TO M-14P M.S.	TASK CARD No. 203	PAGE(S) 207
M.S. ITEM	PROCEDURE: Installation of Compressed Air Distributor Housing	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
1. Inspect the distributor housing flange and the locating seat on the rear cover and make sure they are free from nicks. T.R. Nicks are not allowed. 2. Install the distributor housing on the engine, having placed paronite gasket coated with sealant "50" under the flange. 3. Install two locks and tighten two housing attachment nuts. 4. Lock the nuts.	Dress nicks	

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Pliers, flat-nosed 150 Wrench 7x9 700880-2	Sealant "50" Wire, locking K0-0.8

TO M-14P M.S.	TASK CARD No. 204	PAGE(S) 209, 210
M.S. ITEM	PROCEDURE: Adjustment of Compressed Air Distributor	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
1. Secure the arrow under the airscrew shaft thrust bearing cover attachment nut and bring it to the scale applied to the flange of the airscrew shaft. 2. Drive out one spark plug from each cylinder (Ref. 074.20.02, Task Card No. 201). 3. Drive in the TDC indicator into the plug hole of cylinder No. 4. 4. Set the piston of cylinder No. 4 to TDC in compression stroke against the TDC indicator. 5. Set the piston of cylinder No. 4 to a position of 12° after the TDC in expansion stroke and then turn the airscrew shaft in its normal direction through 8° after the TDC. NOTE: Align the arrow with the scale zero division beforehand. 6. Set the slide valve in the distributor cover so that the slide valve port closer to the center opens the hole for supply of compressed air to cylinder No. 4 for up to 1 mm (down the direction of slide valve rotation). 7. Assemble the cover. 8. Align the splines of the adjustment coupling with those of the drive shaft repositioning the adjustment coupling in the thrust bearing splines. CAUTION: WHEN ALIGNING THE SPLINES OF THE ADJUSTMENT COUPLING AND DRIVE SHAFT, DO NOT OFFSET THE SLIDE VALVE.		

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
9. Remove the arrow. 10. Drive out the TDC indicator from the plug hole of cylinder No. 4. 11. Reinstall the removed spark plugs (Ref. 074.20.02, Task Card No. 202).		

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Indicator, TDC Pliers, flat-nosed 150 Wrench 19x22 700880-7 Wrench, spark plug 22 15-32-173 Wrench 7x9 700880-2	

TO M-14P M.S.	TASK CARD No. 205	PAGE(S) 211, 212
M.S. ITEM	PROCEDURE: Installation of Cover of Compressed Air Distributor Housing	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
1. Coat the paronite and rubber gaskets with sealant "50" and install them on the distributor housing. 2. Install the housing cover on the distributor housing. 3. Fit the locks, install and tighten three nuts for attachment of the distributor housing cover. 4. Lock the attachment nuts. 5. Install aluminium gaskets and nine pipes for supply of air to the cylinders on the compressed air distributor. 6. Screw on and tighten the caps for attachment of the cylinder air supply pipes. 7. Connect the air supply pipe to the distributor. 8. Check proper installation and adjustment of the compressed air distributor by turning the engine crankshaft (Ref. 072.00.00, Task Card No. 201).		

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Pliers, flat-nosed 150 Wrench 19x22 700880-7 Wrench, spark plug 22 15-32-173 Wrench 7x9 700880-2	Sealant "50" Wire, locking KO-0.8

024.00.00
ELECTRICAL POWER SYSTEM

024.30.00

DC ELECTRICAL POWER SYSTEM

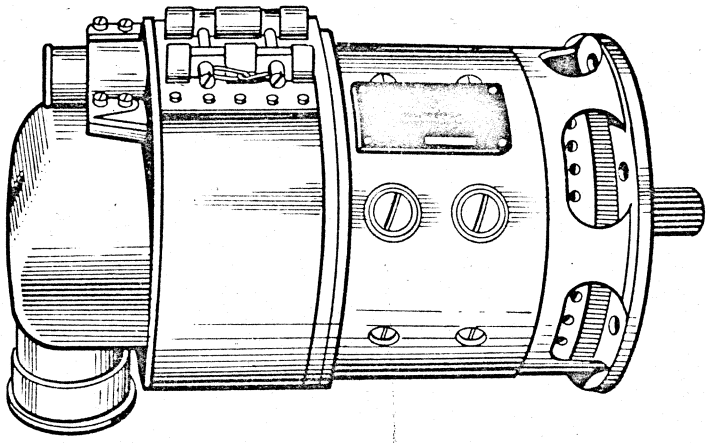
GENERATOR GSR-3000M, SERIES 4 - DESCRIPTION AND OPERATION

1. GENERAL

The GSR-3000M, series 4 generator (Ref. Fig. 1) is intended to feed the airplane electrical system with DC power.

The generator is a shunt-wound four-pole DC machine with four interpoles. The generator is designed for LH rotation (counterclockwise) if viewed from its drive side.

Constructionally the generator is a semi-enclosed electric machine with flange-type mounting and flexible shaft drive. The generator is not protected against ingress of liquid into its interior. The construction of the airplane should ensure such protection.



Generator GSR-3000M, Series 4

Figure 1

2. DESCRIPTION

2.1. CONSTRUCTION

The generator (Ref. Fig. 2) comprises a frame with windings, armature, end shield, and a pipe.

Generator frame (14) serves as a magnetic circuit and carries main poles (13) with field windings (16) and interpoles (2) with windings (1). Bearing (17) is installed in the frame.

Armature (15) has a wave-type winding lodged in slots of lamination stack and interconnected through commutator (11). Flexible shaft (19) is secured by tapered joint inside hollow shaft (18).

End shield (12) is secured to the frame by bolts (20). The inner surface of the end shield carries four brush holders (6). Each brush holder receives two brushes (7) which are pressed to the commutator by helical springs (8) and levers.

Terminal panel (10) is mounted on the end shield. The end shield ports and the panel are closed with protective band (21). Bearing (9) is installed in the end shield.

Cooling pipe (3) is secured to the end shield by a stud and nut (4). The cooling air supply hose is fitted to the pipe.

2.2. SPECIFICATIONS

Voltage	28.5 V
Power (at 30 V)	3 kW
Load current	100 A
Speed of rotation	4000 to 9000 r/min
Duty	Continuous

Permissible overloads:

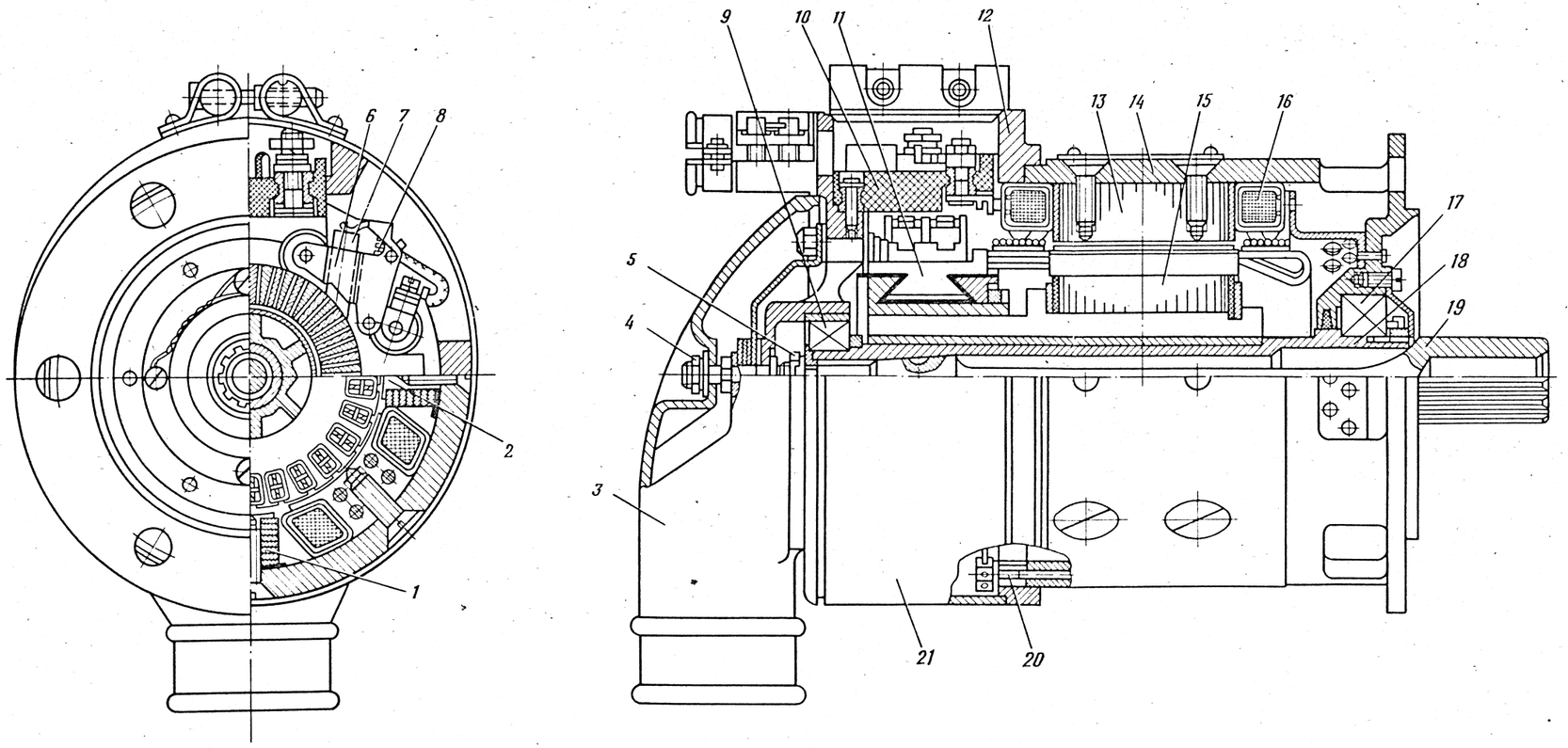
Permissible current at 5000 to 8000 r/min during 1 min	150 A
Permissible current at 5600 to 8000 r/min during 5 s	200 A
Permissible load current without air blowing for 15 min	30 A
Nominal speed of rotation at load of 100 A and voltage of 28.5 V with short shunt (without regulator) when warmed up	Up to 3600 r/min
Forced cooling is carried out by blowing with on-coming non-heated clean air.	
Total air pressure at cooling inlet duct with dynamic pressure at least 50 mm H_2O	At least 150 mm H_2O
Air flow rate at barometric pressure of 760 mm Hg	At least 35 dm^3/s
Mass	Up to 11.6 kg

Winding resistance at 20 °C:

Armature winding	0.024 ohm±10 %
Field winding	2.20 ohms±6 %
Interpole winding	0.0122 ohm

Brushes:

Make	MGS-7I
Number	8 pcs
Overall dimensions	7.2x12x25 mm



1. Interpole Winding
2. Interpole
3. Pipe
4. Nut
5. Nut
6. Brush Holder
7. Brush
8. Spring
9. Bearing
10. Terminal Panel
11. Commutator
12. End Shield
13. Pole
14. Frame
15. Armature
16. Field Winding
17. Bearing
18. Hollow Shaft
19. Flexible Shaft
20. Bolt
21. Protective Band

Construction of Generator GSR-3000M, Series 4

Figure 2

Generator offers trouble-free operation when exposed to the following environmental and mechanical effects:

Relative humidity ..... Up to 98 %

Temperature variations ..... From minus 60 to 50 °C

Mount vibration corresponds to that of the operating engine which carries the generator

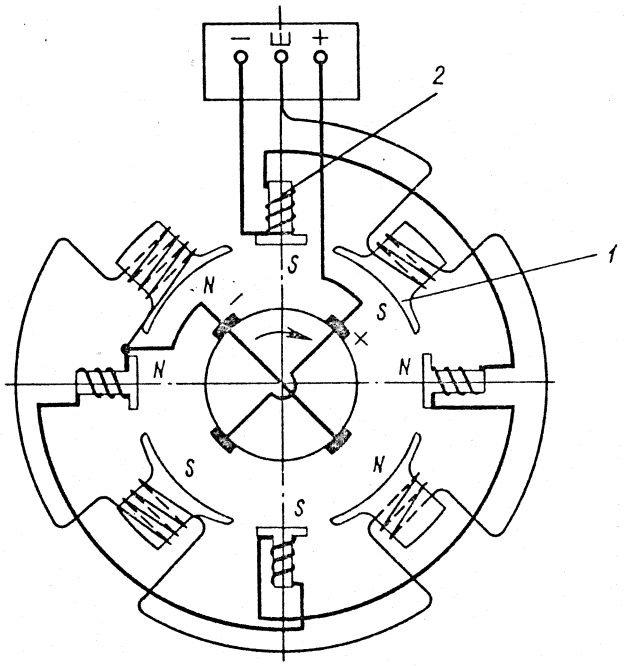
3. OPERATION

As regards its operating principle, the GSR-3000M, series 4 generator does not differ from conventional DC machines.

The generator electric connection diagram is shown in Fig. 3.

When the armature rotates in the magnetic field created by the main poles with field windings, electromotive force is induced in the armature winding. Voltage across the generator terminals is lower than its electromotive force for the value of voltage drop in the armature winding, caused by load current passing through the winding and delivered to the external mains.

Load current passing through the armature winding when the generator operates for the external mains forms armature magnetic field which is stationary in space. This fields acts upon the main pole magnetic field to distort and decrease it (armature reaction phenomenon). To eliminate armature reaction effect, the generator is provided with interpoles whose windings are connected in series with the armature winding. Alternation of polarity of the main poles and interpoles is shown in Fig. 3.



1. Main Pole
2. Interpole

Generator Electrical Connection Diagram
(Commutator Side View)

Figure 3

GENERATOR GSR-3000M, SERIES 4 - TROUBLE SHOOTING

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

Trouble	Possible cause	Correction
1. Generator produces no voltage	(1) Unserviceable brushes:	
	(a) Brushes swell and can hardly be removed from seats, brushes seize in brush holders	Replace brushes
	(b) Brushes hang on pig tail (brushes worn out to length shorter than 17 mm)	Replace brushes
	(2) Damage to field winding. Check field winding resistance:	
	(a) If infinite, field winding circuit is open	Replace generator
	(b) If zero, field winding is shorted	Replace generator
	(3) Polarity reversal of generator.	
	Close terminals "Sh" and "+", connect voltmeter to terminals "+" and "-". If with generator rotating, voltmeter displays reverse readings, generator is remagnetized	Connect storage battery to terminals "Sh" and "-" for 1 to 2 s observing polarity: battery "+" to terminal "Sh", battery "-" to terminal "-"
2. Generator does not produce total voltage or voltage drops under load	(1) Breakdown in field winding.	
	Check resistance of field winding. If it is less than 2.2 ohms$\pm$6 %, field winding is partially shorted	Replace generator

Trouble	Possible cause	Correction
	(2) Breakdown in armature winding. Check generator in operation and inspect commutator after work. If heavy brush sparking is observed during operation of generator and burning of separate bars on commutator with melting out of solder from bar risers are detected, armature is shorted (if solder melts out) or its winding is open	Replace generator
3. Heavy sparking under brushes causing burning of commutator bars	(1) Unseated brushes. Check working surface of brushes. If brushes have non-ground (non-shiny) spots on over 30 % of area, brushes are poorly seated to commutator	Seat and grind brushes
	(2) Damaged brushes. Check brushes. Brushes can hardly be removed from brush holders and have bright friction spots on side surfaces	Replace brushes
	(3) Soiled commutator. Inspect commutator. Black deposit or burning on commutator surface	Wipe commutator with clean cloth slightly moistened in gasoline. If soiling persists, use emery cloth (of glass, grain size up to 8) rotating armature by hand. While doing this, raise brushes
	(4) Increased runout or loosened bars of commutator. Random burning of commutator bars is observed during commutator inspection. Check commutator for runout	Replace generator
	(5) Short circuit in armature winding. Burning of separate bars with melting out of solder from risers of these bars	Replace generator

Trouble	Possible cause	Correction
	(6) Excessive runout of commutator Commutator is grooved by brushes	Replace generator
	(7) Traces of oil on commutator. Check gearbox oil slinger	Eliminate trouble in gearbox oil slinger. Replace generator

GENERATOR GSR-3000M, SERIES 4 - MAINTENANCE PRACTICES

1. LIST OF TASK CARDS

Title	Task Card No.
Servicing	201
Removal/Installation	202
Inspection/Check	203

2. OPERATION PROCEDURE

TO M-14P M.S.	TASK CARD No. 201	PAGE(S) 203 - 206
M.S. ITEM	PROCEDURE: Servicing	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY

1. GENERAL

The following conditions shall be ensured for normal operation of the generator:

Cooling and loading according to "Specifications," Item 2.2.

Protection against ingress of water, oil, snow, dust, corrosive liquids and foreign objects inside the generator.

Accomplishment of scheduled maintenance operations.

2. PREPARATORY OPERATIONS

(1) Remove soiling from the generator outer surface.

(2) Remove the generator from the engine.

(3) Blow the generator interior with compressed air at a pressure of 1 to 2 kgf/cm^2.

(4) Check the brush-commutator assembly for condition; make sure the brush springs and pig tails are intact, the brushes move smoothly in the holders. Check to see that the commutator is free from carbon deposit. The commutator surface should be clean, without soiling or traces of burning. Remove soiling by wiping the commutator with a cloth moistened in clean gasoline. If carbon deposit cannot be removed by gasoline, dress the commutator with glass paper.

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
Inspect working surfaces of the brushes; make sure they are free from chipping. Measure the brush length. The brushes shorter than 17 mm and having chipping should be replaced. Check rotation of the armature with brushes lifted. The armature should rotate freely. 3. CLEANING COMMUTATOR (1) Arrange the generator on the support. (2) Remove the protective band. (3) Blow the generator interior with compressed air at a pressure of 1 to 2 kgf/cm^2. (4) Carefully remove all the brushes from brush holders. (5) Clean the brush holders from dust and soiling with a textolite wedge. Blow the generator to remove brush dust. (6) While turning the armature by the shaft splined end, make sure it rotates freely and without jamming. (7) Clean the commutator bar grooves of dust with a textolite wedge. (8) If carbon deposit or soiling is found on the commutator, wipe it with a clean cloth slightly moistened in clean gasoline and dry in air. Remove soiling that cannot be removed with a cloth, using glass paper. CAUTION: NEVER USE EMERY CLOTH.		

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
When dressing, rotate the generator armature and press a strip of glass paper fitted over a pointed wooden stick to the commutator surface. Move the glass paper with the stick to and fro throughout the commutator length; after cleaning the commutator, carefully blow its interior with clean compressed air at a pressure of 1 to 2 kgf/cm^2. 4. REPLACING BRUSHES (1) Carefully seat the new brushes to the commutator with glass paper. CAUTION: NEVER USE EMERY CLOTH FOR SEATING SINCE FINE EMERY PARTICLES GETTING ON THE SEATED BRUSH SURFACE CAUSE RAPID WEAR OF THE BRUSHES AND COMMUTATOR, DISRUPT BRUSH CONTACT AND MAY LEAD TO PREMATURE FAILURE OF THE GENERATOR. Seat the brushes using the following procedure: Wrap a strip of glass paper, equal in width to that of the commutator, up the latter with abrasive layer outwards so that the strip envelopes the entire outer surface of the commutator. Install the brushes in their holders and carefully lower springs onto them. Rotate the armature with glass paper on the commutator counterclockwise, if viewed from the drive end, till the brushes are fully seated to the commutator around its radius. While seating the brushes, never decrease the brush length for more than 0.5 mm from the original value. (2) Remove the brushes from the brush holders and blow the generator interior through the end shield ports with compressed air at a pressure of 1 to 2 kgf/cm^2. Direct air jet so that the brush dust is ejected from the generator, rather than is forced inside it.		

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
(3) Fit the brushes after seating. The brushes are fitted with the generator run idle in the motor mode at a voltage of up to 15 V. The brushes are considered to be fitted properly if their working surfaces are bright (mirror-like) for at least 85 % of the areas. (4) Blow the generator interior with compressed air at a pressure of 1 to 2 kgf/cm^2 to remove brush dust. NOTE: Operations under Items 3, 4 are carried out according to terms specified in engine Maintenance Schedule. (5) Install the protective band on the generator and tighten it with screws. Lock the band screws with wire. (6) Make an entry on brush replacement in the generator Certificate.		

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Screwdriver 700346 A200x1 Wrenches 14x17 14-232-03 and 7x9 700880-2 Hook, spring lifting (for removing brushes)	Gasoline Nefras-S 50/170 or BR-1, BR-2 Paper, glass, grain size up to 8 Wire DKRM 0.80 L63 Air, compressed

TO M-14P M.S.	TASK CARD No. 202	PAGE(S) 207 - 210
M.S. ITEM	PROCEDURE: Removal/Installation	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY

1. INSTALLATION

(1) Depreserve the generator by wiping its preserved surfaces with a clean cloth moistened in gasoline and then with a dry cloth. Avoid ingress of gasoline inside the generator.

CAUTION: HOT DEPRESERVATION IS NOT ALLOWED.

(2) Inspect the generator to make sure it is free from mechanical defects.

CAUTION: NICKS ON LOCATING SURFACES CANNOT BE ALLOWED.

(3) Install the generator on the drive body having passed six attachment studs through the holes in the body flange and see to it that the generator flexible shaft shank meshes with the intermediate shaft splines.

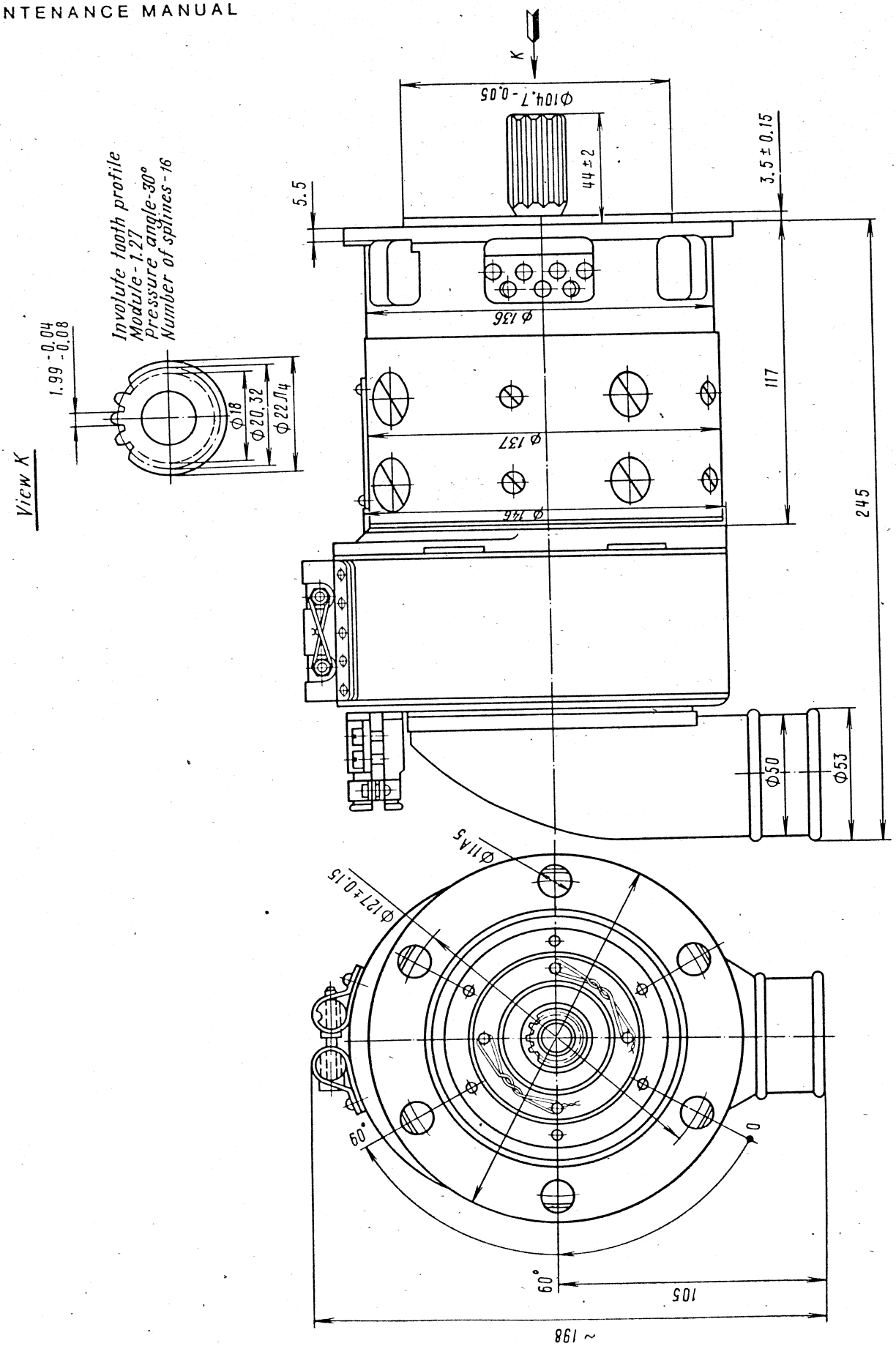
(4) Install six nuts on the studs and cotter-pin them.

(5) Remove the protective band and two clamps.

(6) Connect wires to the generator terminals. Tighten the terminal nuts to ensure reliable contacts.

(7) Install the protective band and clamps on the generator. Lock the screws with wire.

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
(8) Connect the cooling air hose to the generator pipe. Check reliable attachment of the pipe to the end shield. CAUTION: INSTALL THE HOSE ON THE AIRPLANE SO THAT THE GENERATOR IS PROTECTED AGAINST DIRECT INGRESS OF DUST, SNOW, WATER, ETC. (9) Start the engine and check operation of the generator. (10) Overall dimensions of the generator are given in Fig. 201. 2. REMOVAL (1) Remove the protective band and clamps. (2) Disconnect wires from the generator. (3) Install the protective band and clamps on the generator. (4) Disconnect the cooling air hose. (5) Unlock and undo six generator attachment nuts. (6) Remove the generator from the engine.		



Generator Overall Dimensions

Figure 201

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Screwdriver 700346 A200x1 Pliers, flat-nosed 150 Wrench 14x17 14-232-03 Wrench 7x9 700880-2 Wrench 17x19 UB-24-07 Wrench, socket 14 UB-24-16	Gasoline Nefras-S 50/170 or BR-1, BR-2 Wire DKRM 0.80 L63 Cloths

TO M-14P M.S.	TASK CARD No. 203	PAGE(S) 211, 212
M.S. ITEM	PROCEDURE: Inspection/Check	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY

CAUTION: PERFORM OPERATIONS OTHERWISE SPECIFIED WITHOUT REMOVING THE GENERATOR FROM THE ENGINE.

(1) Check attachment of the generator, make sure the generator-to-engine attachment nuts are reliably tightened.

(2) Clean the outer surfaces of soiling, check to see that the generator surface is free from mechanical defects, the air intake hose and pipe are reliably secured.

(3) Remove the protective band from the generator and check reliable contacts of all current-carrying wires.

(4) Check easy movement of the brushes in the holders, condition of the commutator, good repair of brush springs. Measure the maximum brush length. Replace the brushes shorter than 17 mm or having chipping with new brushes of the same make taken from the SPTA set.

NOTE: To preclude hanging of brushes and damage to the commutator, take into account intensity of brush wear during preceding operation period and leave in the generator the brushes of such a length that will suffice to last up to the next scheduled maintenance.

CAUTION: REPLACE BRUSHES ONLY WITH THE GENERATOR REMOVED FROM THE ENGINE. SEAT AND FIT THE NEW BRUSH SET TO THE COMMUTATOR.

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Screwdriver 700346 A200x1 Pliers, flat-nosed 150 Wrench 14x17 14-232-03 Wrench 17x19 UB-24-07 Wrench, socket 14 UB-24-16 Caliper, vernier	Wire, locking K0-0.8 Cloths Brush, hair Paper, glass,grain size up to 8

061.00.00
AIRSCREW

061.20.00

CONTROL

CONSTANT SPEED GOVERNOR R-2, SERIES 04 - DESCRIPTION AND OPERATION

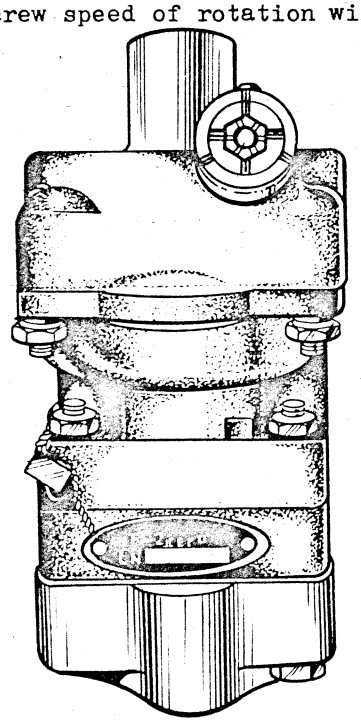
1. GENERAL

The R-2, series 04 airscrew constant speed governor (Ref. Fig. 1) is a unit intended to automatically control the hydraulic airscrew.

The R-2, series 04 governor is designed for operation on the M-14P engine with airscrew V530TA-D35 and ensures accomplishment of the following functions:

Automatic maintenance of the preset airscrew speed of rotation by varying its pitch.

Positive change of the airscrew speed of rotation within the operating range from 900 to 1940 r/min.



Constant Speed Governor R-2, Series 04

Figure 1

2. DESCRIPTION

2.1. SPECIFICATIONS

Type	R-2, series 04
Drive	From engine
Direction of rotation	RH if viewed from governor drive end
Engine crankshaft-to-governor drive transmission ratio	1.045

Governor drive shaft rotational speed ensuring stable operation of engine	1400 to 3085 r/min (engine speed in this case is 1340 to 2950 r/min)
Operating principle	Centrifugal-hydraulic
Operation pattern	One-way, positive
Working fluid	Oil MS-20 GOST 21743-76 from engine delivery line
Oil pressure at governor pump inlet:	
Operating conditions	3 to 4.5 kgf/cm^2
Idling	At least 1 kgf/cm^2
Maximum pressure at governor outlet at n = 2500 r/min, zero flow and oil temperature of 85 to 90 °C	(15 ± 1) kgf/cm^2
Oil temperature at governor inlet:	
Minimum permissible	40 °C
Recommended	50 to 65 °C
Maximum permissible	90 °C
Maximum temperature at governor outlet	100 °C
Oil leakage through gaps at n = 2500 r/min, zero flow and temperature of 85 to 90 °C:	
At acceptance tests	Up to 1.5 l/min
By end of service life	Up to 2 l/min
Governor oil pump output at n = 2500 r/min, outlet pressure P = 8 kgf/cm^2 and temperature 85 to 90 °C	Not less than 7.5 l/min
Governor dry mass	$(1.7^{+0.3})$ kg

2.2. CONSTRUCTION

The mechanism of the R-2, series 04, governor (Ref. Fig. 2) comprises the following assemblies:

Governor body (1).

Oil pump body (2).

Transmission body (6)

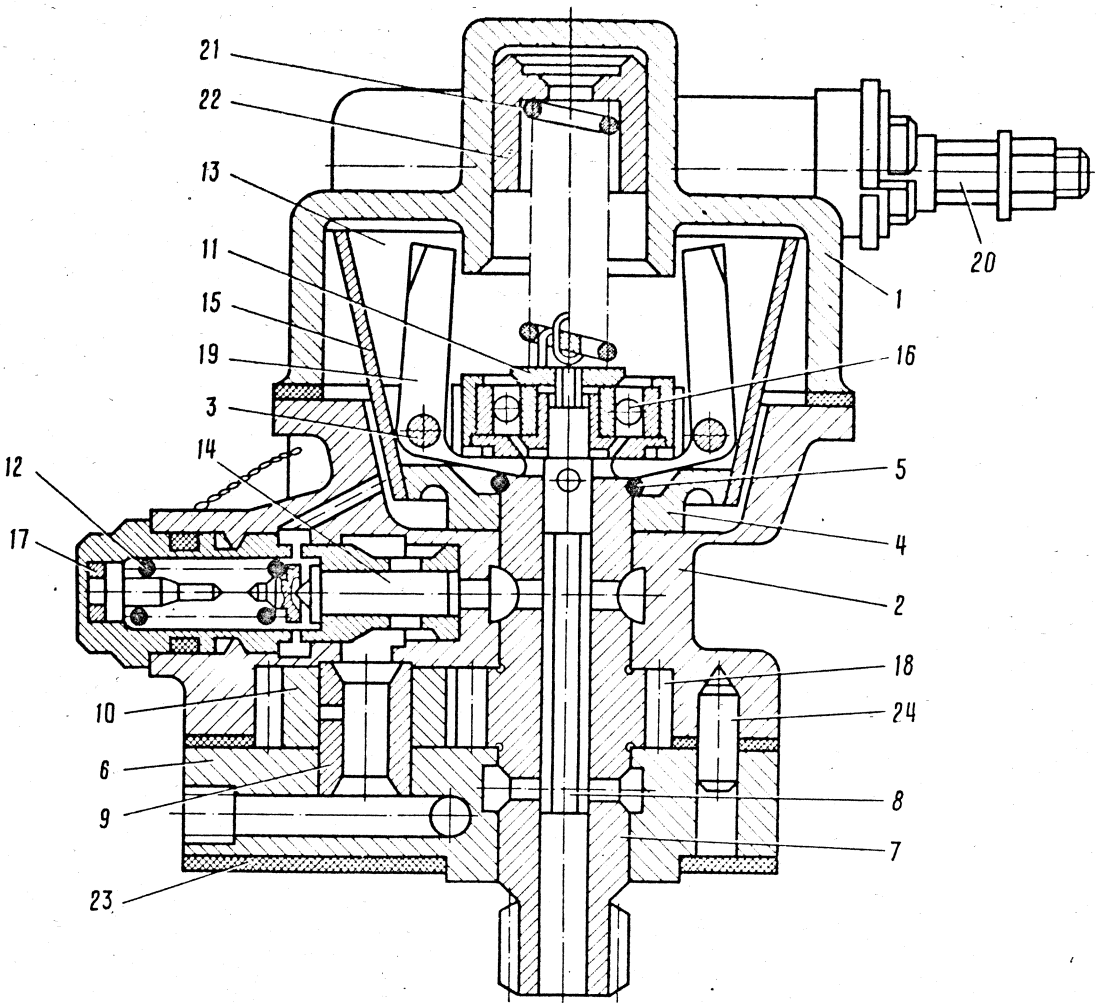
All the governor parts are housed in these three assemblies.

2.2.1. Governor Body

Governor body (1) accommodates a slide valve assembly and control shaft (20).

The slide valve assembly controls distribution of oil flow and comprises slide valve (8) movable inside drive shaft (7).

The slide valve has two shoulders.



1. Governor Body
2. Oil Pump Body
3. Weight Pivot
4. Bracket
5. Retaining Ring
6. Transmission Body
7. Drive Shaft
8. Slide Valve
9. Driven Gear Axle
10. Driven Gear
11. Nut
12. Reducing Valve Spring
13. Centrifugal Governor Assembly
14. Reducing Valve
15. Cup
16. Ball Bearing
17. Adjustment Washer
18. Drive Shaft Gear
19. Weight
20. Control Shaft
21. Slide Valve Spring
22. Gear Rack
23. Drive Gasket
24. Pin

Speed Governor R-2, Series 04, Sectional View

Figure 2

The lower shoulder controls supply of oil to the airscrew cylinder, the upper shoulder serves as a seal to preclude ingress of high-pressure oil to the centrifugal governor chamber.

Installed on the upper shoulder of the slide valve is ball bearing (16) whose inner race is pressed to the shoulder by nut (11). The outer race contacts the short arms of weights (19).

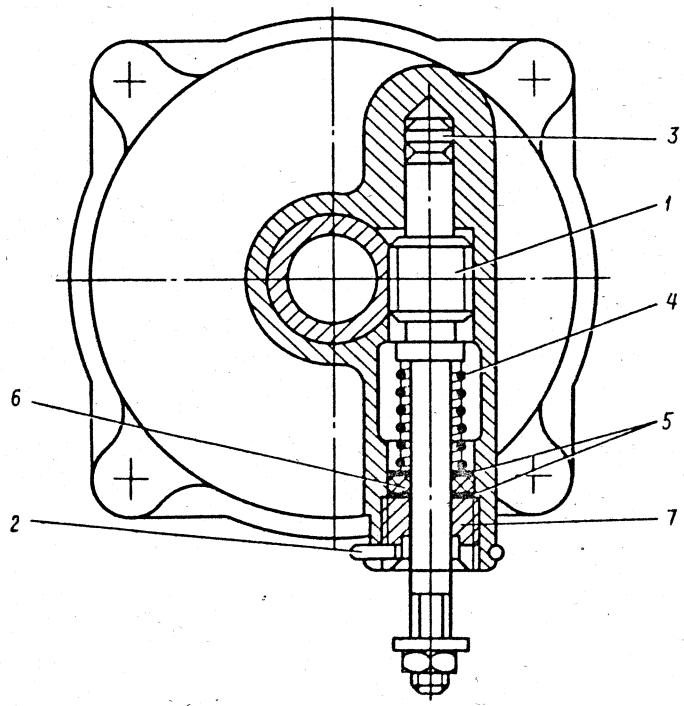
Rotation of drive shaft (7) sets to rotation the centrifugal assembly which thrusts by the ends of the weight short arms against the face of the ball bearing outer race and rotates the latter, whereas the inner race of the bearing and the slide valve are kept against rotation by the centrifugal mechanism spring disposed between the slide valve and the rack.

Rack (22) meshes with the gear of control drive shaft (20).

Control shaft (1) (Ref. Fig. 3) is made integral with a gear meshing the rack teeth.

Number of teeth Z = 12, module m = 1.

The control shaft is arranged in a side bore of the governor body. The shaft rests on end bearing (3) with one end and on sliding bearing (7) with the other end. The sliding bearing is screwed into the body and is locked in it by retaining ring (2), entering the slots in the body and bearing. The shaft is sealed in the body by sealing ring (6) pressed to the bearing face by spring (4) through slip washer (5). The other end of the spring thrusts against the shaft collar to press the shaft to end bearing (3) installed in the body.



1. Control Shaft
2. Retaining Ring
3. End Bearing
4. Spring
5. Slip Washer
6. Sealing Ring
7. Sliding Bearing

Governor Body Unit

Figure 3

The hex end of the shaft protruding from the body receives a roller or remote control lever.

The governor body is connected with the oil pump body by four studs driven into the governor body bosses. The joint of the bodies is sealed by a paronite gasket.

2.2.2. Oil Pump Body

The oil pump body accommodates the oil pump and reducing valve.

The gear-type oil pump comprises two gears - a drive gear and a driven gear.

Drive gear (18) (Ref. Fig. 2) is made integral with drive shaft (7) installed in the oil pump body and in the gearing body.

Driven gear (10) is mounted on axle (9) press-fitted in the transmission body.

The drive gear axle has a center hole for by-passing oil from the reducing valve to the governor pump inlet.

A lateral hole is made in the axle for lubrication of working surfaces of the driven gear, and its axle.

Drive shaft (7) has a central axial hole where slide valve (8) moves with a small radial clearance. Two upper holes in the drive shaft connect the axial hole with the delivery space of the governor pump; six lower holes connect the axial hole of the drive shaft with the airscrew cylinder when the slide valve is lowered.

The drive shaft lower end is splined for coupling with the engine gearbox drive coupling whereby the drive shaft is rotated. The upper end of the shaft has a flat for mounting centrifugal governor assembly (13) and a groove for retaining ring (5) preventing the centrifugal governor assembly from longitudinal displacement. Bracket (4) of the centrifugal governor assembly has a hole for its installation on the drive shaft upper end which drives the centrifugal governor assembly.

Two weights (19) are installed on steel pivots (3) in the slots of bracket lugs. The weights are free to turn on the pivots compressing or releasing spring (21).

Fitted to the tapered outer surface of the bracket is thin-walled steel cup (15) beaded into the groove of bracket (4) and spot welded to the latter.

The cup limits weight travel when speed of rotation reaches the preset value and, additionally, while carrying the oil contained in it, eliminates friction of the weights against stationary oil.

A plunger-type reducing valve is installed in a lateral bore of the oil pump body. The reducing valve comprises a guide bushing pressed in the oil pump body, valve (14) with spring (12), a cover and washer (17).

Spring tension is adjusted by selecting washer (17) for maximum oil pressure.

2.2.3. Transmission Body

Transmission body (6) is the lower cover of the oil pump and the flange for mounting the governor on the engine gearbox case.

Oil is fed from the engine to the governor and from the governor to the airscrew via internal routes for which purpose the transmission body flange has three holes (1), (2), (4) (Ref. Fig. 4).

The transmission body and oil pump body are interconnected by two coupling screws (3), (5). The joint between the oil pump and transmission bodies is sealed by a silk thread placed on sealant between the bodies.

3. OPERATION

The R-2, series 04, governor operates only with direct-action airscrew at one-way regulation scheme.

The airscrew blades are shifted to a smaller pitch by the pressure of oil fed by the governor to the airscrew cylinder.

Shifting to a higher pitch is performed by counterweights installed on the airscrew blades; in this case the governor returns oil from the airscrew cylinder to the engine gearbox case.

3.1. ENSURING CONSTANT PRESET SPEED OF ROTATION OF AIRSCREW AND POWERPLANT

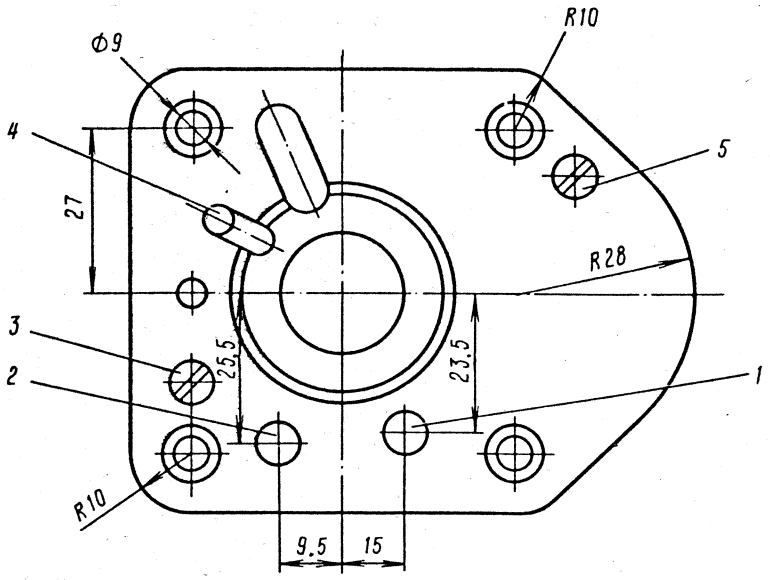
With the governor operating, the oil from the engine line is fed to the locating flange of the governor and then via passage (8) (Ref. Fig. 5) to the inlet of oil pump (7).

The pump increases the oil pressure to a value required for normal operation of the airscrew and feeds oil to the space between two shoulders of slide valve (6) from which it is fed to the airscrew for changing its pitch.

Fig. 5 shows schematic diagram of governor operation under steady-state conditions when the engine power and progressive speed of the airplane remain constant and the governor maintains the required constant speed of the engine.

Under steady-state conditions rotating weights (2) are forced by centrifugal effect to turn on their axles and lift slide valve (6) upward, while spring (3) of the governor forces the slide valve down. Thus, position of slide valve (6) is determined by relation between centrifugal forces of weights (2) and force of spring (3).

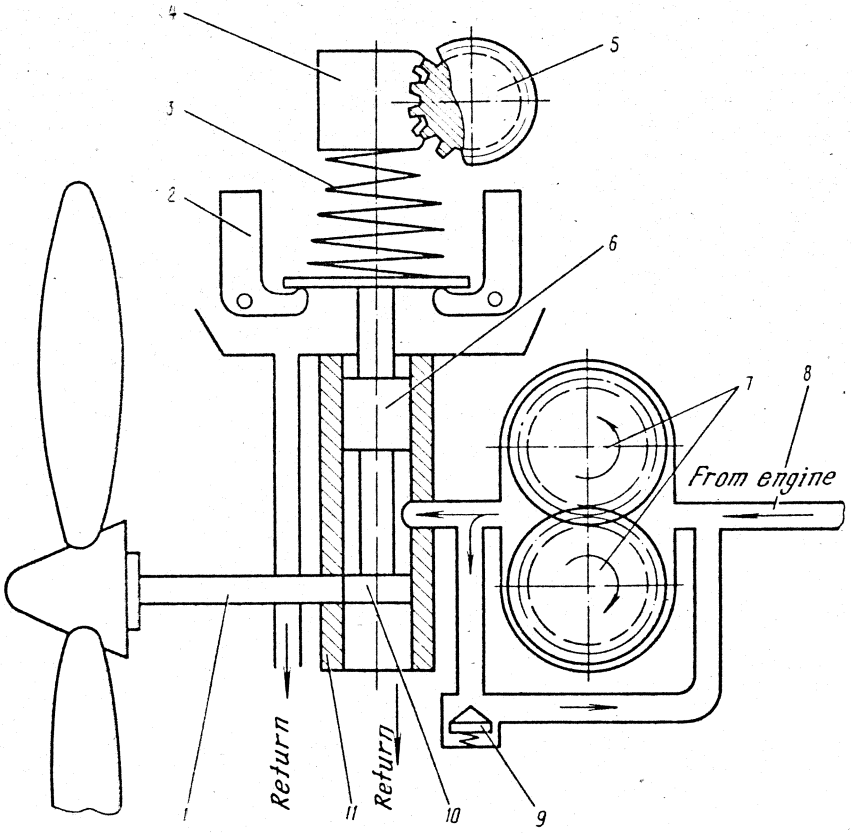
In the case being discussed the spring tension force is equal to the weight centrifugal force.



1. Hole to Supply Oil from Engine to Governor
2. Hole to Supply Oil from Governor to Airscrew
3. Coupling Screw
4. Hole for Returning Oil from Governor to Engine Crankcase
5. Coupling Screw

Governor Locating Flange

Figure 4



1. Passage between Governor and Airscrew
2. Weight
3. Spring
4. Toothed Rack
5. Control Shaft
6. Slide Valve
7. Oil Pump
8. Passage to Supply Oil from Engine to Governor
9. Reducing Valve
10. Slide Valve Shoulder
11. Drive Shaft

Governor Operation Diagram for Equilibrium Speed of Rotation (Steady-State Conditions)

Figure 5

Thus, shoulder (10) of slide valve (6) seals off passage (1) connecting the governor with the airscrew. The oil contained in the airscrew space is confined within the latter.

Acted upon by the centrifugal force moments of the counterweights installed on the blade sleeves, the blades tend to turn towards higher pitch, but the oil retained in the airscrew cylinder precludes them from turning so that the pitch remains constant.

Since airscrew pitch change oil flow is zero, the oil from the governor pump is pumped through reducing valve (9) back to the inlet to the governor pump.

If with changing of flight conditions or engine rating the airscrew speed drops, the speed of rotation of the centrifugal governor and centrifugal force of its weights drop accordingly.

Thus, slide valve (6) is made by excessive force of spring (3) lower down (Ref. Fig. 6).

As slide valve (6) moves down, passage (1) gets connected with the governor oil pump high-pressure space. The oil is fed via passage (1) to the airscrew to decrease its pitch.

As the airscrew pitch decreases, the engine speed starts rising, centrifugal force of weights (2) increases and the weights overcome the force of spring (3), move slide valve (6) upward to the initial equilibrium position (Ref. Fig. 5).

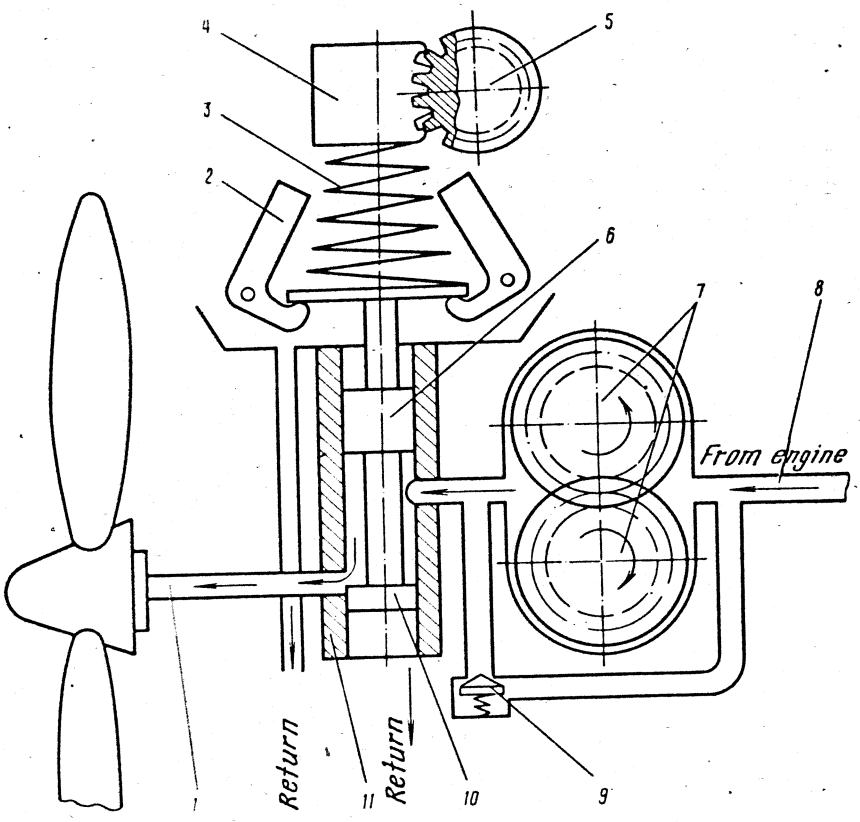
Depending on the rate of deviation of the airscrew speed of rotation from the equilibrium speed, when the mismatch is eliminated the slide valve may overshoot the equilibrium position upward and then downward but the entire system will be balanced in one or two such overshoots.

If the engine speed increases for some reasons, the speed of rotation of drive shaft (11) (Ref. Fig. 7) of the governor increases as well, hence the speed of centrifugal governor weights (2) secured on the shaft.

As the weight speed increases, weight centrifugal force rises to exceed the force of spring (3). Excessive force will move the weights aside from each other and their short arms will compress the spring while lifting slide valve (6). As slide valve (6) moves upward, passage (1) gets connected with the return line leading to the engine gearbox case. Oil will flow to the return line from the airscrew cylinder.

The counterweight centrifugal forces will move the airscrew blades towards higher pitch.

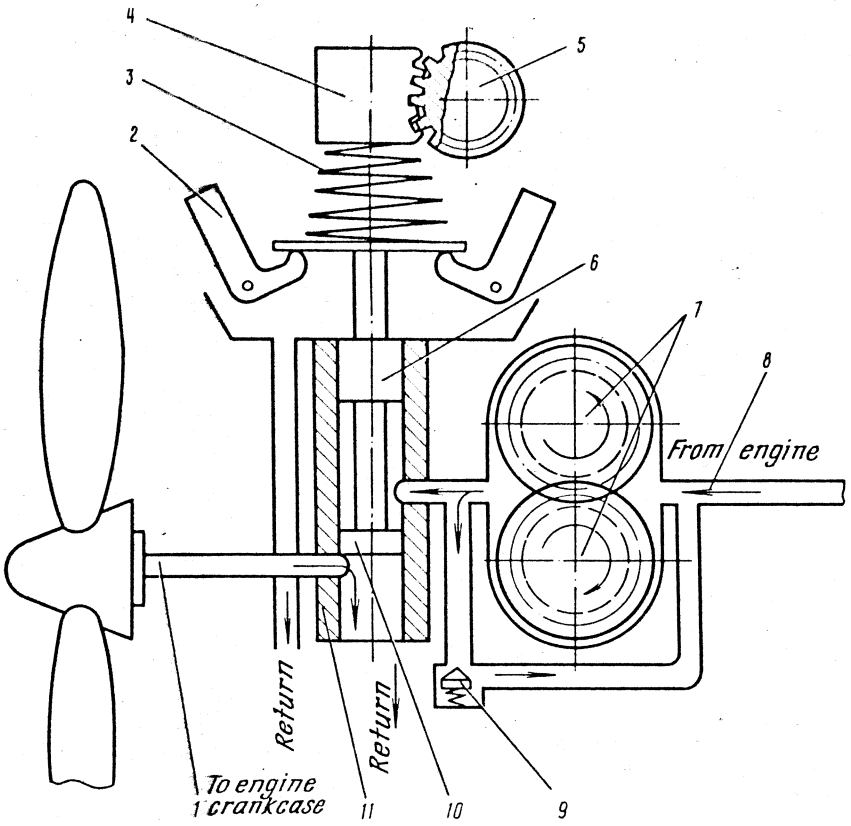
As the airscrew pitch increases, the engine speed drops down, centrifugal force of weights (2) reduces and spring (3) lowers slide valve (6) to the initial position whereat oil return from the airscrew cylinder ceases and the airscrew again runs at preset equilibrium speed of rotation (Ref. Fig. 5).



1. Passage between Governor and Airscrew
2. Weight
3. Spring
4. Toothed Rack
5. Control Shaft
6. Slide Valve
7. Oil Pump
8. Passage to Supply Oil from Engine to Governor
9. Reducing Valve
10. Slide Valve Shoulder
11. Drive Shaft

Governor Operation Diagram for Decreasing Engine Speed

Figure 6



1. Passage between Governor and Airscrew
2. Weight
3. Spring
4. Toothed Rack
5. Control Shaft
6. Slide Valve
7. Oil Pump
8. Passage to Supply Oil from Engine to Governor
9. Reducing Valve
10. Slide Valve Shoulder
11. Drive Shaft

Governor Operation Diagram for Increasing Engine Speed

Figure 7

As speed of rotation restores to the preset one, overadjustment can also take place, i.e. the slide valve may overshoot the equilibrium position one or two times.

3.2. FORCED CHANGE OF PRESET SPEED OF ROTATION OF AIRSCREW AND ENGINE

3.2.1. Change of Engine Speed of Rotation

The airscrews are adapted for changing the engine speed of rotation upon the pilot's will both in flight and on the ground without touching the throttle quadrant. The engine speed is changed by varying spring tension. To achieve this, the governor is provided with toothed rack (4) (Ref. Fig. 5) meshing with control shaft (5) carrying a roller or lever.

In its turn the roller or lever is connected by a rod or cable with a control knob.

When the governor control knob is pulled, shaft (5) turns clockwise. Rack (4) lifts to decrease spring tension so that the engine equilibrium speed of rotation decreases since spring tension force will become equal to weight centrifugal force at lower speed of rotation of the governor drive shaft.

When the control knob is pushed, shaft (5) turns counterclockwise. Rack (4) lowers to increase tension of the spring so that the equilibrium speed of rotation rises, since spring tension force and weight centrifugal force will become equal to each other at a higher speed of rotation of the governor drive shaft.

3.2.2. Shifting Airscrew Blades to Lower Pitch

To shift the airscrew blades fully to low pitch, push the governor control knob all the way forward. Now shaft (5) (Ref. Fig. 6) turns counterclockwise up to the low pitch stop. The spring makes governor slide valve (6) move to the lowermost position whereat high pressure oil from the governor pump is fed to the airscrew through passage (1) for shifting the blades fully to low pitch, which corresponds to maximum speed of rotation of the engine.

3.2.3. Shifting Airscrew Blades to Higher Pitch

To shift the airscrew blades fully to high pitch (decrease engine speed of rotation) without touching the throttle quadrant, pull the governor control knob all the way backward.

Now the control shaft gear turns clockwise up to the high pitch stop. Rack (4) (Ref. Fig. 7) moves upward and the weights shift governor slide valve (6) to the uppermost position whereat the airscrew cylinder space is connected via passage (1) with the return line and the counterweight centrifugal forces move the airscrew blades fully to high pitch which corresponds to minimum speed of rotation.

CONSTANT SPEED GOVERNOR R-2, SERIES 04 - MAINTENANCE PRACTICES

1. LIST OF TASK CARDS

2. OPERATION PROCEDURE

TO M-14P M.S.	TASK CARD No. 201	PAGE(S) 203
M.S. ITEM	PROCEDURE: Removal	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
1. Unlock and undo the attachment nut of the governor control roller and remove the roller. 2. Undo four governor attachment nuts. 3. Remove four flat and four split washers. 4. Remove the governor from the engine. 5. Remove the gasket. 6. Install the governor on the support and secure it to the latter by shipping bolts.		

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Pliers, flat-nosed 150 Screwdriver 700345 A150x0.5 Wrench 11x14 14-24-861 Wrench 9x11 700002	

TO M-14P M.S.	TASK CARD No. 202	PAGE(S) 205
M.S. ITEM	PROCEDURE: Depreservation of New Governor	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
1. Unpackage the new governor. 2. Make sure governor seals and locks are not missing. 3. Undo four nuts, remove shipping covers and support from the governor. 4. Refer to the governor Certificate to make sure the latter is assembled for RH rotation. 5. Depreserve the governor by removing preservation compound from its outer surfaces by a brush or cloth moistened in gasoline. CAUTION: ENSURE AGAINST INGRESS OF GASOLINE ON THE SEALING RUBBER COLLAR OF THE CONTROL SHAFT. 6. Wipe the outer surfaces with a clean dry cloth.		

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Wrench 11x14 14-24-861 Pliers, flat-nosed 150	Gasoline Nefras-S 50/170 or BR-1, BR-2 Brush, hair Cloths

TO M-14P M.S.	TASK CARD No. 203	PAGE(S) 207, 208
M.S. ITEM	PROCEDURE: Installation	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
1. Inspect the mating planes of the governor and engine, drive coupling splines and governor shank. T.R. Nicks are not allowed.	Dress nicks	
2. Check ease of rotation of the governor drive shaft by rotating it by the drive coupling at an ambient temperature of not below 8 °C T.R. The governor drive shaft should rotate smoothly without jamming.	Replace governor in case of jamming	
3. Install the governor on the drive studs without a gasket and make sure the lower flange tightly and without gaps adjoins to the drive plane.		
4. Remove the governor from the drive.		
5. Place the governor gasket coated with sealing on the drive with aligning oil passage holes.		
6. Install the governor on the engine so that the shank splines freely enter the drive coupling by slightly turning the engine crankshaft by the airscrew.		
7. Place four flat and four split washers and tighten four nuts which secure the governor to the engine.		

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Wrench 11x14 14-24-861 Pliers, flat-nosed 150 Screwdriver 700345 A150x0.5 Wrench 9x11 700002	Sealant "50"

TO M-14P M.S.	TASK CARD No. 204	PAGE(S) 209 - 211
M.S. ITEM	PROCEDURE: Adjustment of Governor on Engine	

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
1. Set the governor control lever in the pilot's cabin to the extreme position corresponding to the airscrew maximum pitch.		
2. Turn the governor control shaft all the way clockwise (the spring is fully released).		
3. Fit the roller on the control shaft hex so that the hole intended to attach the cable is at the point of cable contact on the roller.		
4. Secure the roller in this position on the shaft.		
5. Adjust the cable length and secure it on the governor roller.		
6. Check operation of the governor control system and make sure the governor control shaft turns through a complete angle of about 160° without plays, jamming or dead sectors. T.R. Plays, jamming or dead sectors are not allowed.	Eliminate plays and jamming by adjusting rods, cables	
7. Start and warm up the engine (Ref. 072.00.00, Task Cards Nos 201, 202).		
8. Check operation of the governor and its control linkage by changing over the airscrew from low to high pitch and check operation of the airscrew and governor at equilibrium speed of rotation (Ref. 072.00.00, Task Card No. 202).		

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
NOTE: The adjustment is regarded to be completed if with throttle fully open and the governor control lever set to the low pitch stop, the engine gains a speed of 99 % (2900 r/min) and when the lever is shifted to the high pitch from nominal rating II 70 % (2050 r/min), the speed of rotation drops drastically to 53 %. 9. Set the low pitch limit stop of the governor control system, adapted to preclude engine overspeeding above the specified take-off RPM of 99 %, to which end: (1) Accomplish a flight maintaining the crankshaft speed of up to 99 %. (2) Note the position of the speed governor control lever at a fully open throttle corresponding to n = 99 %. (3) After landing and shutting down the engine, set the governor control lever to the position marked in flight with the throttle being fully open (99 %). (4) Leave the low pitch limit stop in this position. NOTES: 1. When setting the speed governor control lever in the pilot's cabin to the maximum speed of rotation, the governor roller should be short of the extreme position for about 5°. 2. When setting the engine speed limit stop, clicking of rack and shaft teeth cannot be allowed. 3. If the airscrew cylinder is damaged in flight, immediately set the governor control lever to the high pitch position to preclude leakage of oil. 4. If oil leaks through the flange, tighten the governor attachment nuts. If trouble persists, replace gasket (part K8936) taken from the individual SPTA set.		

OPERATIONS AND TECHNICAL REQUIREMENTS	CORRECTIVE ACTIONS	CHECKED BY
5. If oil leaks through the control shaft, remove retaining ring (2) (Ref. Fig. 3) and tighten up bearing (7). If trouble persists, replace sealing ring (6) (part PN1-1513) with the ring taken from the SPTA set. Lock the bearing with retaining ring (2).		

TEST EQUIPMENT	TOOLS AND FIXTURES	MATERIALS
	Wrench 9x11 700002 Wrench 11x14 14-24-861 Pliers, flat-nosed 150	

CONSTANT SPEED GOVERNOR R-2, SERIES 04 - STORAGE INSTRUCTIONS

1. STORAGE

The governor which is not meant for immediate installation on the engine should be stored preserved in closed racks in a clean, dry, heated room at an air temperature of 10 to 30 °C and relative humidity of 45 to 70 %.

CAUTION: IT IS PROHIBITED TO STORE ACIDS, ALKALIS, CHARGED STORAGE BATTERIES AND OTHER CORROSIVE SUBSTANCES IN THE ROOM WHERE GOVERNORS ARE KEPT.

The governor prolonged storage term (in the original packaging) is given in its Certificate. The governor mounted on the engine shall be stored and shipped according to the Maintenance Manual for the respective engine.

The governor unpackaged or removed from the engine shall be stored for a period of up to 1 year in sealed packaging and individual container protected against corrosive substances, jolting and vibration.

2. PRESERVATION

The governor and its spares delivered for pre-storage preservation shall be preserved not later than in 24 h after the moment of acceptance. The preservation room temperature should be 10 to 35 °C, relative humidity up to 70 %. At an ambient temperature below 10 °C, the governor, spares and tools carried to the preservation room shall acquire the room temperature of 10 to 35 °C, whereafter the preservation procedure may be started.

All the materials used for preservation and depreservation shall be periodically subject to laboratory tests to confirm their suitability.

Preservation steps should follow one another without intervals.

Corrosion traces, fat stains, soil and moisture are not allowed on surfaces of the item and parts to be preserved.

Wipe the outer surfaces of the item and spares twice with clean cloths generously soaked in gasoline Nefras-S 50/170 or BR-1, BR-2, then with clean dry cloths. Dry in the air for 15 to 20 min and preserve them immediately.

CAUTION: NEVER DRY THE ITEMS IN ELECTRIC OVENS. NEVER TOUCH THE WASHED AND WIPED ITEMS WITH UNGLOVED HANDS. USE KNITTED, CLOTH GLOVES, PARAFFINED PAPER OR APPROPRIATE APPLIANCES.