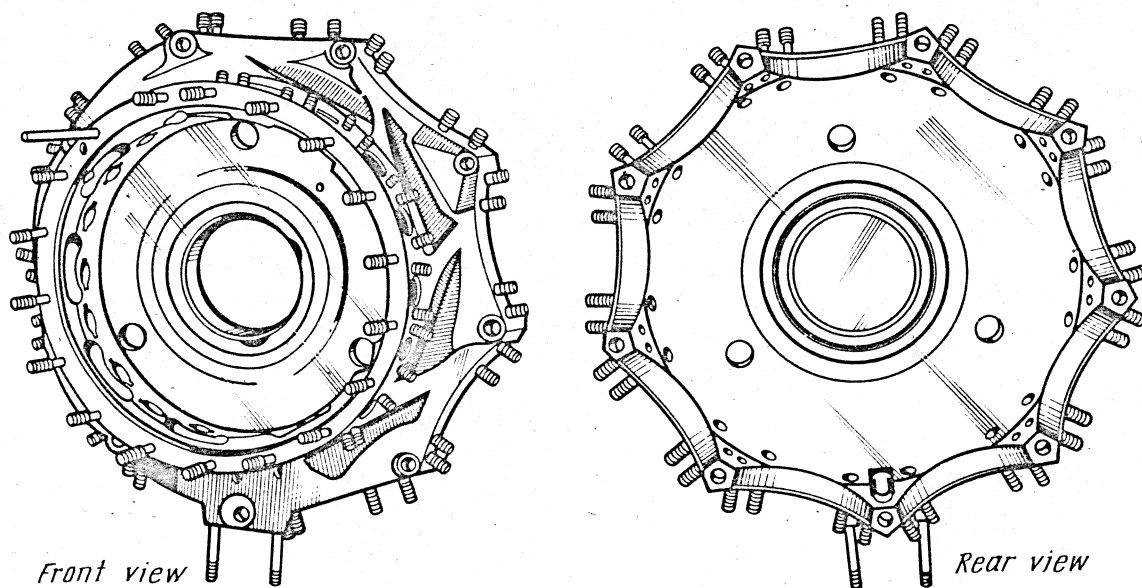
2.3. CRANKSHAFT

The split-type single-throw crankshaft of the engine (Ref. Fig. 5) comprises front and rear sections interconnected by a coupling bolt. The front and rear sections of the crankshaft are made of heat-treated high-grade steel. Front section (11) includes a front end, web, main journal and crank pin making up one integral part.

The front part of the crankshaft hollow end has pressed-in steel bushing (8) potted with lead bronze. The bushing is a rear support for the airscrew shaft. The rear of the end space is closed with aluminium alloy plug (30). The plug is locked with retainer (32).

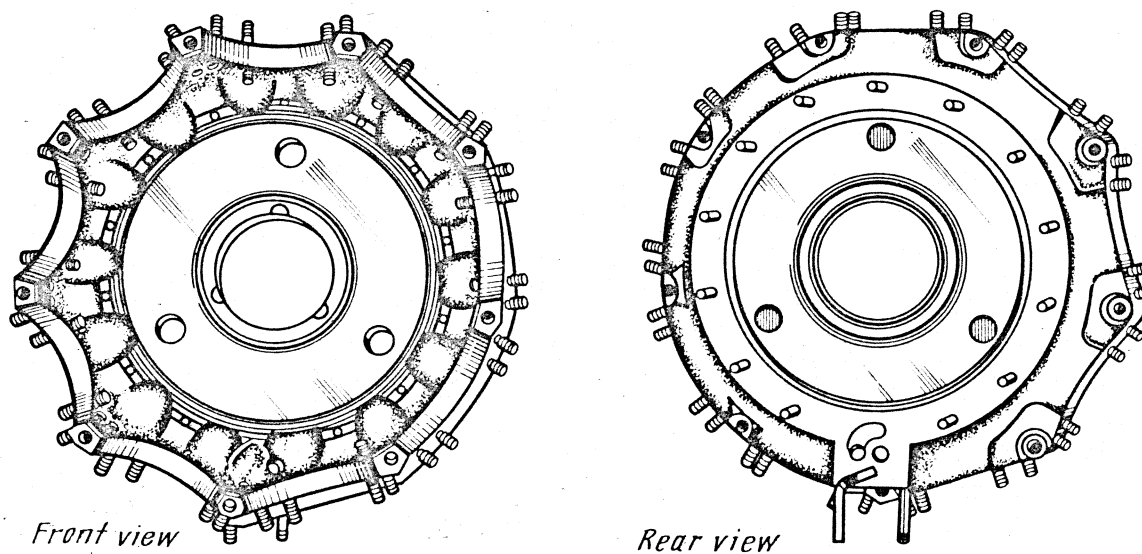
The end front has splines for mounting the gearbox drive gear hub; the crankshaft front main journal is located closer to the web. A groove for key (10) of the timing drive gear is made between them on the shaft outer surface.

Arranged on the crankshaft front end after the web are roller bearing (7), adjustment ring (6), spacer (5) of the cam plate, timing drive gear (4), adjustment ring (3), thrust bearing and gearbox drive gear ring hub. The stack is tightened on the shaft by nut (2). The nut is locked with cotter pin (1).



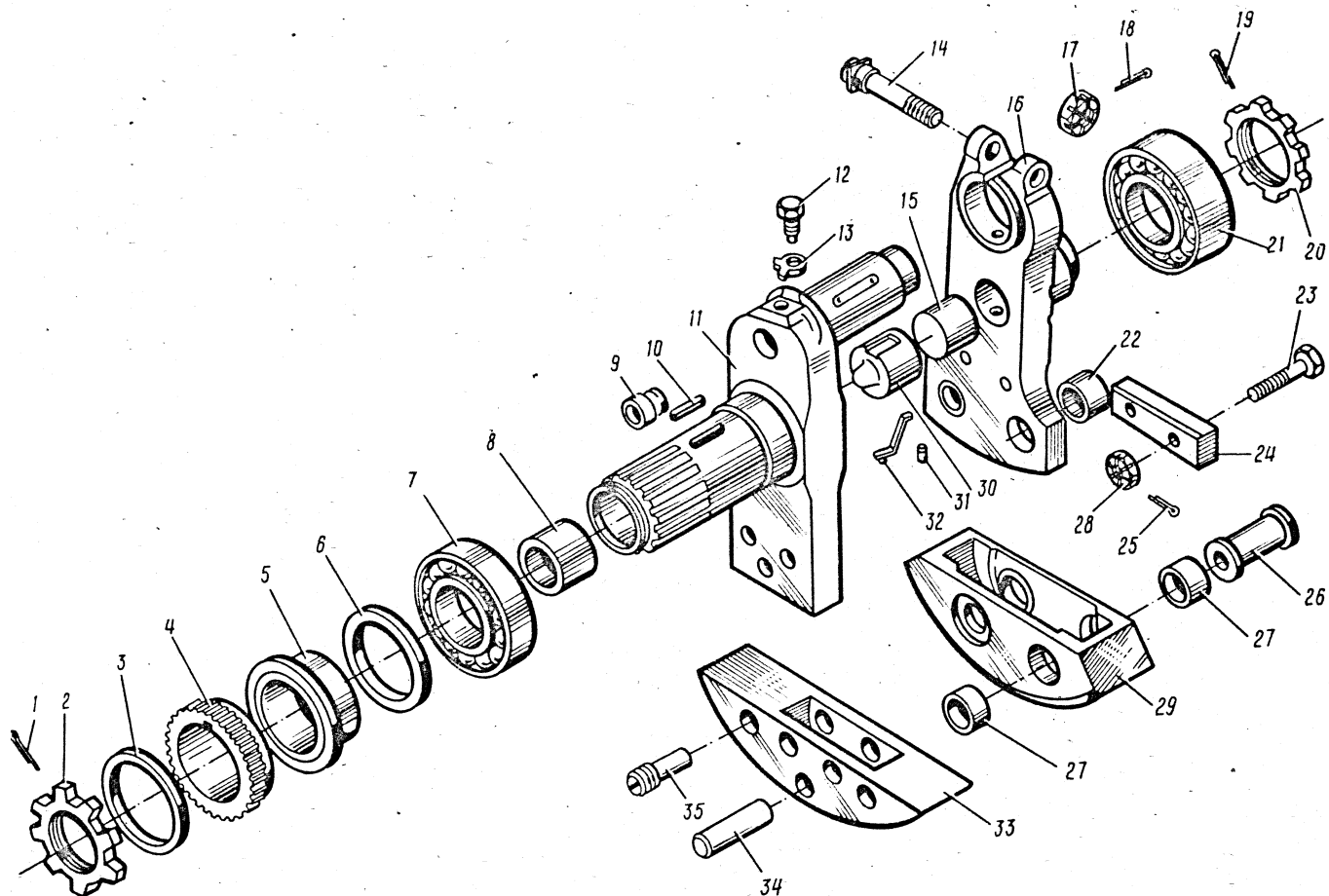
Intermediate Crankcase Front Portion

Figure 3



Intermediate Crankcase Rear Portion

Figure 4



- | | |
|------------------------------|--------------------------------|
| 1. Cotter Pin | 18. Cotter Pin |
| 2. Nut | 19. Cotter Pin |
| 3. Ring | 20. Nut |
| 4. Drive Gear | 21. Rear Main Roller Bearing |
| 5. Spacer | 22. Crankshaft Rear Section |
| 6. Ring | Web Bushing |
| 7. Front Main Roller Bearing | 23. Bolt |
| 8. Bushing | 24. Thrust Strip |
| 9. Plug | 25. Cotter Pin |
| 10. Key | 26. Rear Counterweight Pin |
| 11. Crankshaft Front Section | 27. Rear Counterweight Bushing |
| 12. Oil Jet | 28. Nut |
| 13. Lock | 29. Rear Counterweight |
| 14. Coupling Bolt | 30. Crankshaft Front Section |
| 15. Plug | Plug |
| 16. Crankshaft Rear Section | 31. Retainer |
| 17. Nut | 32. Plug Retainer |
| | 33. Front Counterweight |
| | 34. Pin |
| | 35. Balancing Plug |

Crankshaft

Figure 5

Front counterweight (33) is immovably fixed on the web of the crankshaft front section by three pins (34).

The web and crankpin have a space closed at the front with steel plug (9) and at the rear by the crankpin plane. The space is connected with the shaft front end by a drilled passage. The upper part of the web is provided with a threaded hole receiving jet (12) for squirting oil to lubricate the cylinders and pistons. The jet is safetied with lock (13).

The crankshaft crankpin is externally nitrated to increase wear resistance. The crankpin has a radial hole to supply oil from the crankshaft rear to its front section and two radial holes to feed oil to the master connecting rod bushing which are at an angle of 60° from the axis of symmetry in the direction of crankshaft rotation. Two copper pipes are inserted into these holes and flared to preclude dropping out. The pipe ends project inside the crankpin and serve as oil filter operating as a centrifuge during rotation of the crankshaft.

Crankshaft rear section (16) has a web and a main journal. The upper part of the web has a split lug embracing the crankpin and a hole for coupling bolt (14). The coupling bolt tightening the lug by nut (17), rigidly interconnects the front and rear sections of the crankshaft.

The web lower part has two holes with bushings (22) pressed in them. The bushings receive pins (26) whereby pendulum counterweight (29) with four bushings (27) pressed in it is suspended from the web. The pins are kept against axial displacement by collars and strip (24) secured by two bolts (23).

Rear roller bearing (21) secured with nut (20) is press-fitted to the main journal of the crankshaft.

The surfaces of the front and rear roller bearing inner races contacting the crankcase journals are brass plated to preclude cold hardening.

The rear main journal has a through hole with internal splines whereby the crankshaft is connected through a coupling with the accessory drive shaft. The journal hole has press-fitted plug (15) copper plated on the outside diameter surface; the accessory drive shaft splined coupling is aligned inside the plug. The plug is kept against displacement with a pin. The web has a passage interconnecting the spaces of the main journal and crankpin.

The crankshaft is balanced by selecting weight of two plugs (35) threaded in the front counterweight. The plugs are made of steel or aluminium, depending on balancing requirements.

The rear counterweight is a segment with a through slot at the middle for passing the crankshaft web and two holes for the bushings. The slot inner surface is copper plated to preclude cold hardening.

2.4. CONNECTING ROD ASSEMBLY

Connecting rod assembly (Ref. Fig. 6) of the M-14P engine comprises one master connecting rod (1) and eight articulated connecting rods (5) which are hinged to the master rod by steel pins (7).

The master connecting rod is arranged in cylinder No. 4.

The connecting rods are forged of nickel-chrome steel and heat-treated. The connecting rod surfaces are polished.

The master and articulated connecting rods comprise small and big ends interconnected by an I-section stem. Pressed in the master connecting rod big end is steel bushing (9) potted with lead bronze and locked by two set screws (8). A thin layer of lead-tin plating is applied to the inner friction surface of the bushing after machining. Bushings (2), (6) and (4) made of bronze band are press-fitted in the small end of the master connecting rod and in the ends of all articulated connecting rods, respectively. The bushings are compacted by broaching and their edges are flared.

Two through holes for feeding oil, squirted during operation, to bushing friction surfaces are made in the lower parts of the small ends of all the connecting rods.

The cross section of the master connecting rod decreases from the small end to the big one, while the articulated rods have equal cross section throughout the length.

The master connecting rod big end has two side plates with eight brass plated holes each, to receive pins of the articulated connecting rods. The pins carry eight articulated connecting rods. Oil is fed to them under pressure from the crankpin through the drillings in the rear side plate and pins.

The articulated connecting rod pins are made of steel and cemented for surface hardness. Each pin has a through cylindrical hole with a spool-shaped aluminium alloy plug pressed in. The space between the plug and inner surface of the pin serves to pass oil to the articulated connecting rod bushings.

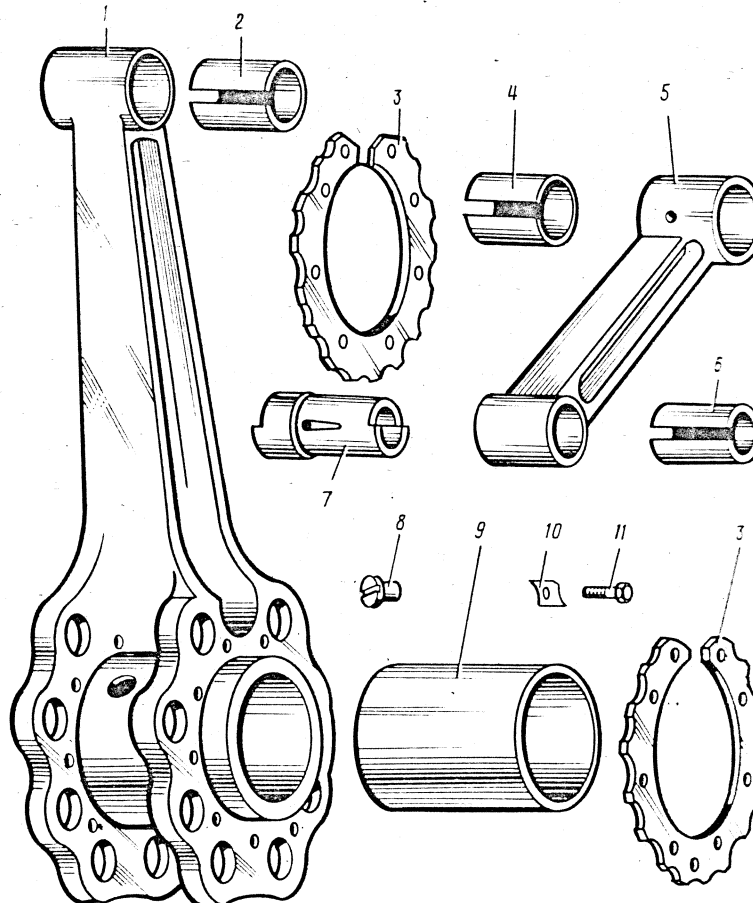
The pin outer surface is stepped.

The front part diameter exceeds that of the other portion of the pin. The steps of the pin outer surface ensure equal-interference fit in both side plates of the master connecting rod. The pin middle part surface is a working portion for the articulated connecting rod bushing; the outer portions are support necks for the pin in the master connecting rod.

Two diametrically opposed flats are made on the pin working surface. Oil is fed to them through the holes drilled in the pin wall from the pin inner space to its friction surface. For uniform distribution of oil over the pin surface, one hole is located closer to the front end and the other hole closer to the rear end. The rear cylindrical part of the pin has an inclined through hole connecting the pin inner space with the oil supply hole in the master connecting rod side plate.

Provided on both end faces of the pin is a straight cutout forming a projection to which the projection of strip (3) adjoins. The strip prevents the pin against longitudinal displacement.

The pin attachment strips are identical and are installed on outer sides of the master connecting rod side plates. The strips are secured by screws (11) which are safetied with plate locks (10).



- | | |
|---|---|
| 1. Master Connecting Rod | 7. Articulated Connecting Rod Pin |
| 2. Master Connecting Rod
Small End Bushing | 8. Set Screw |
| 3. Articulated Connecting Rod
Attachment Strip | 9. Master Connecting Rod
Big End Bushing |
| 4. Small End Bushing | 10. Lock |
| 5. Articulated Connecting Rod | 11. Screw |
| 6. Articulated Connecting Rod
Big End Bushing | |

Connecting Rod Assembly

Figure 6

CRANKSHAFT ASSEMBLY - TROUBLE SHOOTING

For mostly often encountered troubles and their remedies refer to the Table given below.

Trouble	Possible cause	Correction
Impeded rotation or crankshaft	(1) Oil accumulated in lower cylinders at prolonged engine dead period or because of incomplete depreservation	Drive out one lower spark plug from each of cylinders Nos 4, 5, 6 and drain plugs from intake pipes of these cylinders and plugs of exhaust manifold, drain oil, reinstall spark plugs and turn airscrew manually 3 to 5 turns with ignition turned off. Make sure oil is drained fully. Reinstall and lock plugs (Ref. 072.00.00, Task Card No. 201).
	(2) Engine is underwarmed in winter	Warm up engine and fill 2 to 3 lit of hot oil in crankcase

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CYLINDER ASSEMBLY

CYLINDER ASSEMBLY - DESCRIPTION AND OPERATION

1. GENERAL

The engine cylinder assembly comprises cylinders with valve mechanisms, pistons, timing mechanism parts, intake pipes and deflectors.

The engine cylinder with its bottom forms a chamber where fuel-air mixture is combusted and thermal energy is converted into mechanical work.

To ensure well-timed opening and closing of inlet and exhaust valves according to the timing chart, the timing mechanism is used.

Normal operation of the engine is achieved at uniform cooling of its cylinders. The engine is cooled by on-coming air stream created by the airscrew.

2. CONSTRUCTION

2.1. CYLINDER WITH VALVE MECHANISM

Engine cylinder (Ref. Fig. 1) comprises two main parts: a steel machined sleeve and an aluminium alloy head screwed on it when hot. The head lower collar has press-fitted steel shroud ring.

The cylinder sleeve is made of an alloyed steel forging, heat-treated, its internal surface is nitrated, ground and honed. The sleeve has cooling outside ribs and a flange with holes for securing the cylinder to the intermediate crankcase. The cylindrical part below the flange (skirt) ensures alignment of the sleeve relative to the crankcase port.

The sleeve top is provided with a thrust thread having a sealing band for coupling with the cylinder head.

The cylinder head is cast of aluminium alloy integrally with two valve cases. The outer surface of the head is provided with vertical and horizontal ribs cast integrally with the head. The cylinder head inner space is machined, has a thrust thread for mating with the sleeve and defines together with the piston the dome combustion chamber.

Seats for inlet and exhaust valves are pressed at the inner side of the cylinder head. The upper bands of the seat are flared in the head.

The inlet valve seat land is machined at an angle of 30°, the exhaust valve land at an angle of 45° relative to the seat lower end face plane.

The valve case bottoms located on the outer top side of the sleeve have drilled holes where bronze guide bushings of the valves are press-fitted. The bushings are arranged at an angle of 75° symmetrically to the axis of the cylinder. Holes for valve rocker axles with outer recesses for sealing washers are machined in the thickened portion of the valve case side walls. Connections for attachment of rod covers are driven into the front bottom part of the valve cases; air deflector attachment studs are driven in the rear part.

The case front portions have lugs whose holes receive flared axles suspending stops of tensioning wing nuts. A cover attachment screw is driven into a boss provided at the rear part of the cases. A ring cable run in the grooves of the valve case cover is fitted to the screw neck. The other side of the cable is fitted to the tensioning wing nut and on being tightened with a special wrench, tightly presses the cover to the valve case.

The valve cover is sealed with a rubber ring.

Located at the rear of the head are: at the LH side - an inlet branch pipe with a steel copper-plated connection screwed into it, at the RH side - an exhaust branch pipe with a bronze ring screwed on it. The intake pipe (Ref. Fig. 4) is attached to the LH branch pipe and the exhaust manifold branch pipe is connected to the RH branch pipe.

Three bronze bushings with internal thread are driven into the front and rear parts of the cylinder head threaded holes. Two bushings located symmetrically to the cylinder axis serve for receiving the front and rear spark plugs. The third bushing driven in a boss located at the front under the inlet valve case serves for driving in the starting system valve. Located under the front spark plug hole is the louver mounting bracket attachment stud.

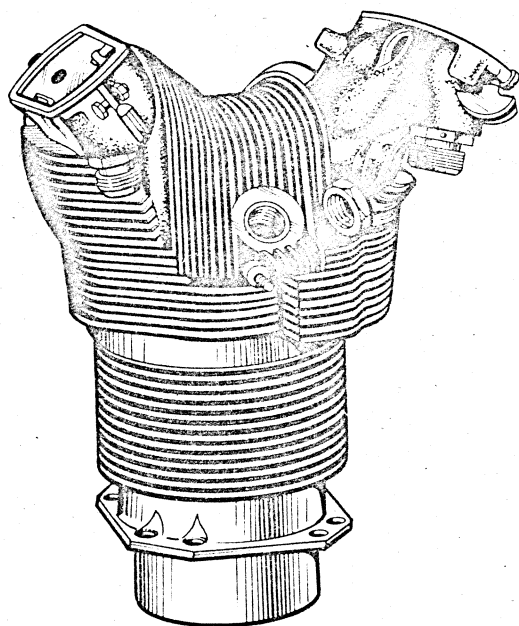
Each cylinder has one inlet valve (1) (Ref. Fig. 2) and one exhaust valve (1) (Ref. Fig. 3) made of heat-resistant steel forgings.

The valves admit mixture to the cylinders and release gases from them during inlet and exhaust strokes and seal the cylinders during compression and expansion strokes.

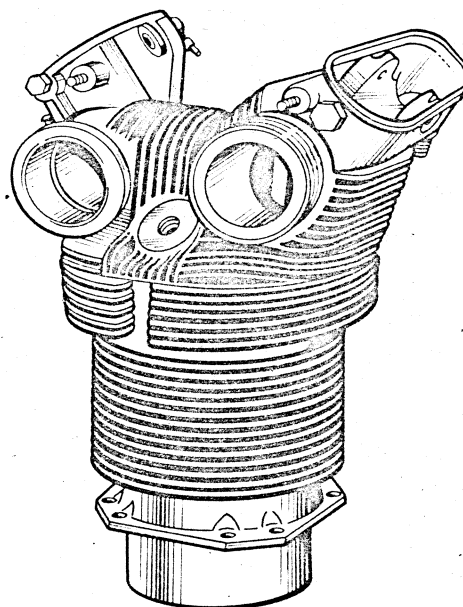
The inlet valve (Ref. Fig. 2) is made of steel Ch12M; its mushroom-type head on the side opposite to the stem is concaved; the mushroom-type head diameter is larger and the stem diameter is smaller than those of the exhaust valve. The inlet valve stem friction surface and tip are hardened with high-frequency currents while the mushroom-type head and a part of the stem (except the land) are subjected to anti-corrosive chemical nickel plating and heat treatment.

The inlet valve is pressed to the seat by two helical springs: outer spring (2) (Ref. Fig. 2) and inner spring (3).

The lower end of the outer spring rests on a washer arranged in the cylinder valve case and the inner spring lower end on the collar of the valve guide bushing.



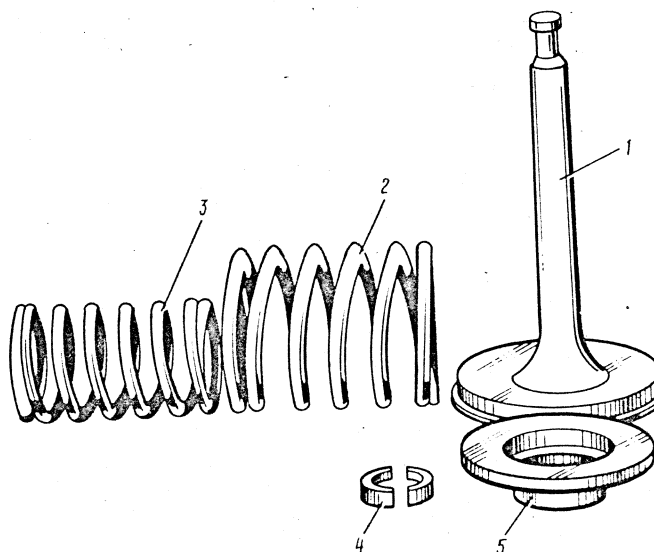
Front view



Rear view

Cylinder

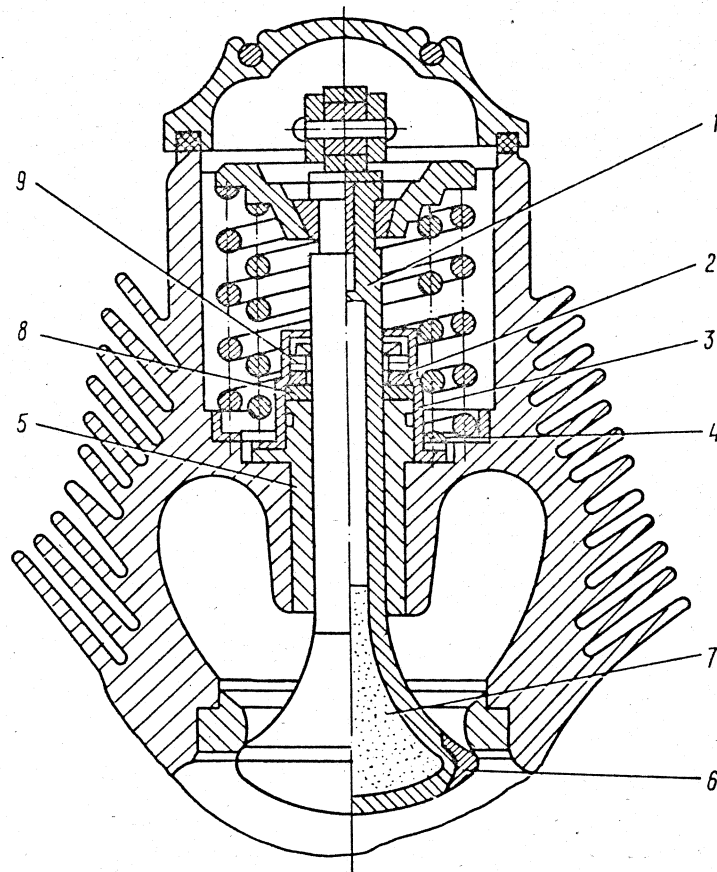
Figure 1



- 1. Inlet Valve
- 2. Outer Spring
- 3. Inner Spring
- 4. Split Retainer
- 5. Valve Plate

Inlet Valve

Figure 2



1. Exhaust Valve
2. Sealing Ring
3. Bushing
4. Inner Spring
5. Guide Bushing
6. Satellite Facing
7. Metallic Sodium
8. Washer
9. Spacing Washer

Sealing and Scraping Device of
Exhaust Valve

Figure 3

The upper ends of both springs thrust against plate (5) which in its turn rest on split taper copper-plated retainer (4) entering the groove in the valve stem. The inlet valve retainer surface is copper plated, that of the exhaust valve is brass plated.

The exhaust valve is made of steel 4Ch14N14V2M and its mushroom-type head is convexed towards the combustion chamber. The exhaust valve stem and mushroom-type head are filled to $\frac{2}{3}$ its interior with metallic sodium which melts on heating thus promoting heat transfer from hotter valve mushroom-type head to its stem, and then through the stem guide bushing and cylinder head to the atmosphere.

Welded to the stem end of this valve is a piece of a more wear-resistant material, while the land is surfaced with stellite VChN-1. The inlet valve land is made at an angle of 30° to the mushroom-type head plane, that of the exhaust valve at an angle of $46^\circ 15'$.

To preclude carbon deposit on the exhaust valve stem and valve sticking, a sealing and scraping device is provided. The sealing and scraping device (Ref. Fig. 3) of exhaust valve (1) comprises two steel sealing rings (2), spacing washer (9) located in steel bushing (3).

Sealing rings (2) are split, thermally stabilized for constant compression of the stem, have an internal tapered surface and are installed on the stem with the larger base of the tapered surface towards the mushroom-type head of valve (1).

Longitudinal displacement of rings (2) is limited at the top with the shoulder of bushing (3) and at the bottom with washer (8) pressed in bushing (3) whose flange is a support surface for inner spring (4) which constantly press the entire stack to guide bushing (5) of the valve. When the valve opens, sealing rings (2) scrape off oil from the step of valve (1) thus precluding formation of carbon, hence "hang-up" of the valve.

2.2. INTAKE PIPES

Intake pipes (Ref. Fig. 4) serves to supply mixture from the blower to the cylinders.

The intake pipes are made of seamless pipe with flaring of the short elbow.

The intake pipe is attached to the cylinder by a nut screwed on the external connection. The pipe is sealed with paronite gaskets installed in the end face groove in the connection.

The pipe lower end is installed in the mixture collector pipe, is attached by a nut and sealed with a rubber ring.

Welded to the intake pipes of lower cylinders Nos 4,5 and 6 are threaded bosses for plugs intended to drain oil or gasoline from the pipes to preclude hydraulic shock.

2.3. PISTON

The piston (Ref. Fig. 5) takes up gas pressure and transmits it through the connecting rod to the crankshaft.

The pistons are stamped of aluminium alloy, machined externally and partially inside.

The piston head is flat and polished on the outside. The outer surface of the head is provided with two recesses under the valves to preclude collision of the piston with the valves in case the latter stick in the open position and when the crankshaft is turned at maladjusted timing mechanism of the engine.

The side outer surface of the piston has five turned grooves: four grooves in the top band and one in the lower band. The grooves are intended to receive piston rings.

Three top grooves receive keystone compression rings chrome-plated on the external diameter, while the fourth groove receives an oil ring with slots and channel, and the fifth ring receives a bevelled oil slinger.

The fourth groove has oil drain holes through which the oil scraped off the cylinder walls is drained to the crankcase.

Arranged inside the piston are two diametrically opposite bosses with holes to receive a piston pin. Depressions are milled near the boss holes on the outer surface to decrease piston weight; holes are drilled in the depressions for additional removal of oil from the cylinder walls.

The piston pin is made of chrome-nickel-tungsten steel. It is hollow and heat-treated to high surface hardness. The pin floats in the piston bosses and in the connecting rod small end.

The pin is precluded against longitudinal displacement in the piston by two aluminium plugs. Each plug has six drain holes and three holes for lubricating plug outer surface.

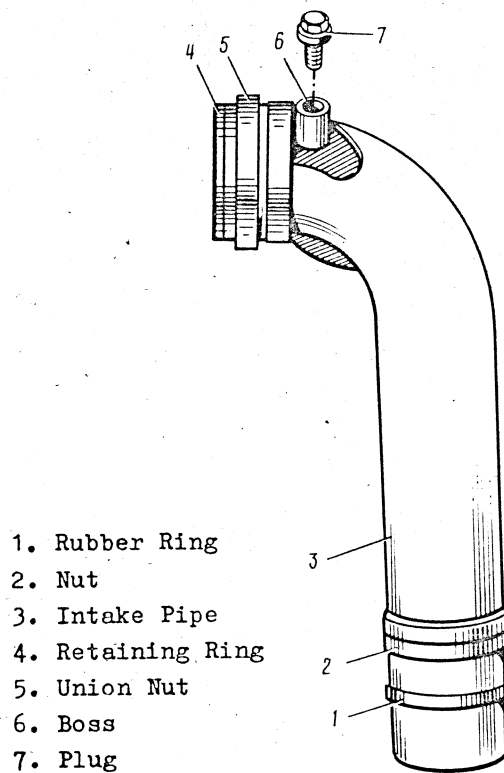
Piston rings are made of alloyed cast iron. The key-stone compression rings feature a cylindrical generatrix with porous chrome plating. Turned along the outer generatrix of the oil control ring is a groove with twelve slots to drain oil.

The oil slinger has a bevelled outer generating surface. The oil slinger is installed on the piston with the cone smaller base towards the piston head.

The pistons with rings and pins as well as working surfaces of cylinder sleeves are lubricated by squirting oil through a jet driven into the web of the crankshaft front section and through gaps in the crank mechanism.

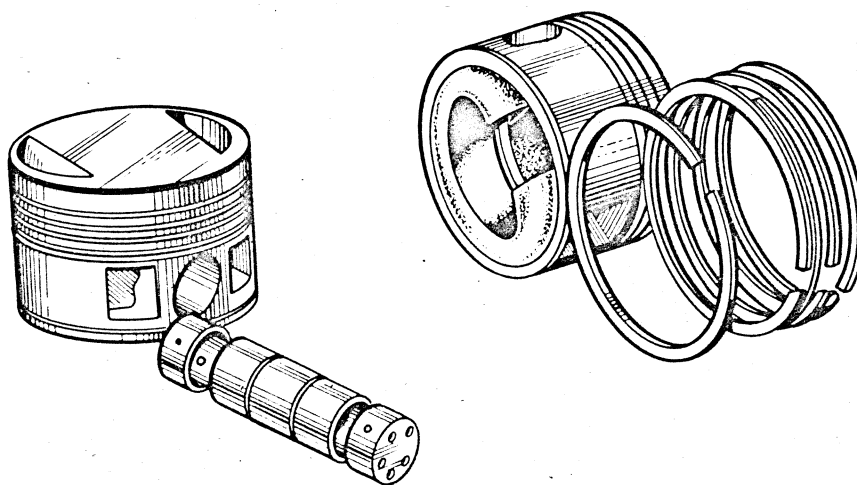
2.4. TIMING MECHANISM

The timing mechanism ensures periodic admission of fuel-air mixture into the engine cylinders and exhaust of combustion products to the atmosphere.



Intake Pipe of Cylinders Nos 4, 5 and 6

Figure 4



Piston, Piston Rings and Piston Pin
with Plugs

Figure 5

The timing mechanism comprises a cam plate, a cam plate drive, tappet guide bushings, tappets with rollers, push rods in casings, valve rockers with adjustment screws and rollers, inlet valves and exhaust valves with springs, plates and retainers.

The valve mechanism is described in Section 2.1.

The schematic diagram of the timing mechanism is given in Fig. 6.

The cam plate is rotated from the crankshaft through a gear train. The cam plate lobes contacting the tappet rollers move the tappets in the guides away from the crankshaft axis. The tappets move the push rods installed between the tappet seats and adjustment screws of the valve rockers. The push rod displaces the front arm of the rocker away from the crankshaft axis, the rear arm approaches to it thrusting with the roller against the end of the valve stem, compresses the valve springs and opens the valve to admit fresh mixture and release exhaust gases. The valve closure is determined by the profile and location of the lobes on the cam plate.

The cam plate (Ref. Fig. 7) is a steel disk with a hub, having two rows of lobes on the outer cemented surface: four lobes per row. The front row of the lobes serve the rollers of the inlet valve tappets, the rear row, the rollers of the exhaust valve tappets. A bronze bushing locked against turning with two retainers is pressed in the hub. Provided on the inner surface of the cam plate is an internal gear rim meshing with the gear rim of the intermediate timing shaft.

The cam plate drive (Ref. Fig. 8) comprises drive timing gear (1), intermediate gear (7), intermediate timing shaft (4), two ball bearings (6) and (9) and other minor components.

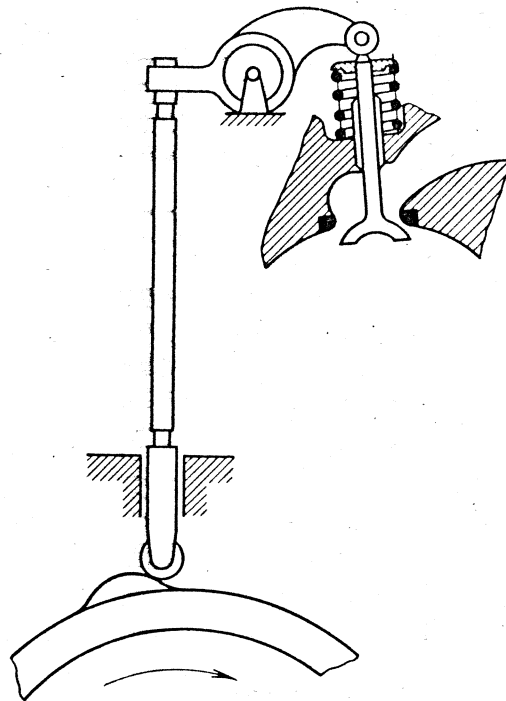
The drive gear is installed on the end of the crankshaft front section and is secured against turning with a sunk key.

Intermediate timing gear (7) is made of steel and has an outer gear rim and a hub. The inner surface of the hub is made with rectangular splines to install intermediate timing shaft (4).

Steel intermediate timing shaft (4) consists of a gear rim made integral with the hollow shaft supported on two ball bearings.

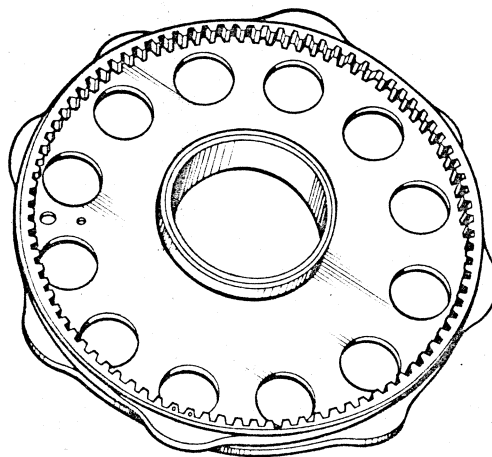
The shaft middle portion is splined externally to receive gear (7) and has two locating cylindrical seats for the ball bearings. The front ball bearing outer race is pressed in the seat of the crankshaft thrust ball bearing front cover. The rear ball bearing outer race is installed in the seat of the timing drive cover. When assembled the shaft carries, starting from the gear rim: rear ball bearing (6), intermediate gear (7), bushing (8) with front ball bearing (9), adjustment washer (10) and drive bevel gear (11) of the speed governor drive, which is secured on the shaft by Woodruff key (5). All the parts on the shaft are tightened with nut (13) and safetied with lock (12).

The cam plate rotates opposite to the crankshaft. The engine timing is ensured by setting the cam plate drive and the cam plate by the timing marks and do not require special adjustments.



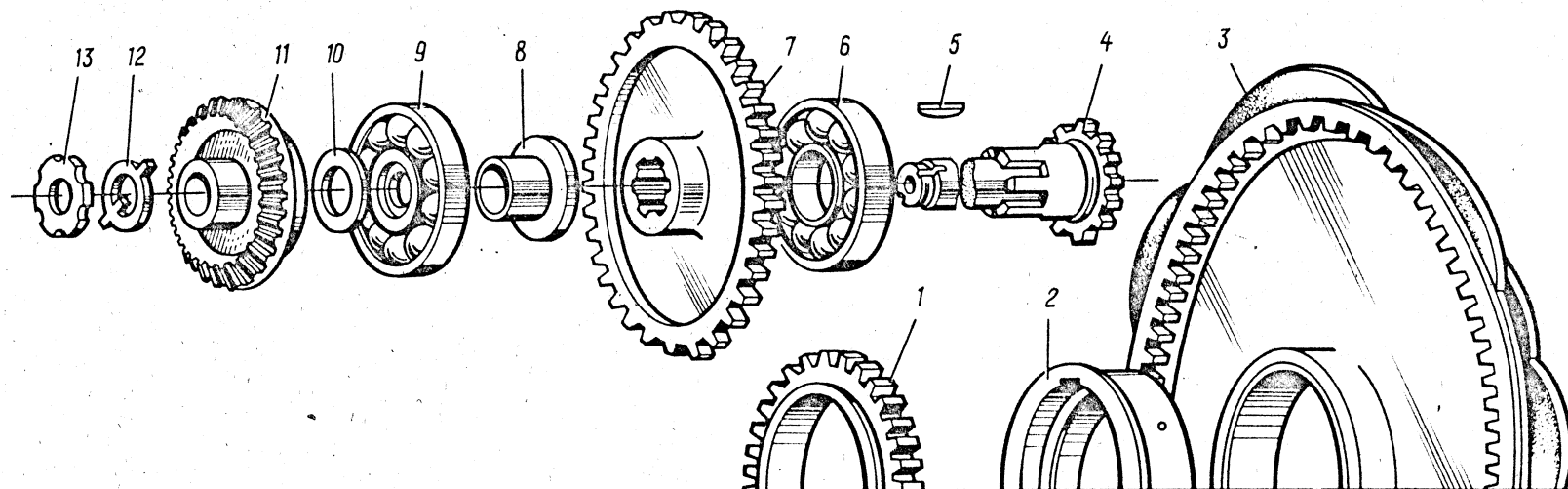
Timing Mechanism Schematic Diagram

Figure 6



Cam Plate

Figure 7



- | | |
|------------------------------|-------------------------------|
| 1. Drive Timing Gear | 8. Ball Bearing Bushing |
| 2. Spacer | 9. Front Ball Bearing |
| 3. Cam Plate | 10. Adjustment Washer |
| 4. Intermediate Timing Shaft | 11. Speed Governor Drive Gear |
| 5. Key | 12. Plate Lock |
| 6. Rear Ball Bearing | 13. Nut |
| 7. Intermediate Timing Gear | |

Cam Plate Drive
Figure 8

The set of a tappet (Ref. Fig. 9) includes guide bushing (3), tappet (4), tappet end piece (2), spring (1), roller (5), roller bushing (6), roller pivot (7).

Tappet (4) is a steel cylindrical rod having a slot, in its lower part with holes for the pivot carrying a floating bronze bushing and the roller. Installed in the upper part of the tappet is a spring and end piece with spherical recess for the push rod end.

The tappets, push rod ends, adjustment screws and valve rockers have passages to supply oil to the valve case mechanisms.

Tappet guide bushing (3) is made of steel, has an oval flange with two holes for securing to the intermediate crankcase. The guide bushing lower part is made with a slot equal in width to that of the roller and fixing the latter relative to the cam plate raceway.

The guide bushings of the tappets of inlet valves in cylinders Nos 1, 2, 8 and 9, as well as of the exhaust valves in cylinders Nos 1, 2, 3, 8 and 9 have slots and holes to supply oil under pressure.

Tappet push rod (1) (Ref. Fig. 10) is made of a seamless steel pipe with steel end pieces having spherical ends pressed into its bored ends.

Spherical ends of the push rods enter respective recesses of the rocker adjustment screw and the tappet. Each push rod is arranged in casing (4).

The push rod casing is a thin-walled aluminium pipe flared at one end and having a bead at the other.

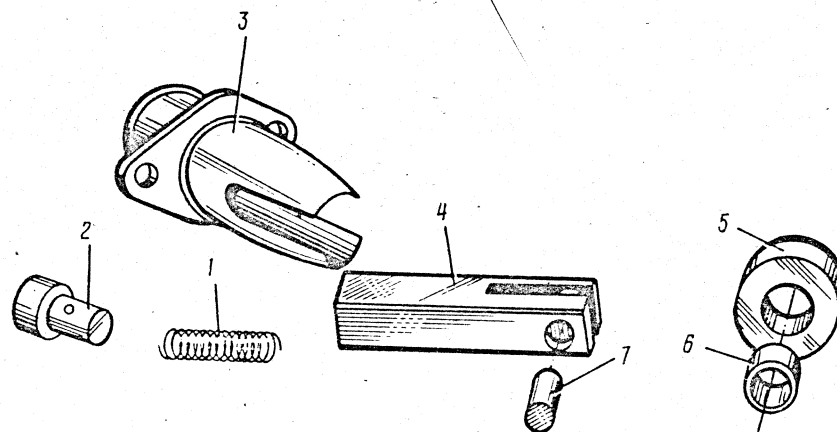
All casings and push rods are interchangeable.

The flared end of the push rod casing is attached by union nut (5) to the connection on the cylinder valve case, while its other end is attached by rubberized fabric hose (2) with the guide bushing of the tappet.

Thrust tapered ring (6) is installed under nut (5) to press by its surface the end of casing (4) to the connection. The rubberized fabric hoses are fastened with clamps (3).

Valve rockers (Ref. Fig. 11) serve to transmit motion from the push rods to the valves at opening and from the valves to the rods at closing of the valves.

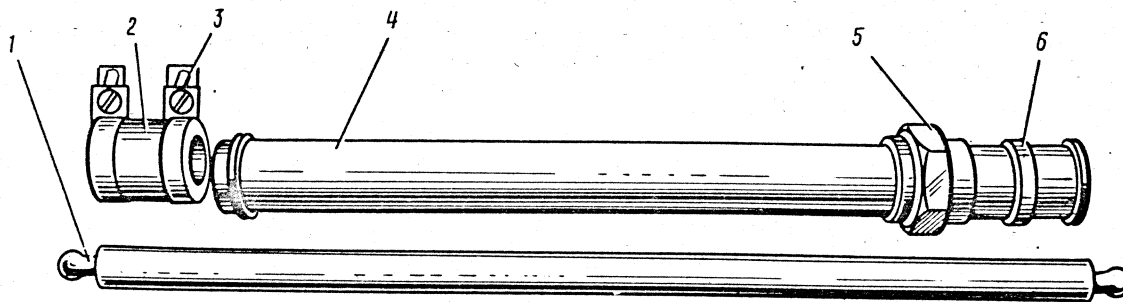
The rockers are made of steel forgings and are installed on needle rollers (8) which rest on steel axle (10) inserted in the cylinder valve case holes. One end of the rocker is forked. The fork has roller (2) mounted on pivot (3) to transmit force to the valve stem during operation of the engine. The other end of the rocker has an adjustment screw which is secured by lock nut (7) after the required clearance between the rocker roller and the valve stem is adjusted.



1. Spring
2. Tappet End Piece
3. Tappet Guide Bushing
4. Tappet
5. Roller
6. Roller Bushing
7. Roller Pivot

Set of Tappet

Figure 9



1. Push Rod
2. Rubberized Fabric Hose
3. Clamp
4. Push Rod Casing
5. Union Nut
6. Thrust Ring

Push Rod and Push Rod Casing

Figure 10

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Needle rollers are mounted on axle (10) by bushing (4), ring (5) and nitrated washers (9). To seal axle (10) of the rocker, aluminium washers (13) are installed on both sides of the valve case in special recesses and steel washers (12) are placed under the axle head and nut (11).

Rocker needle rollers of the valve mechanisms of cylinders Nos 1, 2, 3, 8 and 9 are lubricated under pressure. Oil is fed to them through the oil passages in the valve rockers.

2.5. DEFLECTORS

The cylinder deflectors (Ref. Fig. 12) are intended to direct cooling air stream to the less-blown rear surfaces of the cylinder sleeve and head. The deflectors improve intensity and uniformity of cylinder cooling. The engine carries eight side inter-cylinder deflectors (1) and nine upper (head) deflectors (5).

The deflectors are stamped of sheet aluminium.

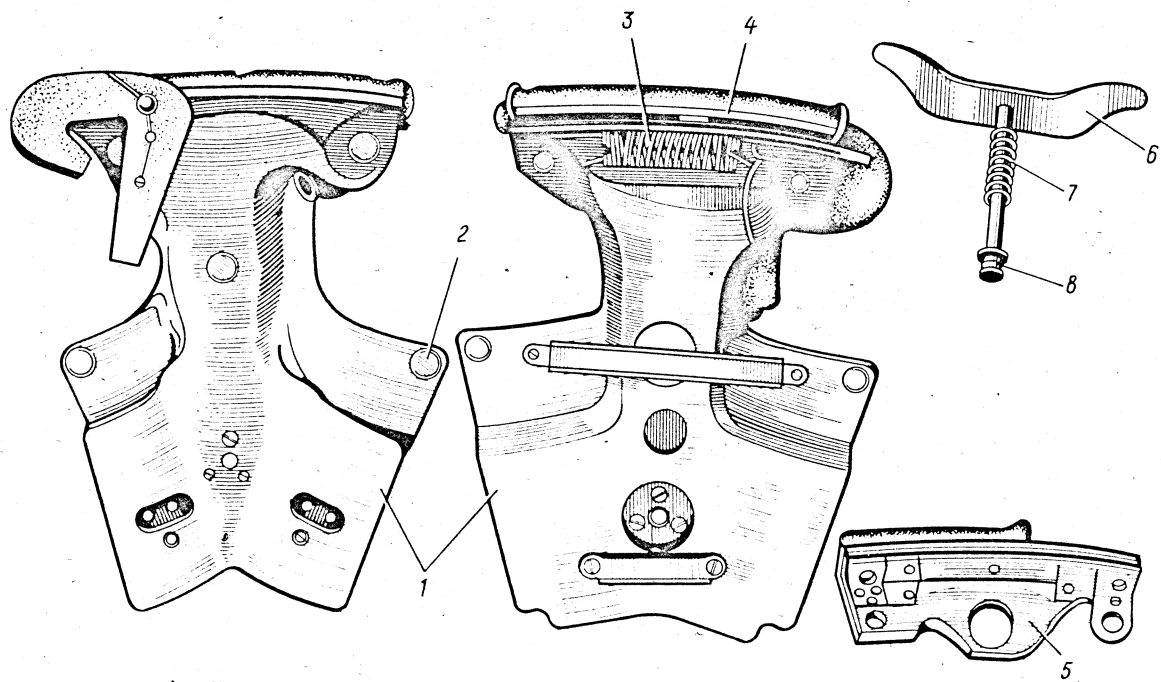
The upper deflectors are secured to each cylinder head by two studs and nuts. They have holes with rubber grommets for passing ignition cables.

Inter-cylinder deflectors (1) are secured at the top to two deflectors of the adjacent cylinders by locks (3) and at the bottom to the cylinder sleeves by clamp (6) disposed between the cooling ribs of two adjacent cylinders.

The deflectors have rubber stops (2) to preclude touching the cylinder ribs.

The engine is cooled by air fed through the controlled louvers in the cowling front portion (Ref. Fig. 13).

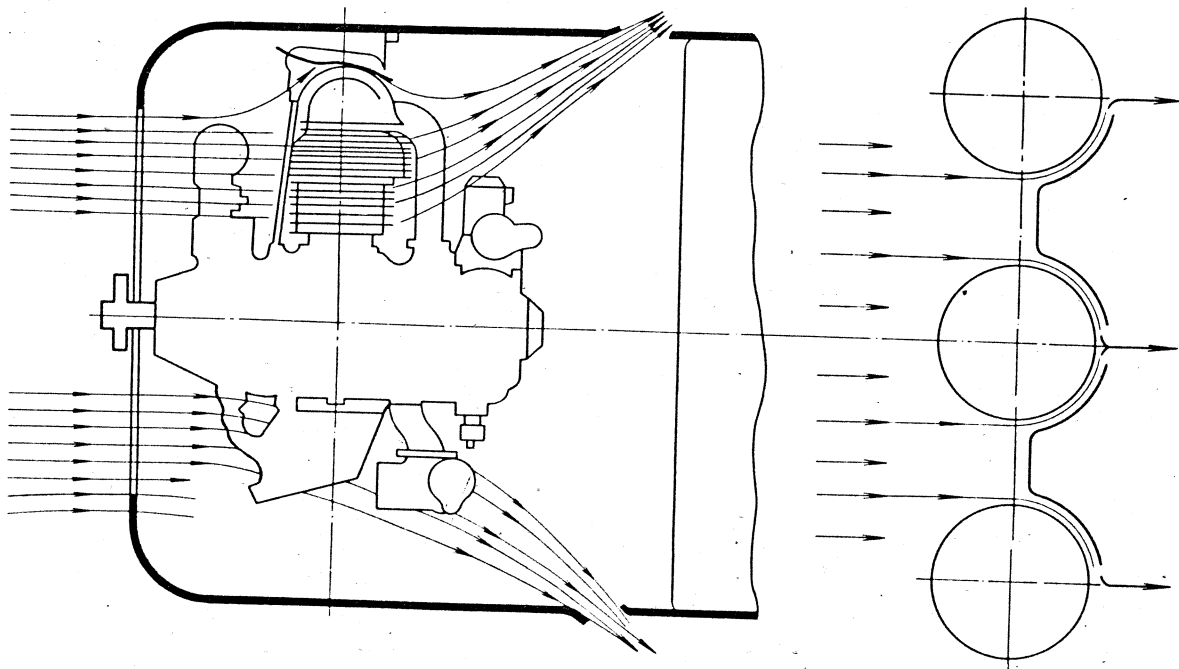
The cylinder head deflectors form a continuous ring with soft gaskets to pack the space between the deflectors and engine cowling. The deflector of cylinders Nos 5 and 6 is not secured to the engine. Cooling air is released through the gap between the rear edge of the cowling and the fuselage surface.



- | | |
|-----------------------------|--------------------|
| 1. Inter-Cylinder Deflector | 5. Upper Deflector |
| 2. Rubber Stop | 6. Clamp |
| 3. Lock | 7. Spring |
| 4. Rubber Stop | 8. Nut |

Cylinder Deflectors

Figure 12



Engine Cooling Diagram

Figure 13

CYLINDER ASSEMBLY - TROUBLE SHOOTING

For mostly often encountered troubles and their remedies refer to the Table given below.

Trouble	Possible cause	Correction
Loss of compression	(1) Incomplete closing of valves	Check clearances between rocker roller and valve stem, adjust them (Ref. 072.00.00, Task Card No. 247)
	(2) Leaky spark plugs or starting valves	Tighten spark plugs and valves. Check starting valves
	(3) Sticking, wear or breakage of piston rings	Remove cylinder with poor compression and eliminate troubles
	(4) Burn-through of valve	Replace valve

NOTE: Operations under Items (3), (4) are to be carried out by the Supplier's representatives.

072.40.00

SUPERCHARGING

SUPERCHARGING - DESCRIPTION AND OPERATION

1. GENERAL

Ambient air density drops with altitude which decreases mass of air supplied to the cylinders, hence engine power at constant speed and constant position of the carburetor throttles.

To increase engine power to the desired level near the ground and maintain nominal power up to the design altitude, the M-14P engine is equipped with a centrifugal blower with positive one-speed drive.

Apart from increasing power, the blower promotes mixing of fuel with air and more uniform distribution of the mixture among the engine cylinders, which is particularly important when starting the engine.

During operation of the engine, the working mixture from the carburetor is sucked into the blower space through an oval port in the lower boss of the mixture collector, is directed to the impeller blades and is urged by centrifugal forces to flow at a high velocity through the passages defined by the impeller blades and mixture collector wall from the center to periphery and then to the diffuser.

2. CONSTRUCTION

The blower comprises mixture collector (1) (Ref. Fig. 1), diffuser (24), impeller (5), drive with coupling (29) and sealing parts.

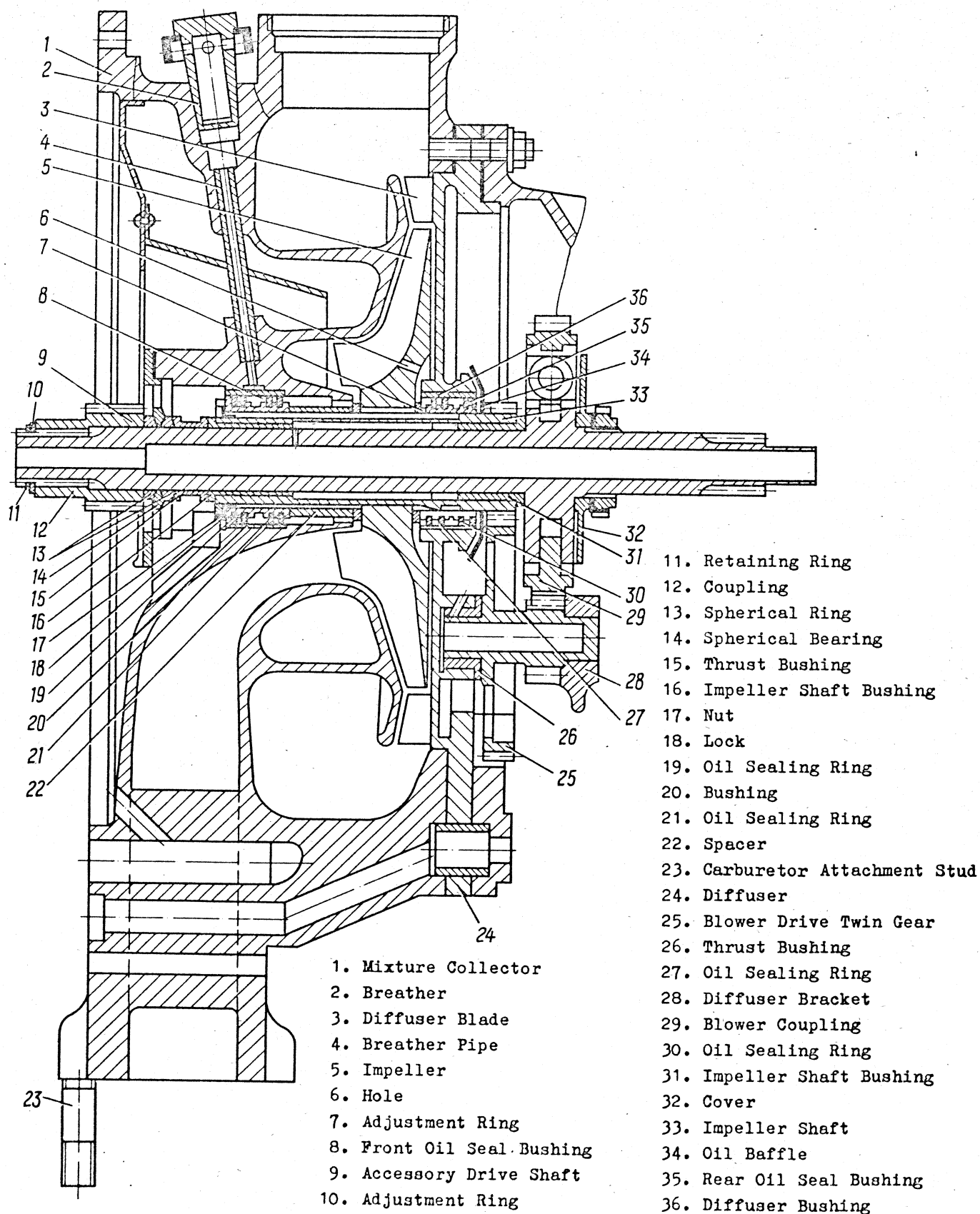
2.1. MIXTURE COLLECTOR

The blower mixture collector (Ref. Fig. 2) cast of aluminium alloy is attached to the rear part of the intermediate casing by studs driven into the latter. The mixture collector has a cast space (release manifold with nine equally spaced release branch pipes) with grooves for rubber sealing rings and thread for the intake pipe sealing nuts.

Eight bosses forming the branch pipes have lugs with holes for engine-to-frame attachment bolts. The thrust bearing of the accessory drive shaft and blower deflector are attached by four studs at the center of the mixture collector front wall.

Pressed in the central hole of the mixture collector is a steel bushing serving to support the rings of the oil seal bushing of the blower front seal assembly.

The blower seal assembly is used to preclude ingress of oil into the suction system of the engine.



Blower. Longitudinal Section View

Figure 1

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The front part of the steel bushing has drilled holes communicating with the atmosphere through the annular recess, passage in the vertical wall and a steel pipe.

A boss with passage to supply mixture from the carburetor to the blower impeller is located in the lower part of the mixture collector.

The boss end face is provided with a flange having two threaded holes with studs for attachment of the carburetor.

The boss of the intake branch pipe of cylinder No. 1 is provided with a flange having two studs to mount the engine rear breather.

The boss of the branch pipe of cylinder No. 2 has a threaded hole for the mixture pressure measuring connection; the threaded hole made in the boss of the branch pipe of cylinder No. 9 is intended to receive the starting nozzle.

To drain oil from the rear cover and ensure inverted-flight breathing through the oil sump, and to supply oil to the oil pump scavenging section, holes are made in the mixture collector lower part extending through the web in the passage for supply of mixture to the blower impeller.

The diffuser of the blower and rear cover are attached to the rear flange of the mixture collector by ten studs.

2.2. DIFFUSER

The blower diffuser (Ref. Fig. 3) is cast of aluminium alloy, has front and rear flanges with collars to be aligned on the mixture collector and rear cover of the crankcase.

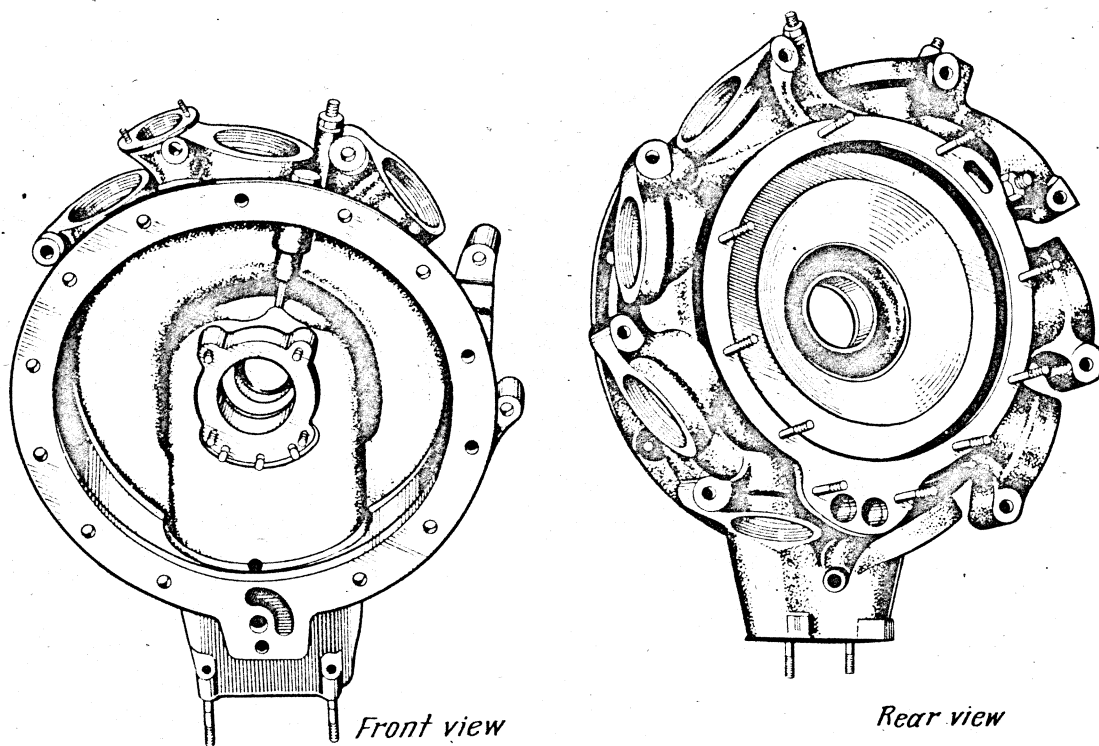
Fifteen shaped blades are made on the diffuser annular surface at the front side which form passages gradually expanding from the center towards periphery.

The flange has ten drilled holes to secure the diffuser, two holes in the diffuser lower part for draining and scavenging oil (the latter hole has a pressed-in steel transfer bushing) and one hole in the upper part for breathing the space of the rear cover in normal flight and draining oil from the rear cover space in inverted flight.

The blower rear seal assembly steel bushing is pressed in the diffuser central hole.

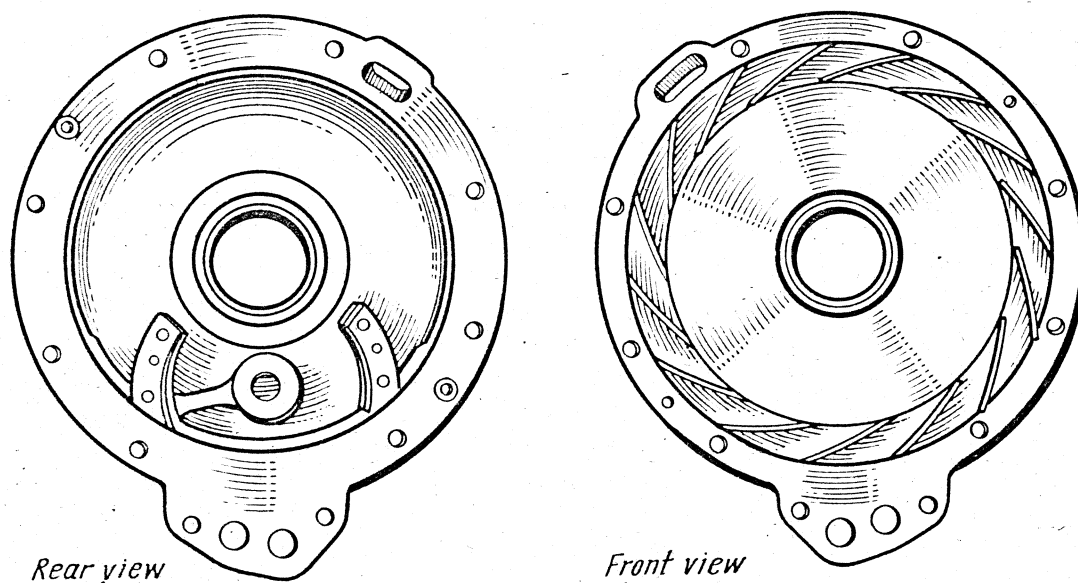
Provided in the lower part of the rear flange is a boss whose bore has pressed-in aluminium bushing. The bushing is a front support for a twin gear of the blower drive. Two bosses in the rear flange lower part are intended to mount the twin gear rear support cover with the aid of four studs.

A hole of the oil passage for lubricating the twin gear supports is made in the rear flange.



Mixture Collector

Figure 2



Diffuser

Figure 3

2.3. IMPELLER

Impeller (5) (Ref. Fig. 1) is the most stressed part of the blower. At take-off rating of the engine its rotational speed reaches as high as 23,700 r/min. To decrease inertia forces and dynamic loads on the impeller drive shaft bearings, the impeller is statically balanced before installing in the engine by removing metal from the surface between the blades.

The blower impeller is stamped from aluminium alloy and comprises a hub and a disk with fourteen radial blades.

To ensure smooth entrance of mixture in the impeller passages, the blade leading edges are curved in the direction of the impeller rotation.

The impeller disk has fourteen inclined through holes (6) connecting the impeller passages with the annular space defined by the conical surface of the impeller disk recess and the diffuser surface. These holes are intended for equalizing pressures on both sides of the impeller, thus decreasing axial pressure on the impeller.

The impeller hub has six internal rectangular splines to mount it on the blower shaft.

The impeller is anodized for protection against corrosion.

Impeller shaft (33) is a hollow cemented steel part having an integral gear rim at the rear.

The shaft outer surface features a cylindrical band, annular groove, six splines, a cylindrical surface with an annular groove and thread for nut (17) intended to secure the parts on the shaft.

Two longitudinal grooves extending through two opposite splines are made between the annular grooves. The grooves interconnect front (8) and rear (35) blower seal bushings.

Bronze bushings (16) and (31) pressed in both ends of the shaft are used to support the impeller shaft on the necks of accessory drive shaft (9).

The blower impeller shaft mounts: oil baffle (34), rear bushing (35) with four bronze oil sealing rings (27) and (30), adjustment ring (7), impeller (5), spacer (22), front bushing (8) with four bronze oil sealing rings (19) and (21) and lock (18) which locks nut (17) securing the stack on the shaft.

Adjustment ring (7) is intended to set the impeller for the required gap between it and the walls of the mixture collector and diffuser.

2.4. BLOWER IMPELLER DRIVE

The blower impeller drive comprises drive shaft (9) (Ref. Fig. 1) of the accessory drive with blower coupling (29), twin gear (25) and impeller shaft (33).

The accessory drive shaft is a hollow cemented steel part. The rear part of the shaft has involute splines whereby it is connected with the internal splines of the drive bevel gear of the rear cover drive.

Two copper-plated bands in the rear part of the shaft are intended for aligning the shaft relative to the drive bevel gear of the rear cover drive (the rear band) and for sealing the oil gallery (the front band).

Three through radial holes on the rear cylindrical band serve to supply oil from the rear cover oil passage to the shaft space being a part of the engine oil gallery.

The middle part of the shaft has a disk with five double projections to mount the blower coupling. Two support necks on the middle part of the shaft are supports for the impeller shaft.

One radial hole for supply of oil to the impeller shaft sliding bearings is made between the necks.

The accessory drive front portion has involute splines for mounting the drive shaft coupling provided with internal and external splines; the coupling is fixed with retaining ring (11) against lateral displacement.

The external involute splines of the coupling enter the rear main journal of the crankshaft and is aligned on the latter by the locating band with sealing the oil gallery joint.

Adjustment ring (10) disposed between the coupling front end and retaining ring is needed to obtain required axial clearance between the blower drive parts.

The rear end of the coupling thrusts through a spherical bronze ring against a spherical bearing secured on the mixture collector, while the accessory drive shaft bears against the coupling through the adjustment ring.

Thus, axial displacement of the accessory drive shaft towards the rear cover is limited; displacement towards the intermediate crankcase is restricted by the impeller shaft which bears through the spacer and spherical bronze ring against the spherical bearing of the mixture collector.

The working end faces of the blower drive parts (coupling, spacer, spherical ring and impeller shaft) are grooved to improve lubrication of friction surfaces.

The blower coupling (Ref. Fig. 4) is assembled on the accessory drive shaft.

The coupling protects the drive parts against overloads at abrupt changes in engine operating conditions and serves to decrease torsional stresses in the drive parts.

The blower drive coupling comprises the following parts: gear (4), five cylindrical helical springs (2), five pairs of plates (1) and (3) and fasteners.

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Gear (4) is made of alloyed steel and has five internal projections.

When the coupling is assembled, the gear internal projections are in the slots of the drive shaft disk which excludes axial displacement of gear (4) relative to the shaft. Two plates (1) and (3) and one spring (2) are installed in each space between the projections of the gear and shaft disk.

To fix the plates and springs in the axial direction relative to the accessory drive use is made of plate collars at the front side and cover (32) (Ref. Fig. 1) at the rear side; the cover is secured on the shaft with a nut.

The spring compression force presses the plates to the end surfaces of the gear and disk projections which precludes free-wheeling of gear (4) (Ref. Fig. 4) on the accessory drive shaft.

During clockwise rotation the projections of shaft (5) act on plates (1) which transmit torque to the projections of gear (4) through springs (2) and plates (3). Under steady operating conditions of the engine, when imparted torque is less than that of pre-compressed springs (2), gear (4) does not turn relative to drive shaft (5).

As operating conditions change, when moments exceeding those of pre-compressed springs may be transmitted to the blower drive, the springs compress and the gear turns relative to the drive shaft through a certain angle precluding high impact loads on the blower drive parts, hence their breakage.

Twin gear (25) (Ref. Fig. 1) of the blower drive comprises two spur gears made as one piece of cemented steel and has two support necks.

The twin gear rests with its front neck in bushing (26) of diffuser (24), with the rear one, in the hole of diffuser bracket (28). Oil is fed to the bushings under pressure through holes in the necks.

Torque is imparted to the blower impeller through the train: from the accessory drive shaft through the blower drive coupling gear of blower coupling (29), small rim of twin gear (25). The large rim of the twin gear meshes with the gear rim of blower impeller shaft (33).

The crankshaft-to-impeller transmission ration is 8.160.

To preclude ingress of oil from the space defined by the front wall of the mixture collector and rear wall of the crankcase, as well as from the rear cover to the fuel mixture, the blower is provided with a sealing system comprising oil baffle (34) and two oil seal bushings (8) and (35) with rings (27) and (30) communicating with the atmosphere through breather (2).

The steel oil baffle installed between the impeller shaft gear rim and oil seal bushing keeps oil off the blower impeller on the rear side of the crankcase cover.

Oil seal bushings (8) and (35) are made of steel and have four grooves each to receive rings contacting with their outer surfaces bushings (20) and (36), pressed in mixture collector (1) and diffuser (24).

The oil sealing rings are made of bronze. Each bushing receives four rings.

A wide annular groove with radial holes emerging to the annular spaces defined by the bushings and the shaft is made at the middle of the oil seal bushing surface. These spaces are interconnected by two passages milled in two opposite splines of the blower impeller shaft.

Radial holes in bushing (20) emerge into an annular space formed by the bushing and the mixture collector. The space is connected to the atmosphere through a passage defined by breather pipe (4) pressed in the mixture collector, and breather (2) driven into the upper part of mixture collector (1).

Atmospheric air getting into the annular grooves of the oil seal bushings decreases rarefaction in them, thus decreasing suction of oil to the blower space and precluding ingress of oil to the fuel-air mixture.

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LUBRICATION

LUBRICATION - DESCRIPTION AND OPERATION

1. GENERAL

Lubrication is intended to decrease friction and transfer heat from friction surfaces of the operating engine parts.

The oil system (Ref. Fig. 1) includes: the oil pump, oil sump, filter with chip detector, mesh filters.

The friction surfaces of the engine are lubricated under pressure and by splashing of oil. Oil under pressure is fed to all main friction surfaces through internal passages. The cylinder walls, pistons, antifriction bearings, gear teeth are lubricated by oil splashing.

Apart from decreasing friction and removing heat from friction surfaces, oil protects engine internal parts against corrosion and carries away metal particles separated from friction surfaces as a result of wear to the oil sump.

The oil sump is used to collect, settle and filter oil flowing down from the engine parts.

The filter with chip detector detects metal chips in the oil sump at breakage or intensive wear of operating engine parts.

The mesh filters installed upstream of oil pump MN-14A and of the speed governor clean oil of mechanical impurities.

Oil from the sump is scavenged through the oil cooler to the oil tank. The engine oil system construction does not provide for scavenging oil from the engine in inverted flight because specified inverted flight duration does not exceed 2 min.

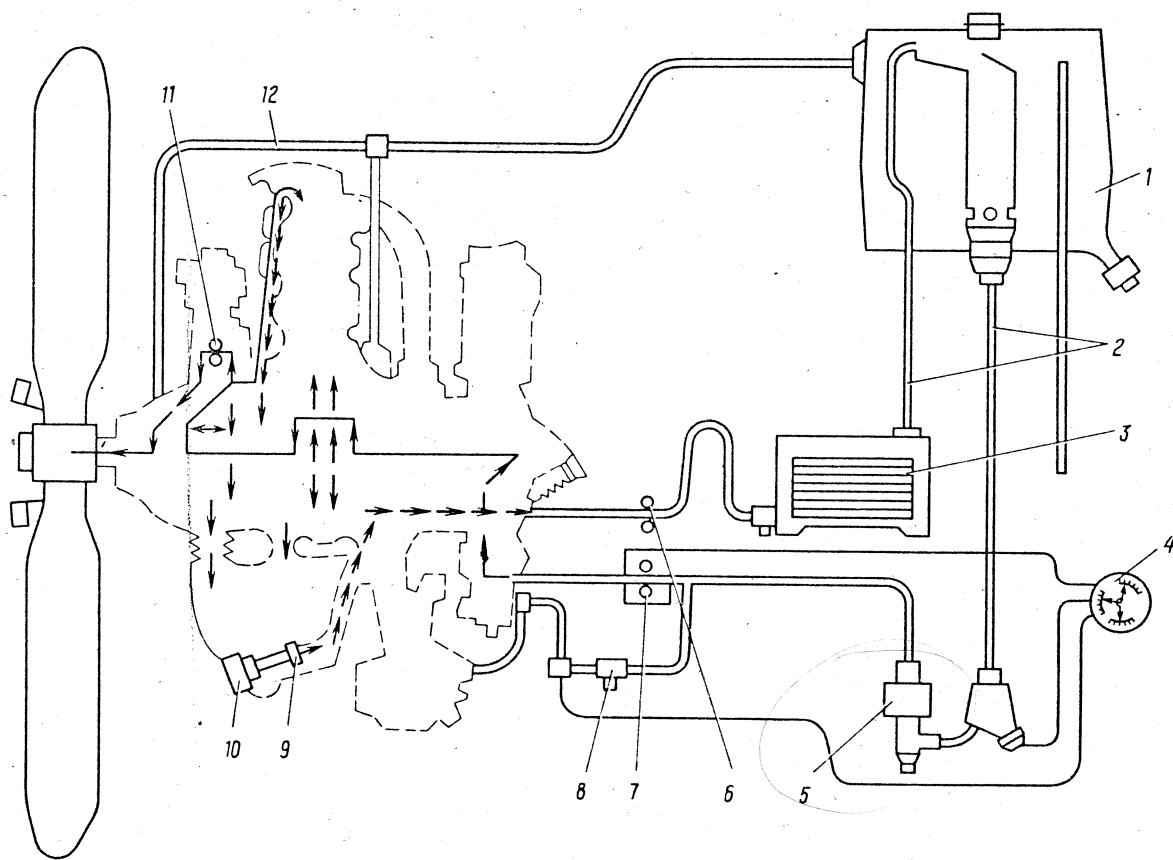
The engine is not flooded with oil since the latter partially is drained to the oil tank through the engine breathing system.

The engine oil system includes the following test instruments:

Temperature gauges for checking oil temperature at engine inlet and outlet.

Oil pressure gauge for measuring engine inlet oil pressure.

Oil is fed to all forced-lubrication parts of the engine by the MN-14A oil pump including delivery and scavenging sections.



1. Oil Tank
2. Oil Line
3. Oil Cooler
4. Oil Temperature and Pressure Gauge
5. Oil Filter
6. Oil Pump
7. Oil Pump Delivery Section
8. Dilution Cock
9. Oil Sump
10. Filter with Chip Detector
11. Speed Governor Oil Pump
12. Breathing Connection Pipeline

Engine Lubrication and Breathing Diagram

Figure 1

2. DESCRIPTION

Oil from the tank is fed to the oil pump via an oil line through the oil inlet connection, mesh filter in the rear cover and inner space of the driven shaft to the oil pump delivery section (Ref. Fig. 1).

Oil under pressure from the delivery section of the oil pump is fed to the space of the oil pump drive shaft, then through the hollow vertical shaft, radial holes in its walls to the annular recess of the vertical boss of the crankcase rear cover to lubricate the bushings of the upper and lower supports of the vertical shaft.

Oil from the annular recess of the vertical boss is supplied to the attachment flanges of the tachometer generator drive, compressed air distributor and compressor to lubricate these drives and their accessories.

Further oil flows through drilled passages to two grooves for the magneto drive housing for lubricating these drives and to the twin gear of the blower impeller drive.

Oil is delivered to the bearings of the drives of the tachometer generator, compressed air distributor, compressor and magnetos through the recesses, flats and radial holes in the drive housings.

The bulk of oil fed from the annular recess in the vertical boss of the crankcase rear cover is fed through a passage to the central boss of the crankcase rear cover and is branched in two directions:

Through the drilled passage to the aligning recess for the generator drive housing and further through the passage drilled in the generator drive housing stiffening rib to the inner annular recess to lubricate gear bearings.

Through radial drilled passages in the drive gear to the space of the drive shaft connected with the space in the main journal of the crankshaft rear section. A part of oil from the drive shaft space passes through drilled holes to lubricate support necks of the drive gear, drive shaft and blower impeller shaft.

From the crankshaft rear section main journal space, oil gets through drilled passages in the web to the space of the crankpin and then the oil flow is divided into three directions:

Through two oil intake pipes to the flat of the crankpin to lubricate the crank mechanism.

Through the calibrated orifice in the jet driven into the web of the crankshaft front section to the crankcase for additional lubrication of the cylinders, pistons and connecting rods.

Through the passage in the web of the crankshaft front section to the space of the crankshaft front section end.

Two oil intake pipes installed in the crankpin space and serving as an oil cleaning centrifuge supply clean oil to the crank-mechanism parts.

During rotation of the crankshaft, heavier particles contaminating the oil are rejected by centrifugal force to the base of the pipe protruding part, while clean (lighter) oil gets through the pipes to the master connecting rod bushing.

Oil from the gap between the master connecting rod bushing and the crankpin of the crankshaft flows through radial passages in the bushing and in the lugs of the master connecting rod to the space of the articulated rod pins from which it is fed through two radial passages to lubricate friction surfaces of the articulated rod big end bushings.

The cylinder surface, pistons, pins and bushings in the connecting rod small ends are lubricated by oil squirted from the gaps of the crank mechanism and from the oil jet of the crankshaft.

The crankshaft bearings are also splash-lubricated.

Oil from the crankshaft front section space is fed through the radial hole in the shaft end, through the spacer to the cam plate bushing.

The gears and bearings of the timing mechanism, the cam plate and speed governor drive are lubricated by oil splashing.

The tappets and parts of valve mechanisms, needle rollers and rocker rollers, valve springs, spherical surfaces of tappet push rods and inlet valve stems of cylinders Nos 1, 2, 8, 9 and the exhaust valve stems of cylinders Nos 1, 2, 3, 8, 9 are pressure lubricated with oil supplied from the gearbox housing.

Other tappets and parts of the valve mechanisms are lubricated with oil gravitating to them through the gap between the tappets and their guide bushings.

Oil from the crankshaft front section end space flows to the airscrew shaft space to lubricate the bushing pressed in the crankshaft end and serving as the airscrew rear support.

Further the oil flows along the airscrew shaft passage.

Oil is fed through a flat and a special passage in the airscrew shaft to the annular space between the spacer and the airscrew shaft, from the annular space the oil is fed via special passages of the airscrew shaft to the annular groove in the airscrew shaft.

From the annular groove the oil is supplied through the passages in the satellite cage to the satellite pivots. From the satellite pivots the oil is fed through the passages for lubricating satellite needle roller bearings.

The front ball bearing is lubricated with oil fed from the gearbox housing jet.

Other gears and friction parts of the gearbox are lubricated by splashing.

The oil is fed to the speed governor and airscrew as follows.

Oil from the airscrew shaft space is supplied through the longitudinal recess on the airscrew shaft plug surface and radial hole in the airscrew shaft and spacer to the rear annular space formed by the oil transfer bushing. From the annular space the oil flows through the passage in the gearbox housing, mesh filter at the governor inlet to the speed governor.

Oil is delivered from the speed governor to the airscrew and back from the latter to the speed governor through the same route.

With the engine running, oil from the governor is fed to the airscrew and back through the passage in the gearbox housing, which connects the speed governor with the front annular space of the oil transfer bushing. From this space oil is delivered through radial holes in the spacer and airscrew shaft to the longitudinal hole in the airscrew shaft plug and then to the airscrew cylinder.

Oil flowing out from the gaps between friction surfaces of the gearbox parts as well as from the timing mechanism drains down to the oil sump.

Oil from the spaces of the intermediate crankcase, mixture collector and rear cover also flows to the oil sump.

The oil is sucked through the filter with chip detector located in the lower front part of the oil sump, passages of the oil sump, mixture collector and crankcase rear cover by the scavenging section of the oil pump and is fed further through the oil cooler to the oil tank.

During operation of the engine certain amount of gases penetrates from the combustion chamber through the gaps between the piston rings and cylinder sleeves to the crankcase, besides, oil contained in the crankcase partially evaporates owing to high temperature.

The blow-by gases and oil vapour increase pressure inside the crankcase which may lead to oil leakage through the crankcase joints.

To equalize the pressure between the engine crankcase cavities they are interconnected by the breathing holes and to equalize the pressure inside the crankcase with the atmospheric pressure the engine is equipped with two breathing holes, one of which is located in the gearbox housing, and the other on the mixture collector. These holes are connected with the breathing system of the airplane.

Provided in the lower front part of the oil sump is a flange with two studs and a hole which serves for providing airplane breathing during inverted flight.

3. LUBRICATION SYSTEM UNITS

3.1. OIL PUMP MN-14A

The oil pump is intended to deliver oil from the tank to the engine oil gallery and to scavenge oil from the oil sump to the tank.

Specifications

Direction of rotation Left

Drive transmission ratio 1.125

Pump drive shaft speed of rotation:

Maximum (for up to 10 min) 3319 r/min

Minimum 580 r/min

Working fluid Oil MS-20 GOST 21743-76

Pump delivery at drive shaft speed of 2400 r/min:

Delivery section:

At oil pressure of (5 ± 0.2) kgf/cm² in oil gallery and
oil temperature of 50 to 60 °C 516 l/h

At cap plugged and outlet backpressure of
 (6 ± 0.2) kgf/cm² Not less than 900 l/h

Scavenging section at outlet backpressure of
 (1 ± 0.2) kgf/cm² and oil temperature of 75 to 125 °C Not less than 1460 l/h

The oil pump comprises a housing, drive shaft, driven shaft with gear rims, four gears, reducing and check valves, packing gland and other parts.

The pump housing assembly is a magnesium casting comprising scavenging section housing (9) (Ref. Fig. 2), delivery section housing (4), upper cover (14) and lower cover (2).

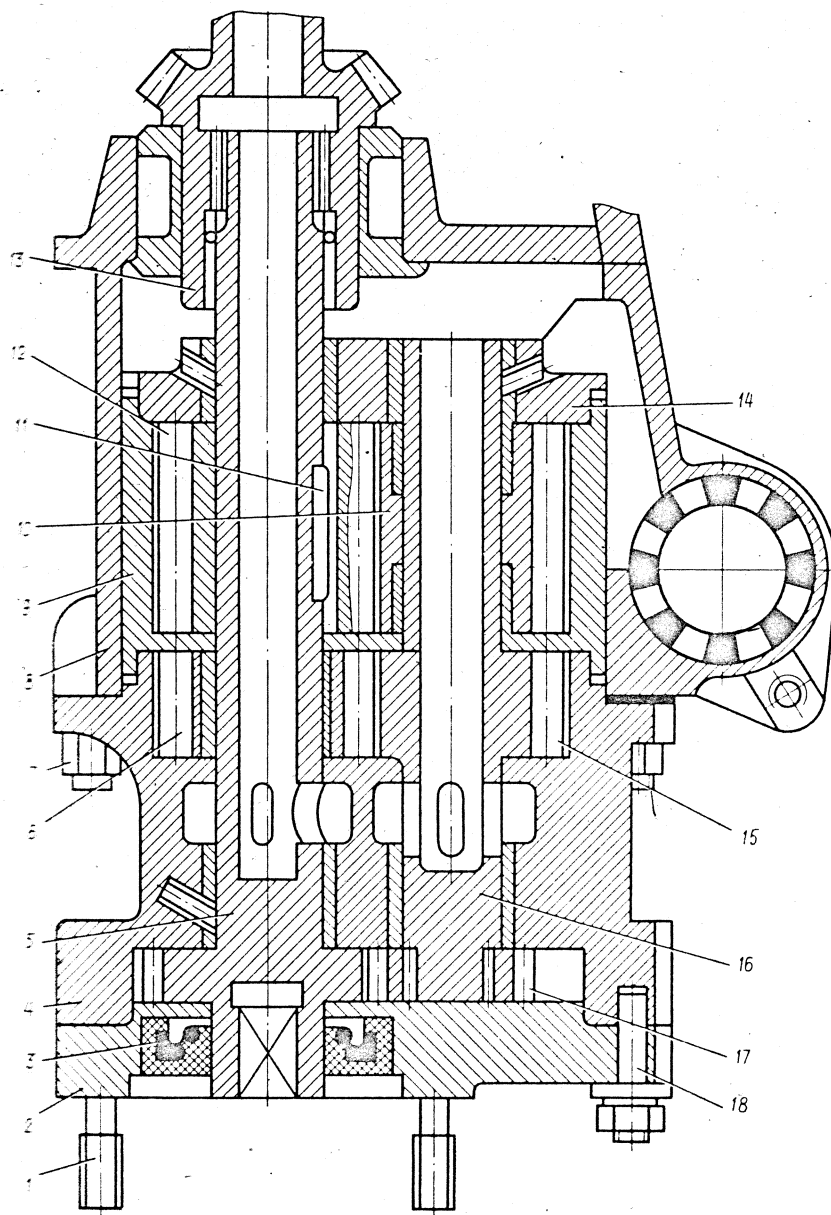
The scavenging section housing has two wells accommodating gears (10) and (12), holes for studs and shafts, holes for inlet and outlet of oil and locating recesses.

The scavenging housing bottom makes the partition between the scavenging and delivery sections.

Delivery section housing (4) has two wells for gears (6) and (15), oil inlet and outlet holes, holes with pressed-in bronze bushings serving as shaft lower bearings, flange with holes for studs (7) adapted to attach the housing to the rear cover and six studs (13) for attachment of lower cover (2).

The lower flange wells accommodate delivery section gearing, reducing and check valves and oil pressure measuring connection.

Housing upper cover (14) has a locating collar, two holes with pressed-in and locked bronze bushings being the pump shaft bearings and four holes for passing studs (11) (Ref. Fig. 3) which secure the pump housings.



- | | |
|----------------------------------|-------------------------------|
| 1. Fuel Pump Attachment Stud | 10. Scavenging Section Gear |
| 2. Lower Cover | 11. Key |
| 3. Rubber Seal with Metal Insert | 12. Scavenging Section Gear |
| 4. Delivery Section Housing | 13. Rear Cover Vertical Shaft |
| 5. Drive Shaft | 14. Upper Cover |
| 6. Delivery Section Gear | 15. Delivery Section Gear |
| 7. Rear Cover Attachment Stud | 16. Driven Shaft |
| 8. Rear Cover | 17. Driven Gear |
| 9. Scavenging Section Housing | 18. Stud |

Oil Pump MN-14A. Longitudinal Section View

Figure 2

Lower cover (2) (Ref. Fig. 2) has a locating collar and is attached by six studs (18) to the delivery section housing. The cover has a flange with four studs (1) to mount the fuel pump and a seat for rubber seal with metal insert (3) which precludes leakage of oil from the oil pump and fuel pump.

The shafts and gears are of steel and have cemented teeth.

Pump drive shaft (5) has a gear rim, splines for connecting with vertical shaft (13) rotating the pump, slot for key (11) of scavenging section gear (12), radial and central holes for delivery of oil through the pump drive shaft to the engine, a square hole shank whereby the fuel pump is rotated.

Driven shaft (16) is made integral with gear (15), its lower end has a splined shank on which gear (17) is installed, meshing with the gear rim of drive shaft (5).

Scavenging section gears (10) and (12) have central holes for mounting on shafts (5) and (16).

Gear (12) includes a slot for key (11) whereby it is connected with drive shaft (5) of the pump.

Pressed in gear (10) are two bronze bushings which allow free rotation of the gear on shaft (16).

Delivery section gear (6) has a central hole with a bronze bushing which allows free rotation of the gear on shaft (5).

The reducing valve assembly (Ref. Fig. 3) comprises a seat pressed in the pump housing, valve (1), bushing (3), spring (2), adjustment screw (7), lock nut (5), cap (8) and gaskets (6). The oil in the delivery section (outlet line) is adjusted to the required pressure by the adjustment screw. If the delivery section pressure exceeds the permissible limit, the valve opens and by-passes excessive oil to the delivery section inlet, thus maintaining constant pressure of oil in the oil system during normal operation of the engine.

The check valve comprises a body, a valve, a guide and a spring. The valve is made of bronze and has a spherical collar whereby it is pressed to the seat in the housing by the spring.

The valve is installed on its guide by the cylindrical hollow shank.

The valve body is a hollow steel part pressed in the delivery section housing.

The valve body has four cutouts on each of two sides to pass flow of oil during operation of the engine.

With the engine inoperative, the check valve precludes flow of oil from the tank to the engine.

When the engine is running, the valve is opened by the oil pressure to pass oil from the pump delivery section to the engine oil system.

3.2. OIL SUMP

The oil sump (Ref. Fig. 4) cast of magnesium alloy is installed between cylinders Nos 5 and 6 and serves as a container to receive oil from the engine.

The oil sump is attached to the intermediate crankcase by two flanges and studs driven into the intermediate crankcase. The flanges have passages to drain oil from the intermediate crankcase.

Besides, the rear flange of the oil sump has an outlet hole of the passage for scavenging oil from the sump, connected to the passages in the intermediate crankcase, mixture collector, diffuser and rear cover.

The top front portion is provided with a flange for mounting the bellows and a round hole to drain oil from the gearbox housing.

The lower part of the oil sump has a flange with three studs to install the adapter of the filter with chip detector and a flange with two studs to connect the pipeline to breath the engine in inverted flight.

3.3. FILTER WITH CHIP DETECTOR

The filter with chip detector is intended to timely warn of troubles linked with failure of parts and to clean oil fed from the engine to the oil pump.

The filter with chip detector comprises a filtering section and a detector section.

The filtering section comprises filter (10) (Ref. Fig. 5) and insulation bushing (3) entering the bore in the oil scavenging passage. The filter is soldered to contact stem (2).

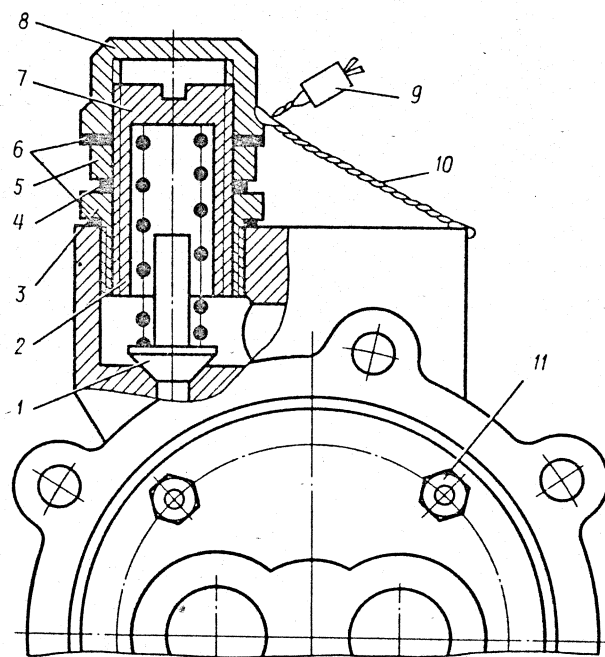
The detector comprises contact stem (2), plate stack (9), rings (8), textolite bushing (6), metal washer (5).

The entire stack is secured on the stem by nut (4). The contact stem carries end piece (1).

Plate stack (9) comprises seventeen brass plates separated from each other by cardboard insulation segments (three segments between two plates).

The insulation segments are attached to the plates by epoxy resin.

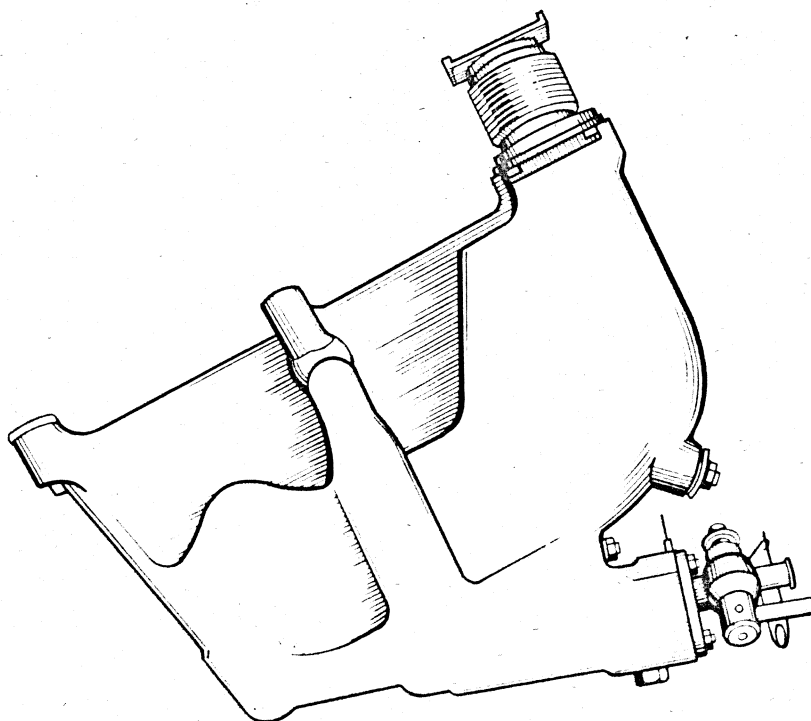
The filter with chip detector is connected to 27-VDC system. Current from the power source is fed to the terminal of end piece (1), passes through contact stem (2), plate stack (9) and body (7) to the oil sump housing. When the gap between the plates is filled with chips, the electric circuit is made and warning light illuminates in the pilot's cabin.



- 1. Reducing Valve
- 2. Spring
- 3. Adjustment Screw Bushing
- 4. Gasket
- 5. Lock Nut
- 6. Gasket
- 7. Adjustment Screw
- 8. Cap
- 9. Seal
- 10. Wire
- 11. Stud

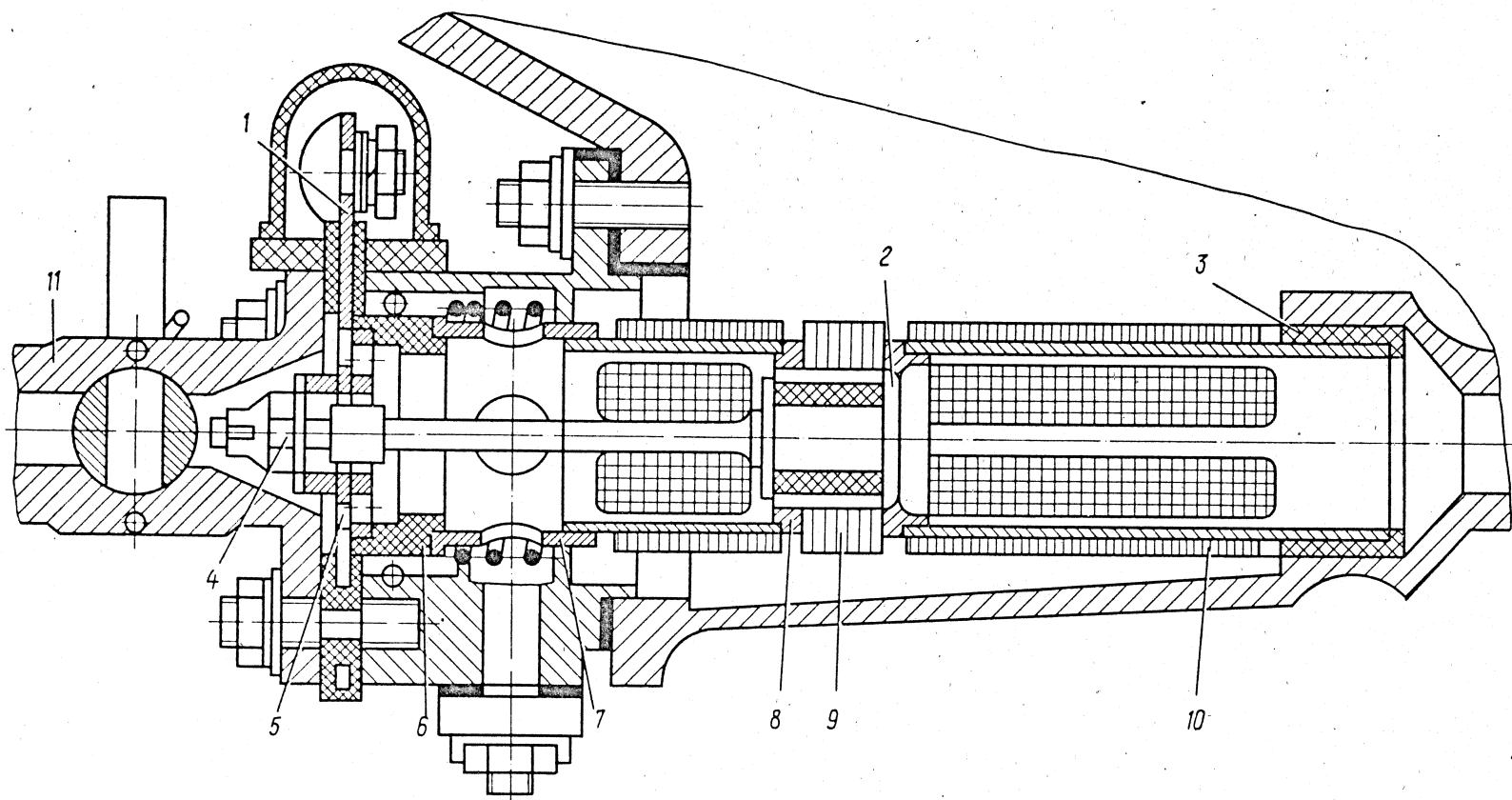
Oil Pump Reducing Valve Assembly

Figure 3



Oil Sump

Figure 4



1. End Piece
2. Contact Stem
3. Insulation Bushing
4. Nut
5. Washer
6. Bushing
7. Body
8. Ring
9. Plate Stack
10. Filter
11. Oil Drain Cock

Filter with Chip Detector
Figure 5