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DATSUN SPORTS 2000

U20 ENGINE and 5-SPEED TRANSMISSION

SERVICE MANUAL

Publication Number: 47121

SERVICE MANUAL

U20 ENGINE and 5-SPEED TRANSMISSION

for
DATSUN SPORTS 2000

NISSAN MOTOR CO., LTD.

TOKYO, JAPAN

SERVICE MANUAL

U20 ENGINE AND 5-SPEED TRANSMISSION FOR DATSUN SPORTS 2000

NISSAN MOTOR CO., LTD.

6-17-1 GINZA CHUOKU
TOKYO, JAPAN

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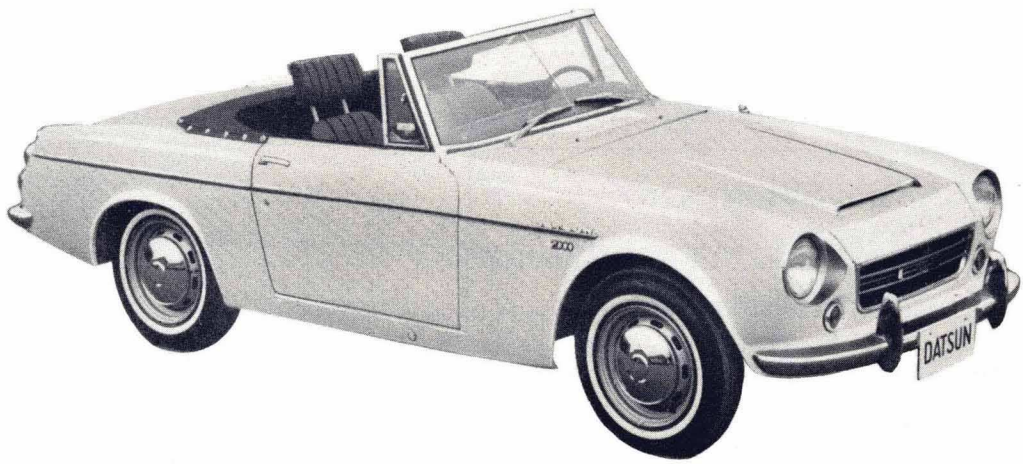
FOREWORD

The service procedure and Specifications Contained in this manual are outlined for MODEL U20 ENGINE & FS5C71A TRANSMISSION equipped in DATSUN SPORTS 2000 MODEL SR311 Series.

Since proper maintenance and service are most essential to satisfy our customers by keeping their cars in the best condition, this manual should be carefully studied.

The specifications and adjustments contained in this manual were in effect at the time of publication. Nissan Motors reserves the right to change specifications or design without notice or incurring obligation.



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GENERAL INFORMATION

GENERAL INFORMATION

SPECIFICATIONS

Item \ Model				SP(L)311-(U)	SR(L)311-(U)
DIMENSIONS	Vehicle Overall Length		mm (in)	3,955 (155.70)	
	Vehicle Overall Width		mm (in)	1,495 (58.900)	
	Vehicle Overall Height		mm (in)	1,300 (51.574)	
	Interior size of cargo space	Overall Length	mm (in)	750 (29.524)	
		Overall Width	mm (in)	1,275 (50.200)	
		Overall Height	mm (in)	990 (38.976)	
	Tread	Front	mm (in)	1,275 (50.196)	
		Rear	mm (in)	1,200 (47.244)	
	Wheel Base		mm (in)	2,280 (89.800)	
	Min. Road Clearance		mm (in)	145 (5.708)	
	Floor Height				
	Overhang to the Ront End (Without Bumper)		mm (in)	620 (24.400)	
	Overhang to the Rear End (Without Bumper)		mm (in)	885 (34.842)	
	Frame Overhang to the Front End		mm (in)	525 (20.700)	
	Frame Overhang to the Rear End		mm (in)	830 (32.677)	
TIRE SIZE	Front & Rear			5.60S14-4PR	5.60S14-4PR (Option 6.45H14-4PR)
WEIGHT	Vehicle Weight		kg (lb)	900 (1,984)	910 (2,006)
	Seating Capacity			2	
	Max. Payload				

	Item / Model			SP(L)311-(U)	SR(L)311-(U)	
WEIGHT	Vehicle Gross Weight			1010 (2, 227)	1020 (2, 249)	
	Distribution of Vehicle weight without load	Front	kg (lb)	505 (1, 113)	515 (1, 135)	
		Rear	kg (lb)	395 (800)		
	Distribution Vehicle weight with load	Front	kg (lb)	555 (1, 224)	565 (1, 246)	
		Rear	kg (lb)	455 (1, 003)		
	Chassis Weight		kg (lb)	495 (1, 091)	505 (1, 113)	
	Distribution (Front)		kg (lb)	340 (749)	350 (771)	
	Distribution (Rear)		kg (lb)	155 (342)		
	Height of Gravity Center		mm (in)	470 (18.503)		
PERFORMANCE	Max. Speed		km/h (m/h)	170 (106)	SOLEX CARB. 205 (127.4)	SU CARB. 190 (118.1)
	Fuel Consumption by Paved Flat Road with Max. load (presumptive)		km/ℓ (US. MPG)	12 (28.23)	8 (18.823)	10 (23.53)
	Grade Ability Sin θ			0.497	0.560	0.527
	Min. Turning Radius		m (ft)	4.9 (16.08)		
	Brake Stopping Distance (50 km/h)			13.5 (44.3)		
ENGINE	Model			R	U20	
	Make			Nissan		
	Clasification of Fuel			Gasoline		
	Cooling System			Water Forced Circulation		
	No. of Cylinder & Arrange			4 in line		
	Cycle			4		
	Combustion Chamber			Wedge Type		
	Bore × Stroke		mm (in)	87.2 × 66.8 (3.433 × 3.267)	87.2 × 83 (3.433 × 3.267)	

Item \ Model			SP(L)311-(U)	SR(L)311-(U)	
ENGINE	Displacement	ℓ (cu. in)	1.595 (97.32)	1.982 (120.92)	
	Compression Ratio		9.0	9.5	
	Compression Pressure	kg/cm2 (lb/in2)/r.p.m.	9.0	9.5	
	Max. Exploding Pressure	kg/cm2 (lb/in2)/r.p.m.	50 (711.2)/4000	54 (766.26)/5600	
	Max. Mean Effective Pressure	kg/cm2 (lb/in2)/r.p.m.	10.6 (150.8)/4000	11.5 (163.1)/4800	
	Max. Power	B.H.P./r.p.m. (SAE)	96/6000	SOLEX CARB 150/6000	SU CARB 135/6000
	Max. Torque	m-kg (ft-lb)/r.p.m. (SAE)	14.3 (103)/4000	19.1 (138)/ 14800	18.2 (132)/ 14400
	Length × Width × Height	mm (in)	635 × 650 × 623 (25 × 25.6 × 24.5)	692 × 641 × 670 (27.24 × 25.23 × 26.37)	
	Weight	kg (lb)	155 (342)	160 (353)	
	Position of Engine		FRONT		
	Type of Piston		AUTO THERMIC TYPE		
	Material of Piston		LO-EX		
	No. of Piston Ring	Pressure	2		
		Oil	1		
	VALVE TIMING	Intake Open B.T.D.C.	20°	SOLEX CARB. 30°	SU CARB. 18°
		Intake Close A.B.D.C.	56°	70°	58°
		Exhaust Open B.B.D.C.	58°	70°	58°
		Exhaust Close A.T.D.C.	18°	30°	18°
	Valve Clearance	Intake mm (in)	0.43 (0.0169)	0.2 (0.007874)	
		Exhaust mm (in)	0.43 (0.0169)	0.3 (0.011811)	

Item \ Model				SP(L)311-(U)	SR(L)311-(U)	
IGNITION SYSTEM	Ignition Method			BATTERY-COIL TYPE		
	Ignition Timing B.T.D.C./r.p.m.			16°/600	SOLEX CARB. 20°/700	SU CARB. 16°/700
	Firing Order			1-3-4-2		
	IGNITION COIL	Type		C6R-50 (HV-13Y)		
		Make		HITACHI (HANSHIN)		
	DISTRIBUTOR	Type		D407-51		
		Make		HITACHI		
		Ignition Timing Advance System		Vacuum & Governor	Governor	Vacuum & Governor
	SPARK PLUG	Type		B-6E (L-45)		
		Make		NGK (HITACHI)		
		Thread	mm (in)	14 (0.551)		
		Gap	mm (in)	0.7 ~ 0.8 (0.027 ~ 0.031)		
FUEL SYSTEM	CARBURETOR	Type		HJB38W	44PHH	HJG46W
		Manufacturer		HITACHI	MIKUNI	HITACHI
		Throttle Valve Bore	mm (in)	38	44	46
		Venturi Size	mm (in)	Variable	OUTER 37 (1.456) INNTER 10 (0.3937)	Variable
		Main Jet			#180	
		Pilot Jet			# 60	
		Pump Jet	mm (in)		0.30 (0.01181)	
	Air Cleaner	Type & No.		PAPER TYPE		
		Make		TSUCHIYA		

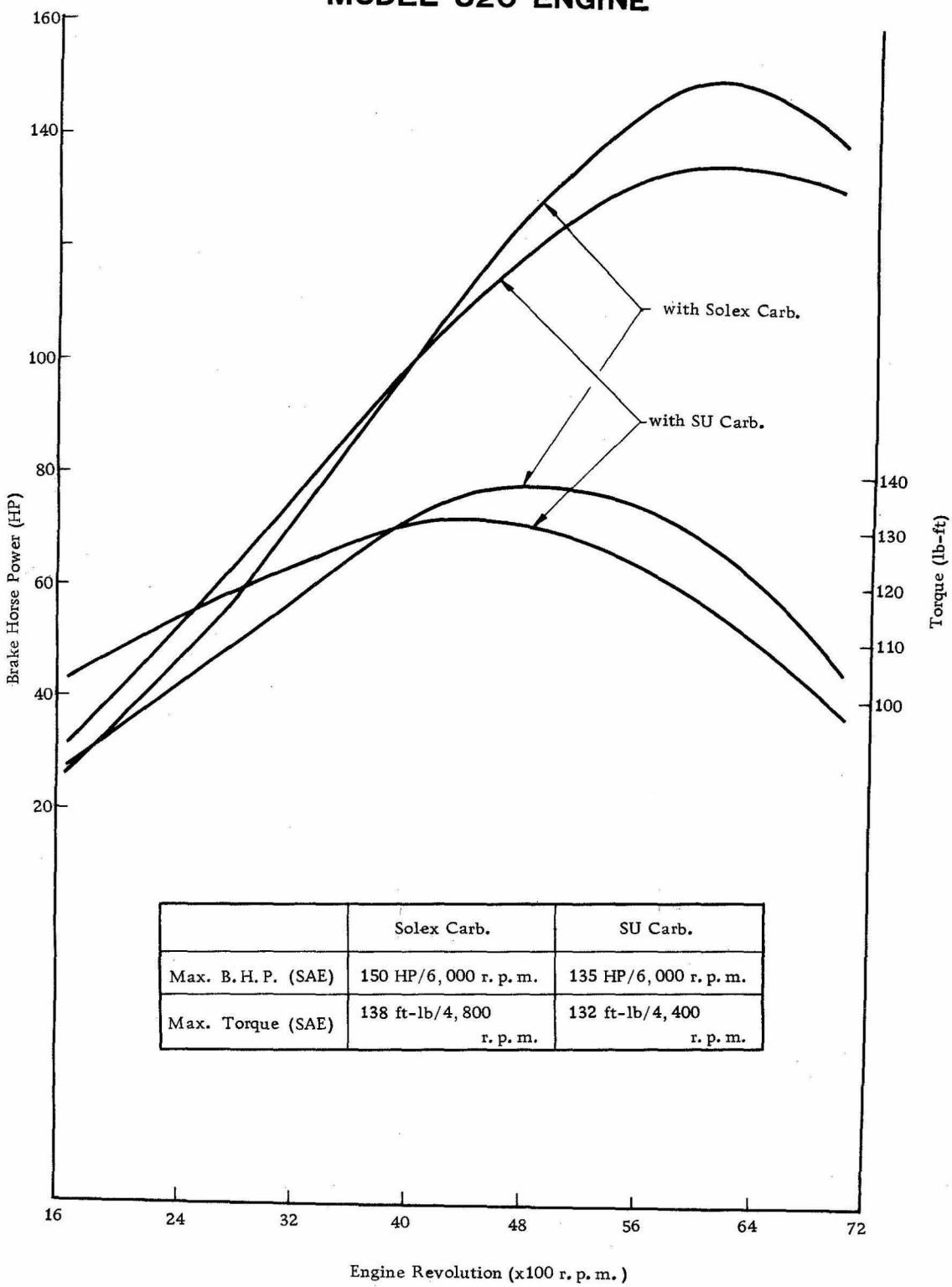
Item			Model	SP(L)311-(U)	SR(L)311-(U)	
FUEL SYSTEM	FUEL PUMP	Type		DIAPHRAGM		
		Make		SHOWA, KYOSAN		
	Fuel Tank	Capacity of Fuel Tank	ℓ (U.S.gal.)	43 (11.36)		
LUBRICATING SYSTEM	Lubricating Method			FORCED PRESSURE TYPE		
	Oil Pump Type			GEAR TYPE		
	Oil Filter			FULL FLOW TYPE		
	Oil Pan Capacity		ℓ (U.S.gal.)	4.1 (1.083)	SOLEX CARB. 7.1 (1.875)	SU CARB. 4.1 (1.083)
COOLING SYSTEM	Type			PRESSURIZED WATER COOLING SEALED TYPE		
	Radiator			CORRUGATED FIN & TUBE TYPE		
	Capacity of Coolant		ℓ (U.S.gal.)	8 (2.11)	8.5 (2.245)	
	Type of Water Pump			CENTERIFUGAL TYPE		
	Thermostat			PELLET TYPE		
BATTERY	Type			2SMB (or CORVAIR)		
	Voltage V			12		
	Capacity A.H.			50 (40 ... For R/H Car)	50	
GENERATOR	Type			AC300/12 × 2R	AS2030A2	
	Make			MITSUBISHI		
	Generating Method			ALTERNATOR		
	Voltage		V	12		
	Capacity		Kw	0.3		
	Voltage Regulator			RL2220B5		
Starter	Type			S114-91	ME-Y2R	
	Make			HITACHI	MITSUBISHI	

Item \ Model			SP(L)311-(U)	SR(L)311-(U)
Starter	Voltage & Power V-HP		12-1.4	
CLUTCH	Type		SINGLE DRY DISC WITH DIAPHRAGM SPRING	
	Number of Plate		(FACING) 2	
	Outer dia.×Inner dia.×Thickness mm (in)		200 × 130 × 3.5 (7.87 × 5.12 × 0.138)	
	Total Friction Area cm^2 (in^2)		364 (56.42)	
TRANSMISSION	Type		F4C63L	FS5C71A
	Operating Method		Direct Floor Shift	
	Gear Ratio	1st	3.382	2.957
		2nd	2.013	1.858
		3rd	1.312	1.311
		4th	1.000	1.000
		5th		0.852
		Reverse	3.365	2.922
	Lubricant Capacity ℓ (U.S.gal.)		2.2 (0.58)	2.6 (0.68)
Propeller Shaft	Length × Outer dia. × Thickness mm (in)		760 × 63 × 59.8 (29.92×2.48× 2.35)	838 × 63.5 × 1.6 (32.99×24.99×0.06299)
	Type of Universal Joint		63H	63H
FINAL GEAR	FIRST GEAR	Type of Gear	HYPOID GEARS	
		Gear Ratio	3.889 (OPTION 4.111)	3.700
		Speedometer	16/5 (17/5)	18/6
DIFF. GEAR	Housing Type		BANJO	
	Type and Number of Gear		STRAIGHI BEVEL PINION 2 EACH	
	Lubricant Capacity ℓ (U.S.gal.)		0.93 (0.25)	
STEERING SYSTEM	Type of Gear		CAM AND LEVER	
	Gear Ratio		14.8	
	Steering angle In and Out.		36°16', 29°20'	

Item \ Model				SP(L)311-(U)	SR(L)311-(U)
Steering System	Steering Wheel Dia. mm (in)			400 (15.75)	
	Lubricant Capacity ℓ (U.S.gal.)			0.25 (0.07)	
RUNNING DEVICE	Wheel Arangement			2 FRONT, 2 REAR	
	Front Axle			WISH BONE BALL JOINT TYPE	
	Toe-in (Unladen) mm (in)			2 ~ 3 (0.0787 ~ 0.1181)	
	Camber (Unladen)			1°25'	
	Caster (Unladen)			1°30'	
	Inclination Angle of King Pin			6°35'	
	Type of Rear Axle			SEMI-FLOATING TYPE	
BRAKE SYSTEM	HYDRAULIC BRAKE	Type	Front	DISC	
			Rear	LEADING TRAILING	
		Lining Dimension (Front) Width × Thickness × Length mm (in)		47.5 × 16.7 × 53.98 (1.87 × 0.66 × 2.125)	
		Lining Dimension (Rear) Width × Thickness × Length mm (in)		40 × 4.5 × 215 (1.57 × 0.18 × 8.46)	
		Total Braking Area (Front) cm^2 (in^2)		102.6 (15.9)	
		Total Braking Area (Rear) cm^2 (in^2)		351 (54.4)	
		Dia. of Disc (Front) mm (in)		284 (11.18)	
		Dia. of Drum (Rear) mm (in)		228.6 (90)	
		Inner Dia. of Master Cyl. mm (in)		19.05 (0.75)	
		In Dia. of Wheel Cyl. (Front) mm (in)		53.98 (2.125)	
		In Dia. of Wheel Cyl. (Rear) mm (in)		19.05 (0.75)	
		Max. Oil Pressure (lb/in^2) kg/cm^2		137 (1948.6)	
	PARKING BRAKE	Type		MECHANICAL FOR REAR WHEEL	
		Lining Dimension mm		40 × 4.5 × 215	

Item			Model	SP(L)311-(U)	SR(L)311-(U)
SYSTEM OF THE BRAKE	PARKING BRAKE	Total Braking Area	cm^2 (in^2)	351 (54.4)	
		In Dia. of Drum	mm (in)	228.6 (90)	
SUSPENSION	Front			INDEPENDENT WITH COIL SPRING	
	Coil Spring Size Wire Dia. × In. Dia. of Coil × Free Length - No.		mm (in)	12.7 × 87.5 × 290 - 6 (0.499 × 3.44 × 11.41 - 6)	
	Rear			PARALLEL SEMI FLLIPTIC	
	Spring Size Length × Width × Thickness - No.		mm (in)	$1200 \times 60 \times \frac{6-2}{5-2}$ (47.2 × 2.36 × 0.23)	
	Shock Absorber (Front)			TELESCOPIC DOUBLE ACTION	
	Shock Absorber (Rear)			TELESCOPIC DOUBLE ACTION	
	Stabilizer			FORSION BAR TYPE FOR FRONT	
	Torque Rod			At the Rear Right Side of Frame	
FRAME	Type			X MEMBER	
	Section			BOX TYPE	
	Dimension Height × Width × Thickness		mm	UPPER 75 × 100 × 1.6 LOWER 25 × 100 × 2.3	

PERFORMANCE CURVES OF MODEL U20 ENGINE

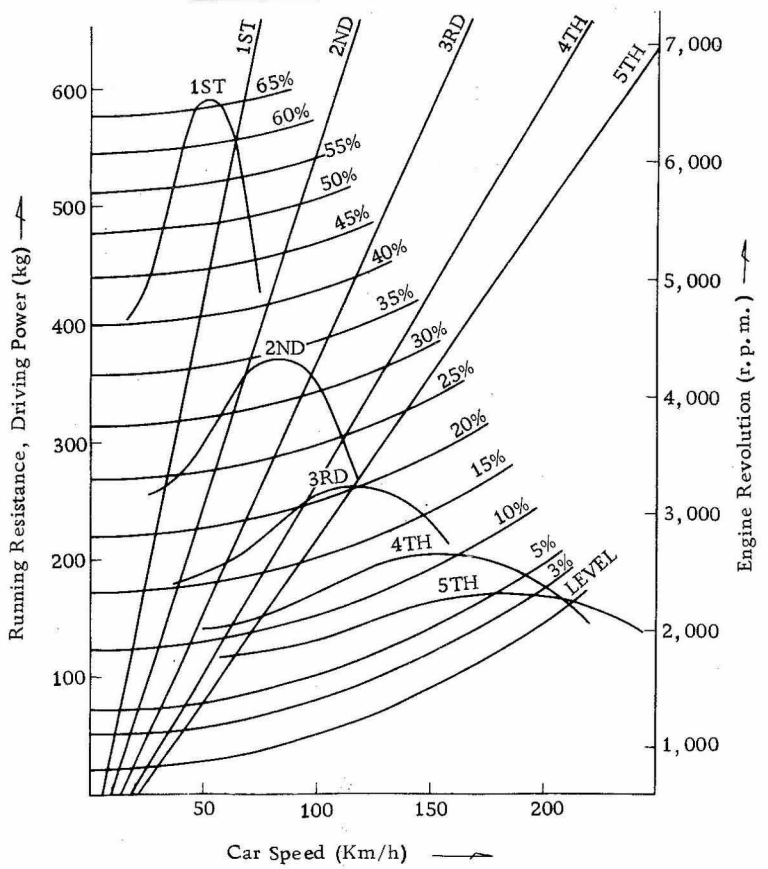


	Solex Carb.	SU Carb.
Max. B. H. P. (SAE)	150 HP/6, 000 r. p. m.	135 HP/6, 000 r. p. m.
Max. Torque (SAE)	138 ft-lb/4, 800 r. p. m.	132 ft-lb/4, 400 r. p. m.

MODEL SR(L)311-U RUNNING PERFORMANCE CURVES

(U20 Engine with Solex Carburetor)

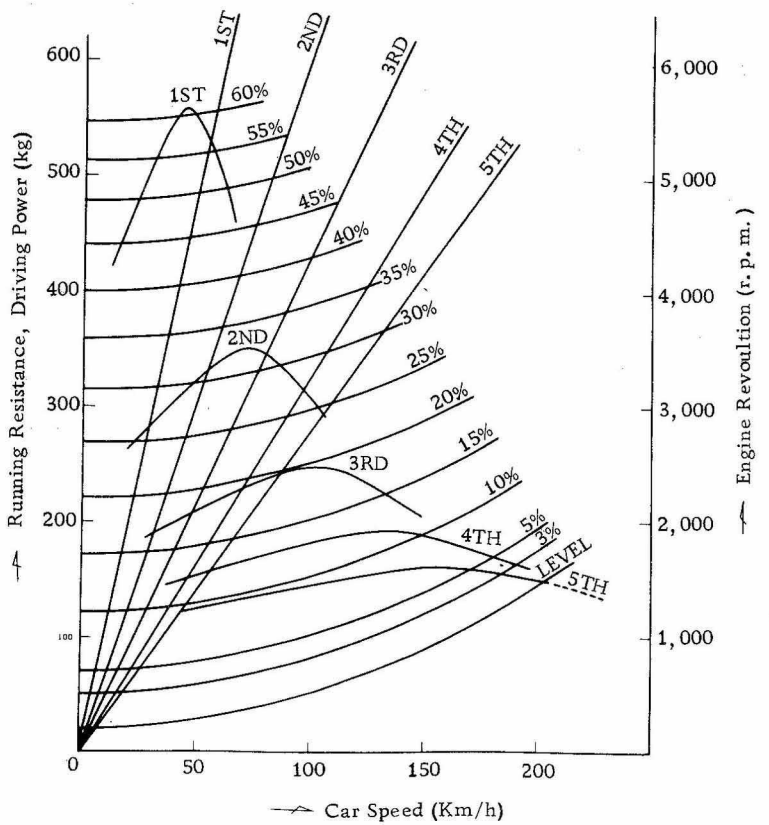
Final gear ratio	3.700 (37/10)
1st speed ratio	2.957
2nd speed ratio	1.858
3rd speed ratio	1.311
4th speed ratio	1.000
5th speed ratio	0.852
Max. grade ability	Tan θ =0.675 (Sin θ =0.560)
Max. Torque (SAE)	19.1 m-kg (138.0 ft-lb)
Max. B.H.P. (SAE)	150 HP/6,000 r.p.m.



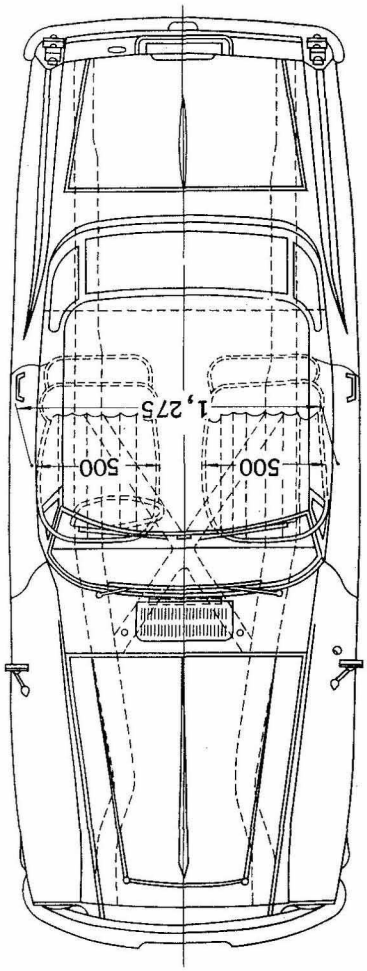
MODEL SR(L)311-U RUNNING PERFORMANCE CURVES

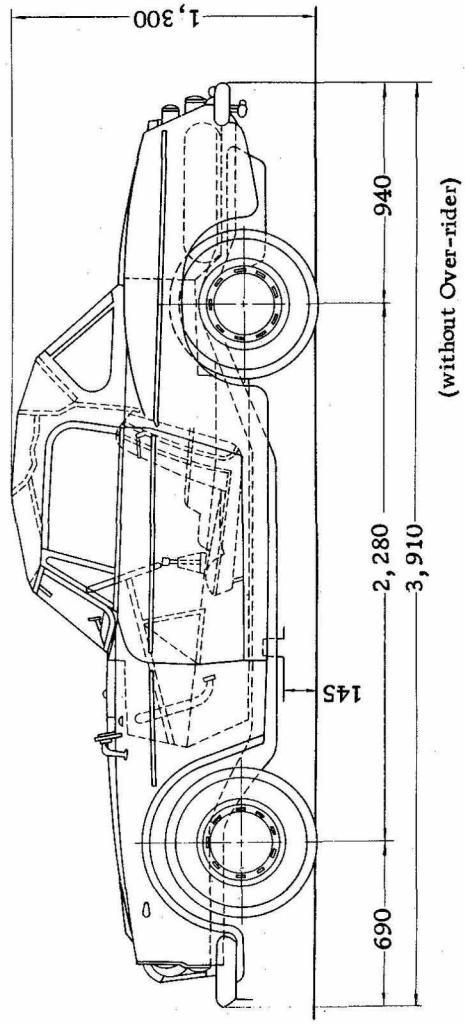
(U20 Engine with SU Carburetor)

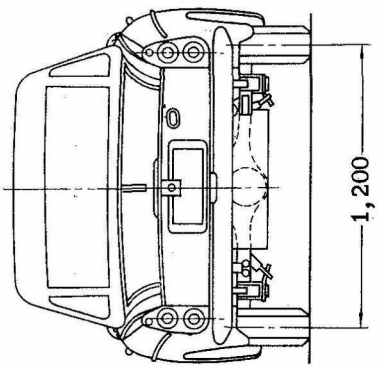
Final speed ratio	3.700 (37/10)
1st speed ratio	2.957
2nd speed ratio	1.858
3rd speed ratio	1.311
4th speed ratio	1.000
5th speed ratio	0.852
Max. grade ability	Tan θ =0.620 (Sin θ =0.527)
Max. Torque (SAE)	18.2 m-kg (131.6 ft-lb)
Max. B.H.P. (SAE)	135 HP/6,000 r.p.m.

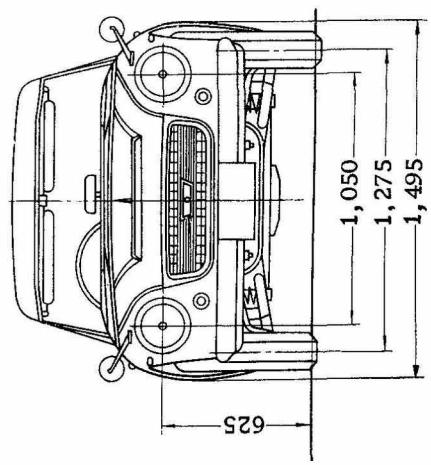


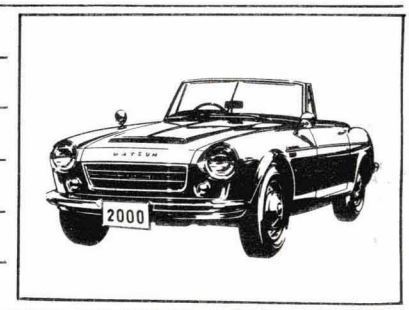
GENERAL VIEWS OF DATSUN SPORTS 2000







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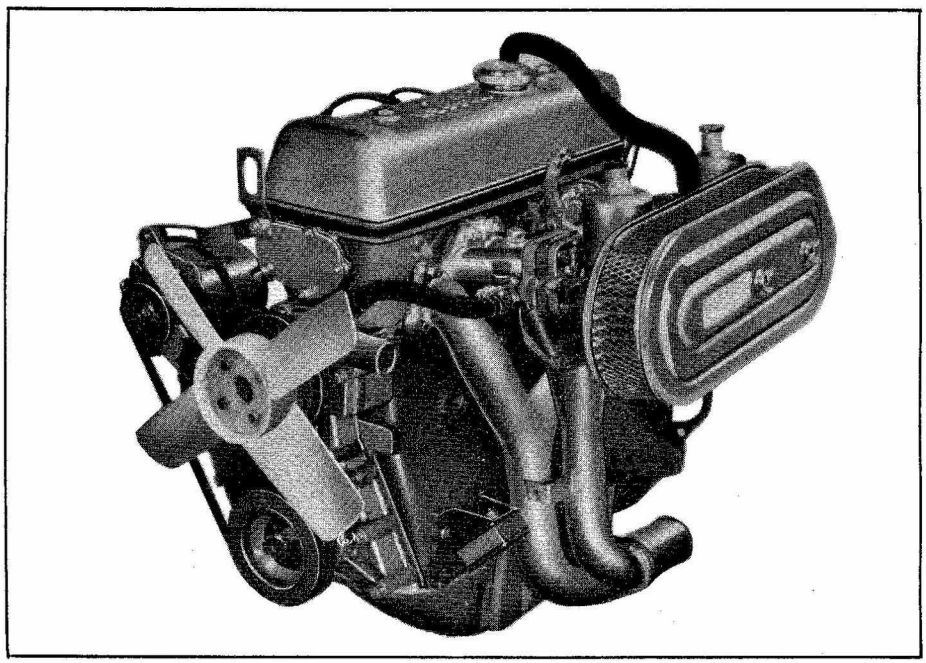
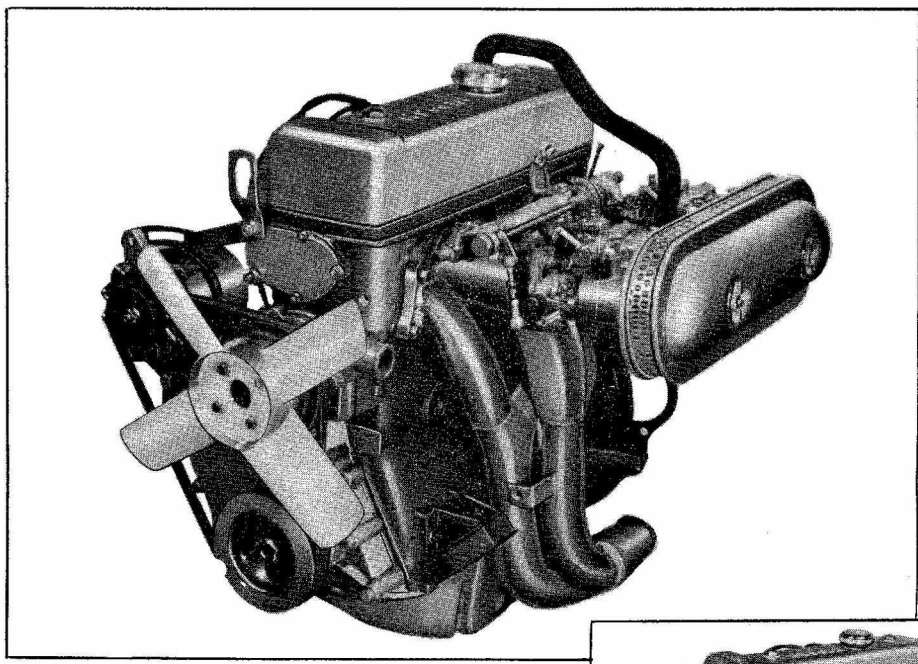
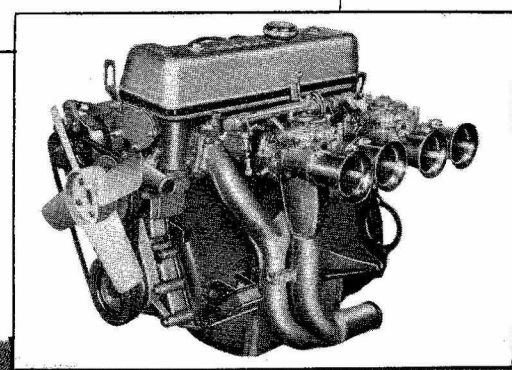
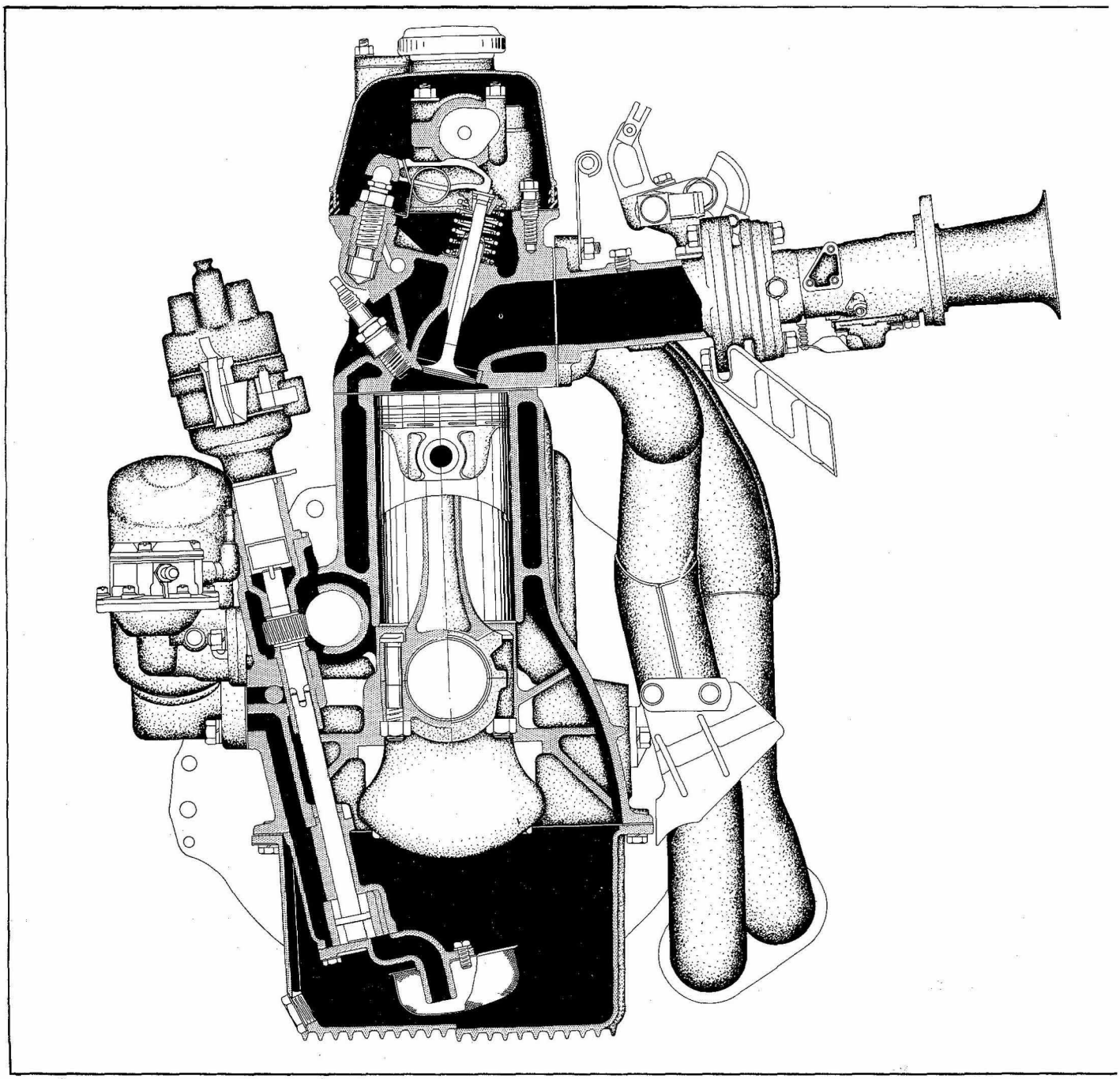
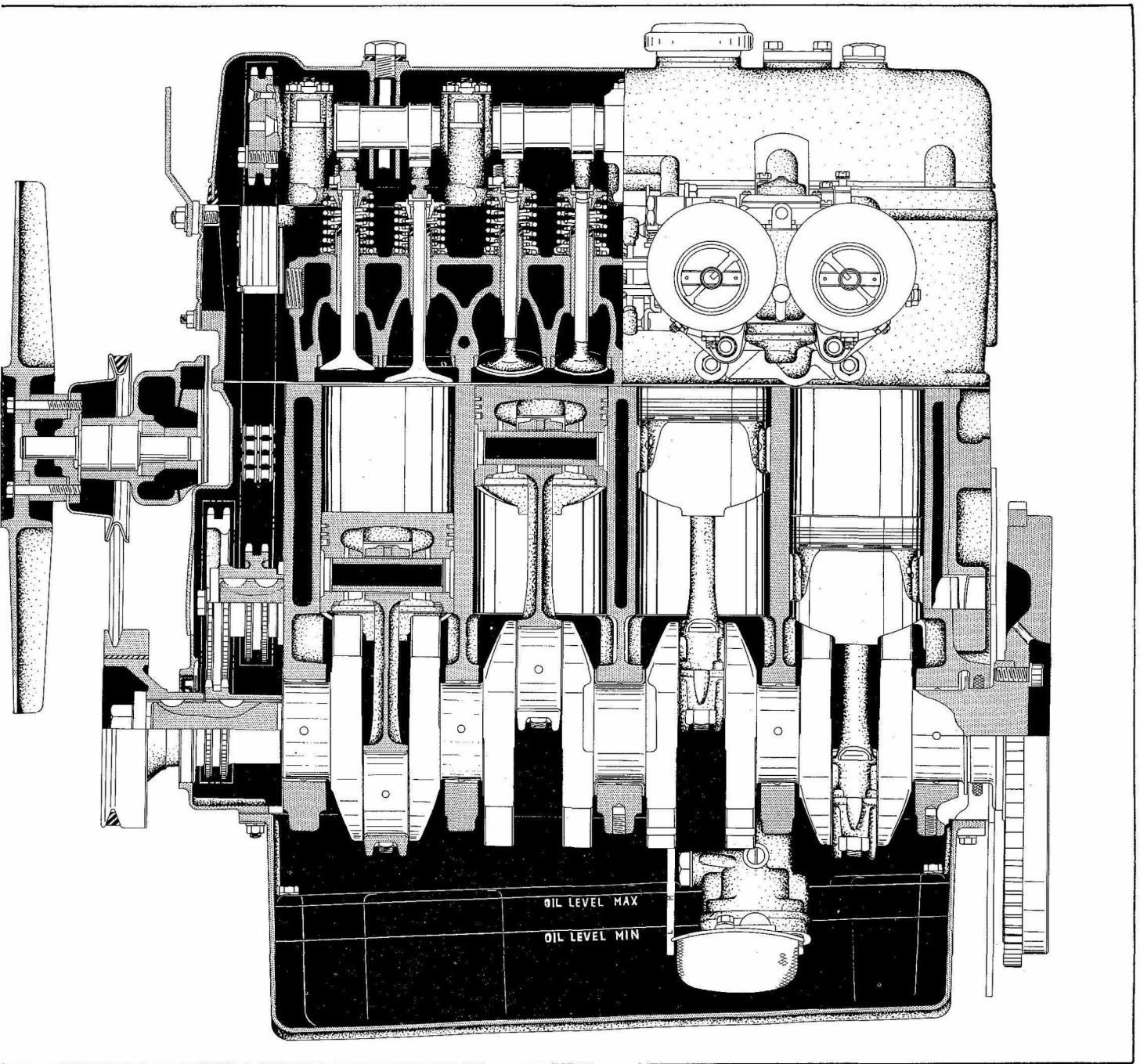








ENGINE MECHANICAL



GENERAL DESCRIPTION

U20 engine is a 1982 cc in line overhead camshaft four-cylinder engine and has 87.2 mm (3.4331 in.) bore and 83 mm (3.2677 in.) stroke with a compression ratio of 9.5 : 1.

This engine uses SU type dual carburetor as standard equipment and Solex type dual carburetor as optional. When the optional carburetor (Solex type) is to be equipped, change Air cleaner, Intake Manifold, Camshaft and Oil Pan at the same time.

Cylinder Block

The cast iron cylinder block has a vertical row of four cylinders. Five main bearings support the crankshaft. Bearing caps fit in recesses in the block which assure accurate alignment and facilitate assembly.

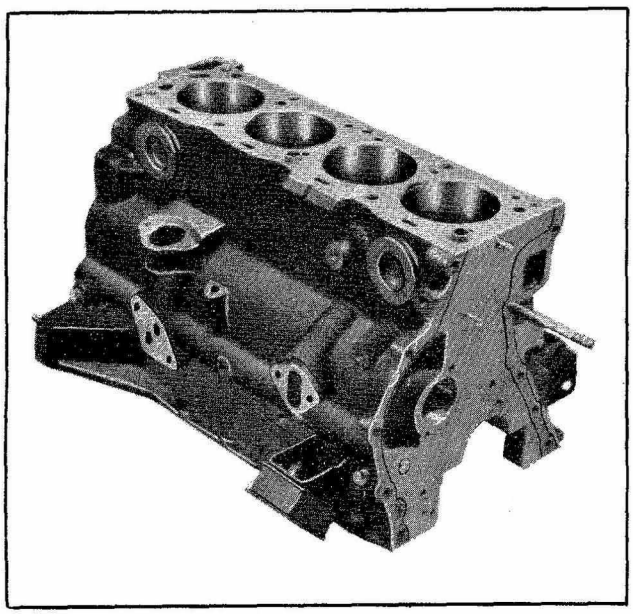


Fig. EM-1

Crankshaft

The crankshaft is made of forged steel and is supported by five main bearings.

Main bearings are lubricated from oil holes which intersect the main oil gallery which runs parallel to the cylinder bores.

Crankshaft has eight balance weights and dynamically balanced.

A slip-on vibration damper on the forward end of the crankshaft dampens any engine torsional vibrations.

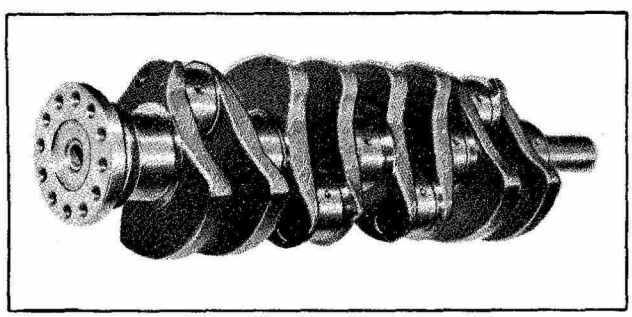


Fig. EM-2

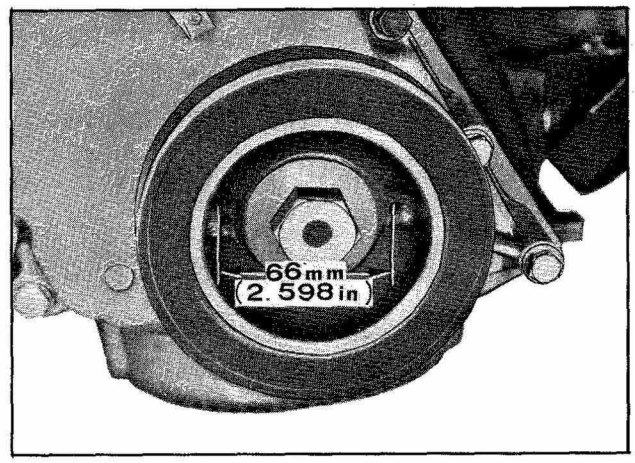


Fig. EM-3

Pistons and Connecting Rods

New-design light-weight pistons are of cast aluminum slipper-skirt type. Top and second rings are compression rings and of tapered face type. All piston rings are hard chromium plated.

Connecting rods are made of forged steel. Full pressure lubrication is directed to the connecting rods by drilled oil passages from the adjacent main bearing journal. Oil holes at the connecting rod journals are located so that oil is supplied to give maximum lubrication just prior to full bearing load.

Connecting rod bolts are fitted tightly to connecting rods.

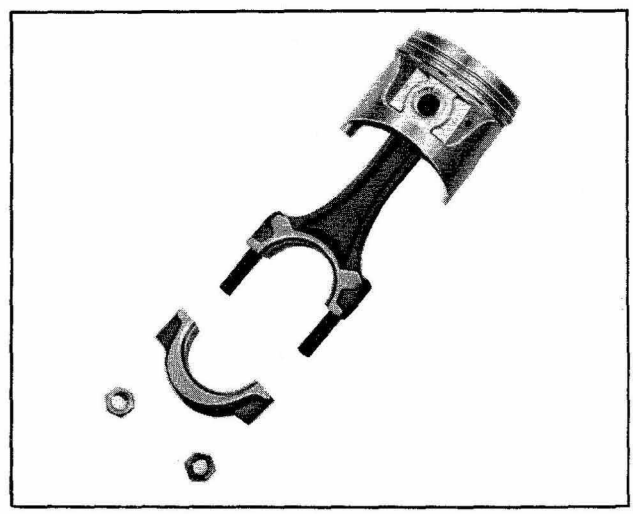


Fig. EM-4

Cylinder Head

Cylinder head is made of aluminum and is tightened to cylinder block with ten special steel bolts.

Cylinder head is press-fitted with valve guides and valves arranged in line with the top of the valves tilted inboard slightly to the manifold side.

Combustion chambers are fully contour machined with a new and improved wedge shape.

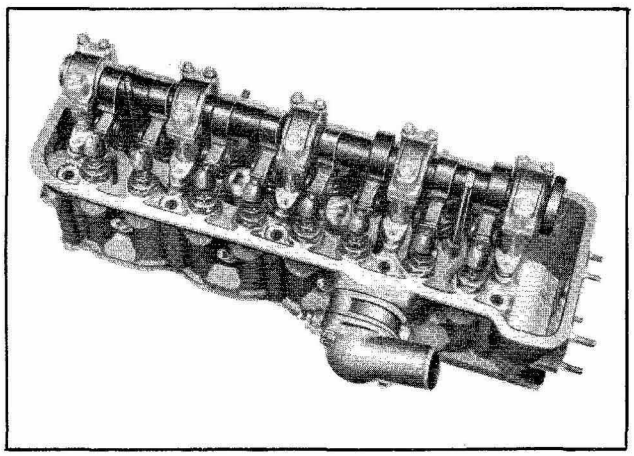


Fig. EM-5

Jackshaft

Jackshaft is made of special cast iron and supported by three bearings.

This shaft drives the distributor drive gear and fuel pump.

Camshaft over the cylinder head is driven by timing chains through this jackshaft.

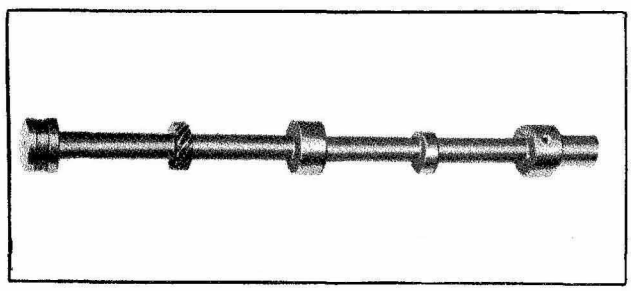


Fig. EM-6

Camshaft

Camshaft is made of special cast iron and located inside the rocker cover.

Five aluminum brackets support this camshaft.

These bearings can be separated to upper and lower parts, so replacement of camshaft is possible with the engine in vehicle.

Camshaft bearings are lubricated from oil holes which intersect the main oil gallery of the cylinder head.

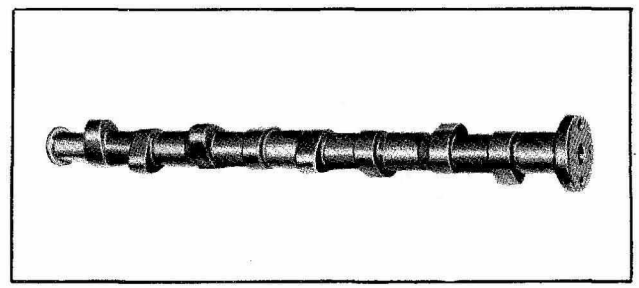


Fig. EM-7

Concentric passages drilled in the front and rear part of the camshaft form the galleries which supplies oil to each cam lobe through an oil hole drilled in the base circle of each lobe.

These holes supply lubrication to the cam pad surface of the rocker arm and to the valve tip end.

Lubrication is supplied to the front oil gallery from 1st and 3rd camshaft bearings and to the rear oil gallery from 3rd and 5th camshaft bearings.

Camshaft Drive

Camshaft is driven by two double row roller chains driven by crankshaft through jackshaft.

Crankshaft chain driven by crankshaft sprocket drives the jackshaft sprocket-front and jackshaft. Nextly, Camshaft chain driven by jackshaft sprocket-rear drives the camshaft sprocket and camshaft.

The "tension" of each chain is controled by the upper and lower chain tensioners which are operated by spring and oil pressure.

The contacting surface of chain tensioner is made of special anti-oil, heat proof hard rubber.

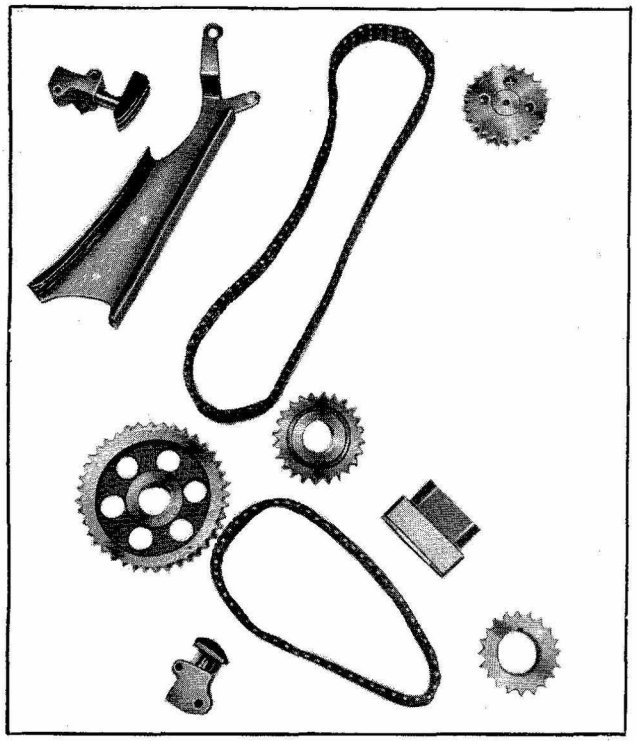


Fig. EM-8

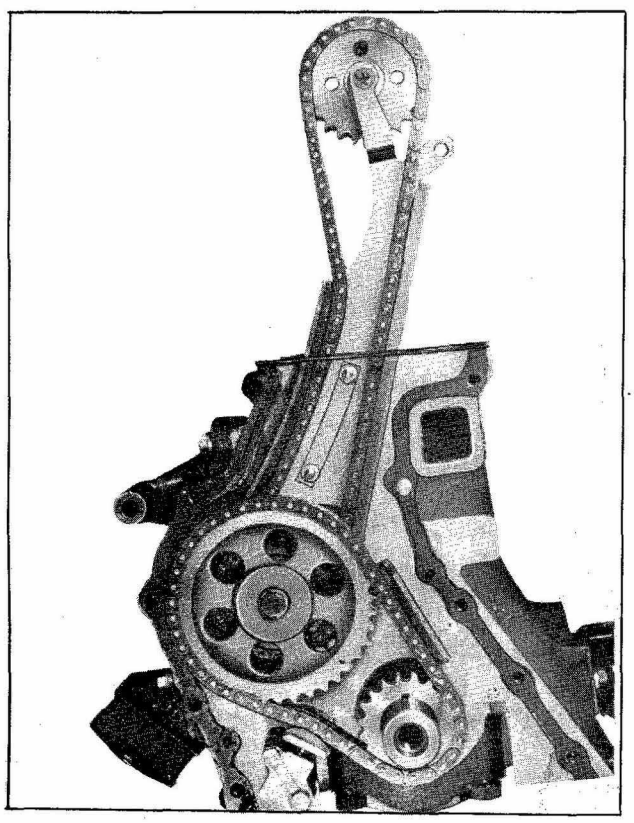


Fig. EM-9

Manifold

The "over under" design of the two part inlet and three-part exhaust manifolds is arranged to provide a hot exhaust gases to warm cold incoming fuel mixtures.

Dual intake manifold with individual inlet tube permits a single passage to feed each cylinder. Individual exhaust ports are utilized to provide improved breathing.

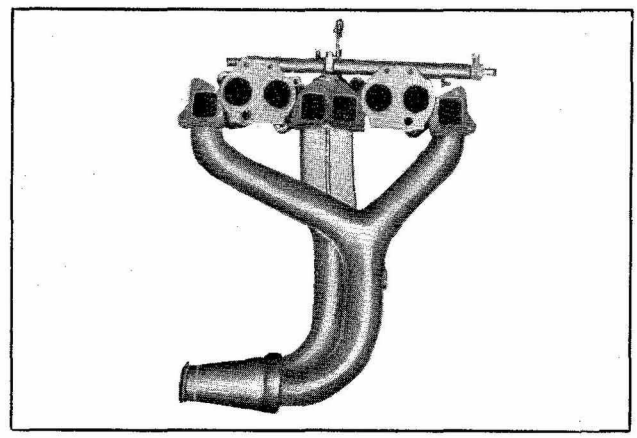


Fig. EM-10

SERVICE OPERATIONS

ENGINE IN VEHICLE

Engine-Remove and Install

To remove Engine off the vehicle, it is more efficient to remove it together with Transmission as attached to Engine.

1. Mark hinge location on Hood and remove Hood from hinges.

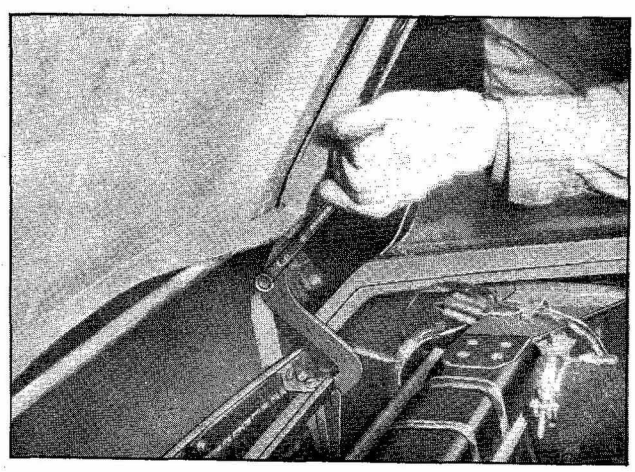


Fig. EM-11

2. Drain cooling system.
3. Disconnect battery cables at Battery.
4. Remove Battery.
5. Disconnect engine wire harness and engine to frame ground straps.

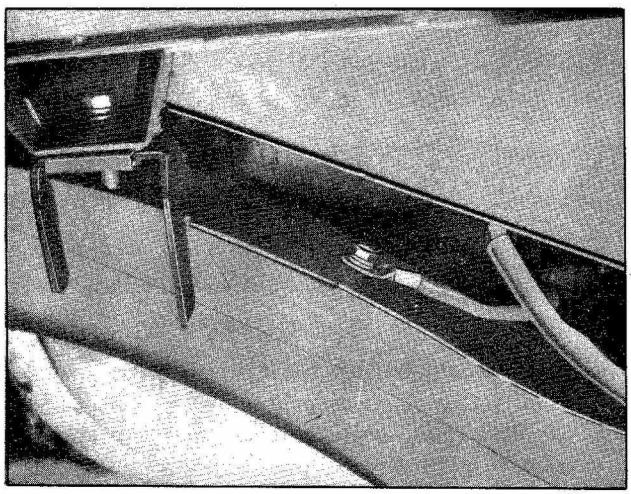


Fig. EM-12

6. Disconnect Tachometer cable.
7. Disconnect High tension cables.
8. Disconnect Radiator and heater hoses at engine attachment.

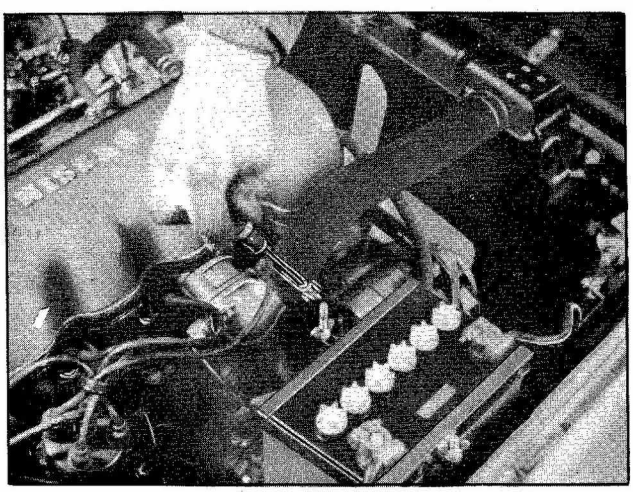


Fig. EM-13

9. Remove Screws attaching Radiator shroud to Radiator.
10. Remove Radiator.

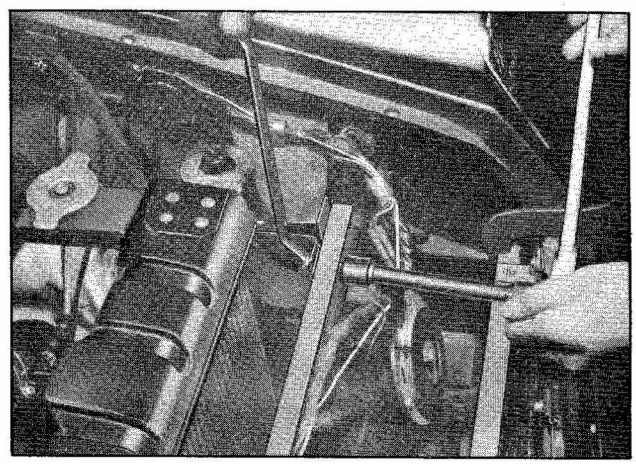


Fig. EM-14

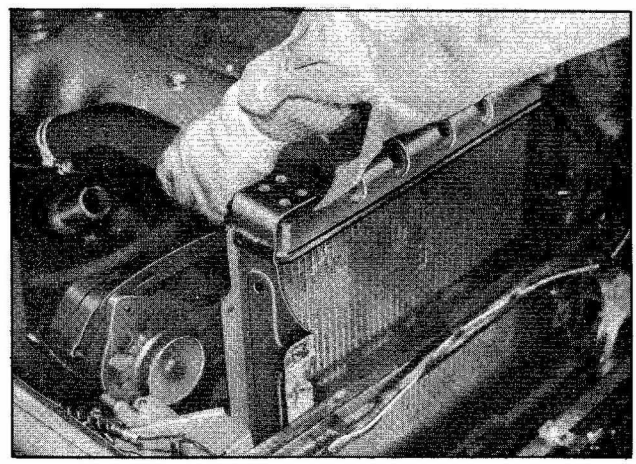


Fig. EM-15

11. Remove Radiator shroud.
12. Disconnect Accelerater control linkage.

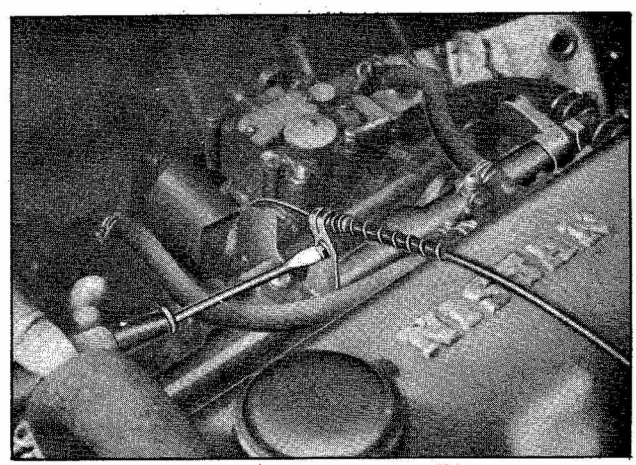


Fig. EM-16

13. Disconnect fuel lines at Fuel pump.

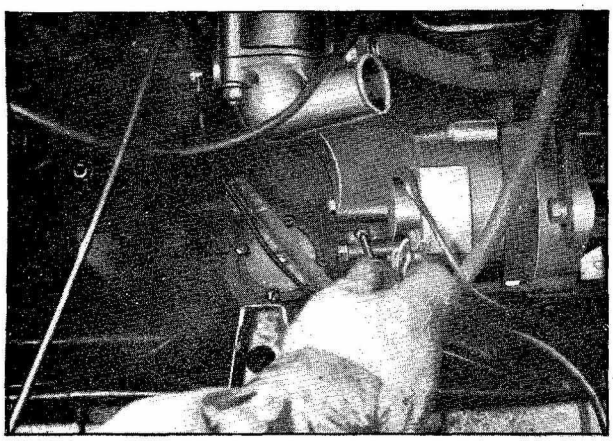


Fig. EM-17

14. Disconnect Exhaust pipe from Manifolds.

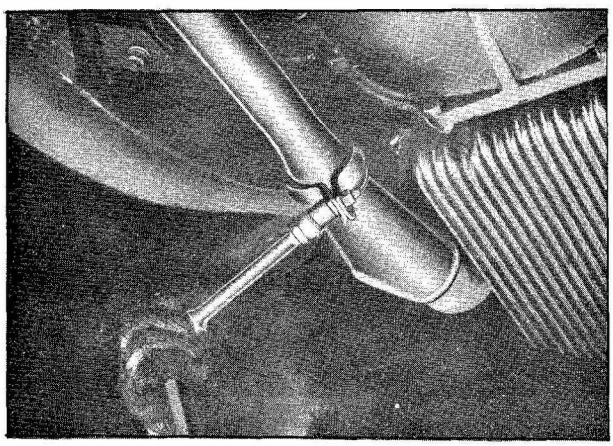


Fig. EM-18

15. Disconnect Speedometer cable.

16. Remove Clutch operating cylinder.

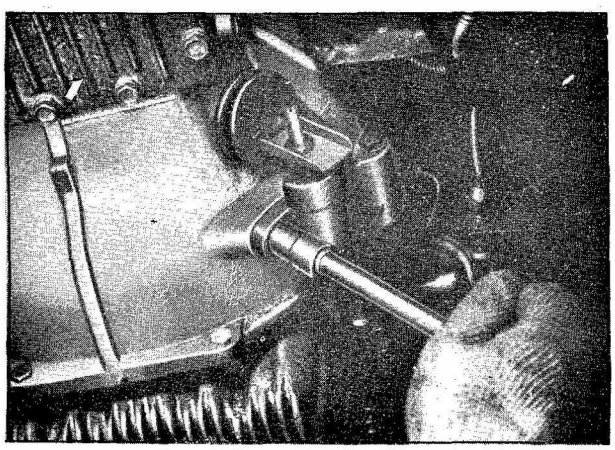


Fig. EM-19

17. Disconnect Propeller shaft from Differential gear case.

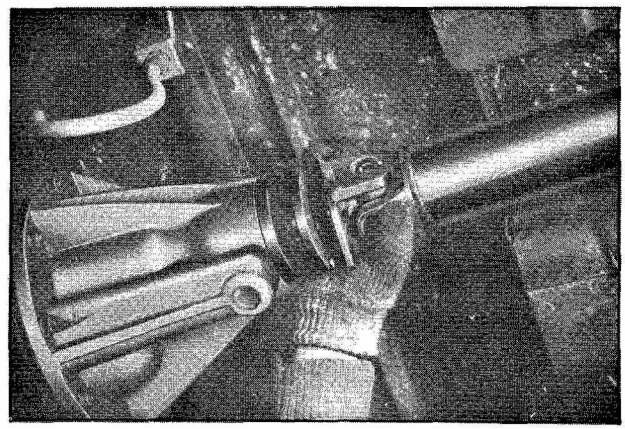


Fig. EM-20

18. Remove Propeller shaft from Rear extension flange of Transmission.

19. Remove two bolts securing Rear engine mounting to Frame cross member bracket.

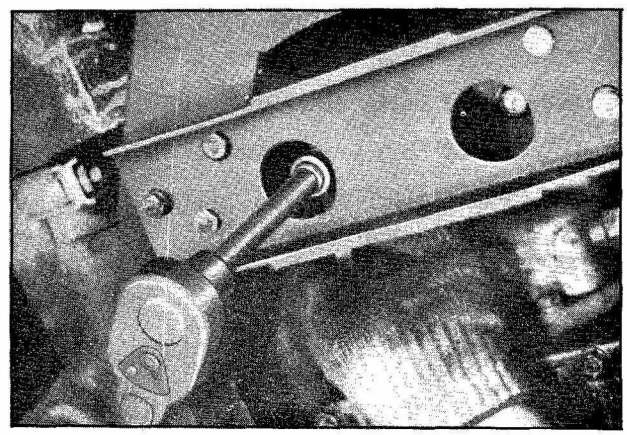


Fig. EM-21

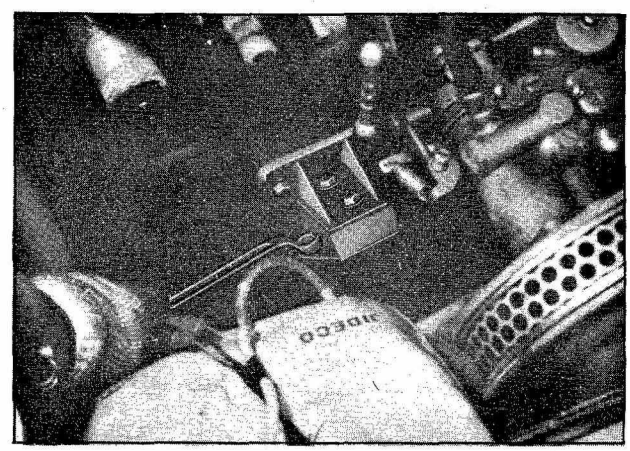


Fig. EM-22

20. Remove all bolts securing Front engine mountings to Frame brackets.
21. Using a suitable lifting equipment, raise Engine.
22. Disconnect Starter wires.

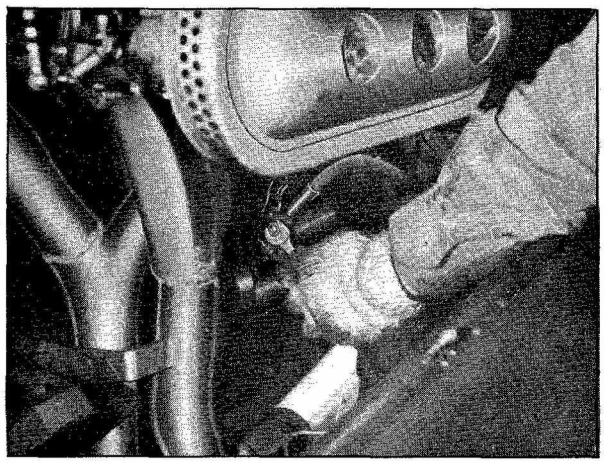


Fig. EM-23

23. Remove Engine.

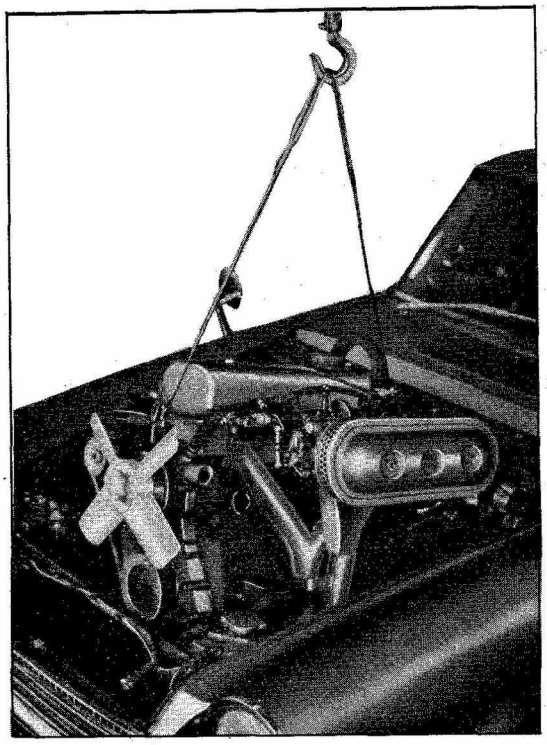


Fig. EM-24

Replacement is a reversal of the removal procedure.

Engine Mounting

Resilient rubber mounting cushions support the engine and transmission at three points. A cushion is located at each side on the center line of the engine, with the rear supported by a cushion between the transmission extension housing and the engine rear support cross-member.

Removal or replacement of any cushion may be accomplished by supporting the weight of the engine or transmission at the area of the cushion.

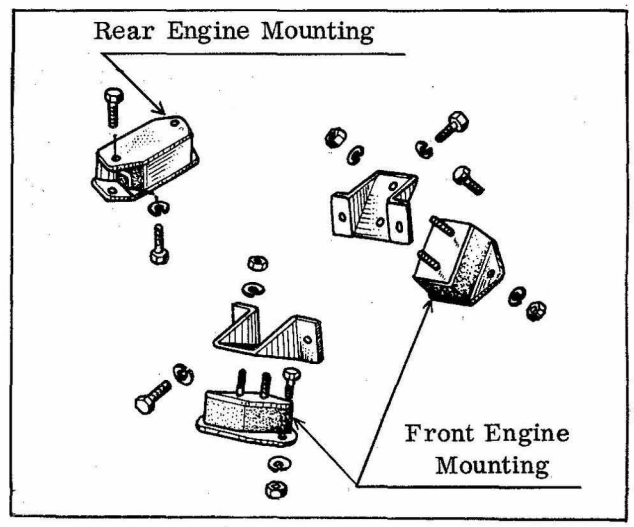


Fig. EM-25

Service Operations with Engine in Vehicle

Following service operations are possible with Engine in Vehicle.

As for other operations it is advisable to put Engine on a suitable engine stand after removing Engine from Vehicle.

1. Air Cleaner-Remove And Replace
2. Carburetors-Remove And Replace
3. Intake And Exhaust Manifold-Remove And Replace
4. Camshaft-Remove And Replace
5. Cylinder Head-Remove And Replace
6. Fan And Water Pump-Remove And Replace
7. Oil pan and Oil pump-Remove And Replace

THE SIDE OF ENGINE

Carburetor-Remove and Replace

1. Disconnect Exhaust emission control hose.
2. Remove Air cleaner.

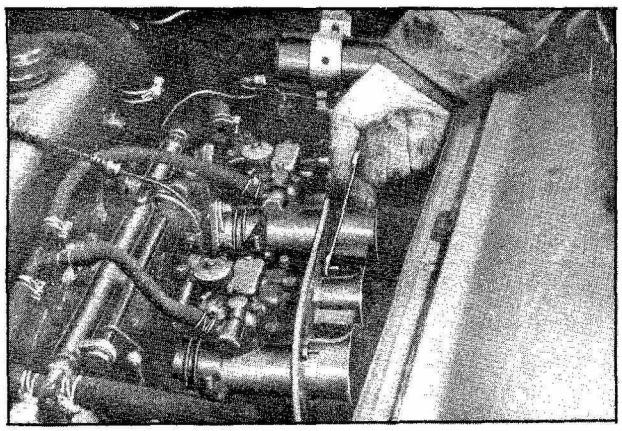


Fig. EM-26

3. Disconnect Throttle cable at bell crank and disconnect connecting rod from throttle shaft.

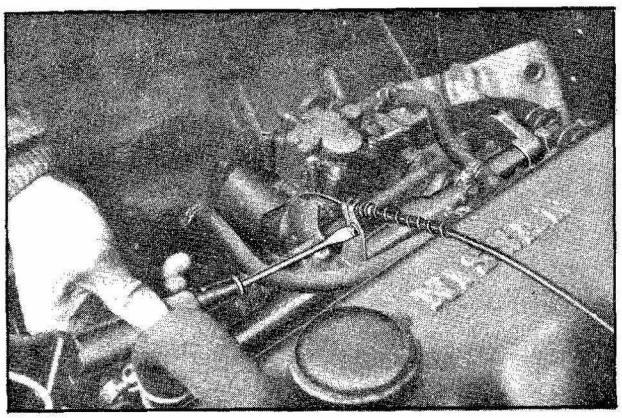


Fig. EM-27

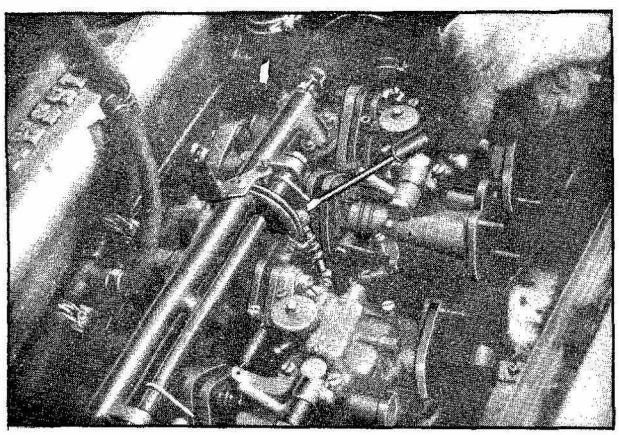


Fig. EM-28

4. Disconnect Fuel and vacuum lines from carburetor. (As for Solex type, there is no vacuum line.)

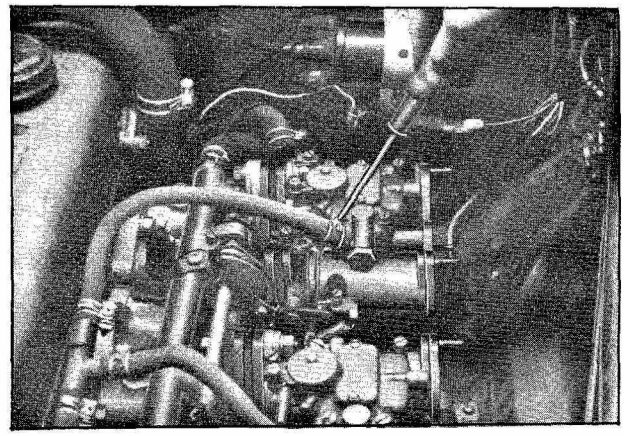


Fig. EM-29

5. Remove Carburetors by removing insulator to carburetor stud nuts (eight nuts).

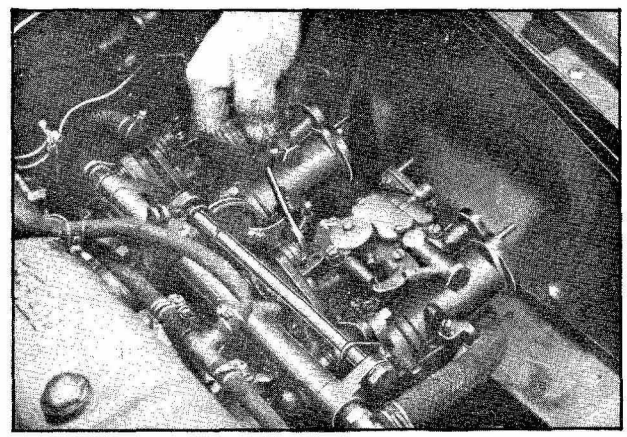


Fig. EM-30

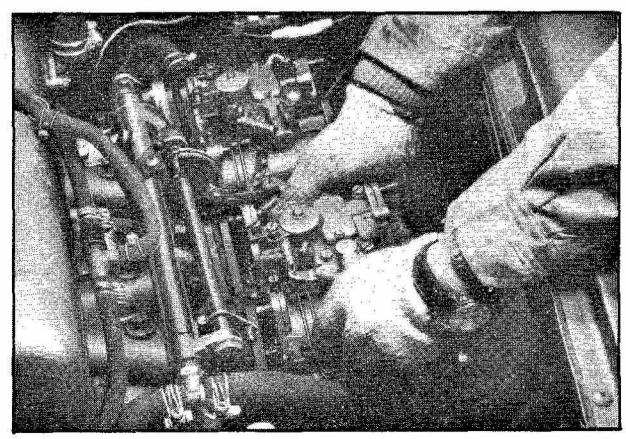


Fig. EM-31

Replacement is a reversal of the above procedure.

Intake and Exhaust Manifold-Remove and Replace

Remove

1. Remove Air cleaner and Carburetors as previously mentioned.

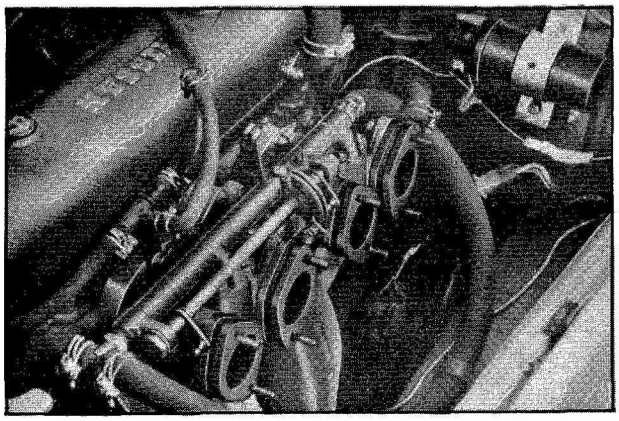


Fig. EM-32

2. Remove Intake manifold to Cylinder head stud nuts.

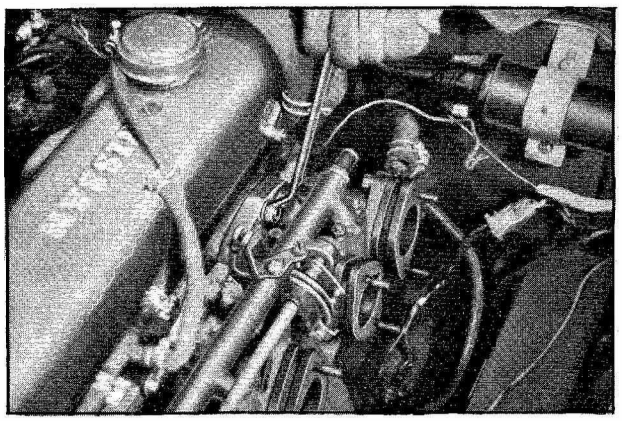


Fig. EM-33

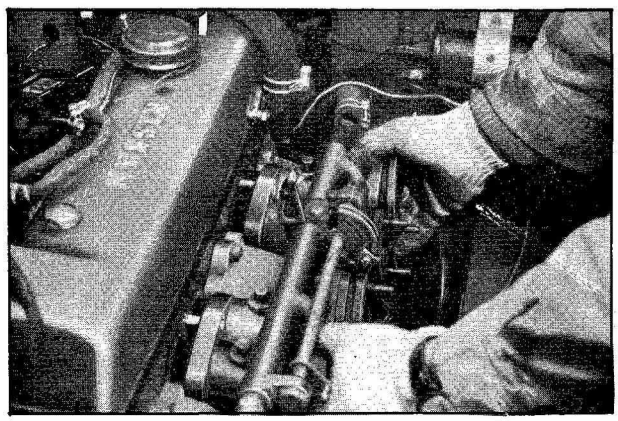


Fig. EM-34

3. Remove Intake manifold.
4. Remove Stud nuts and one manifold to bracket bolt.
5. Remove Exhaust manifold.

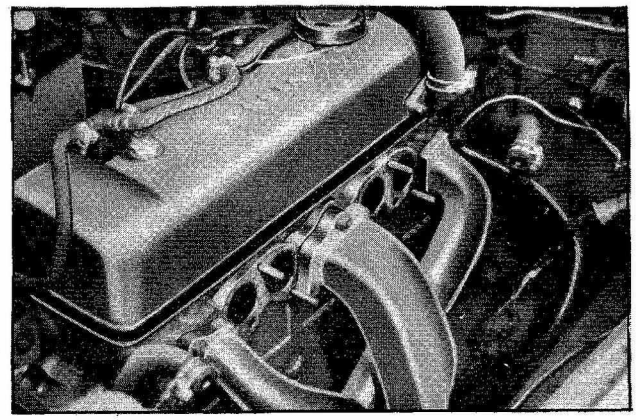


Fig. EM-35

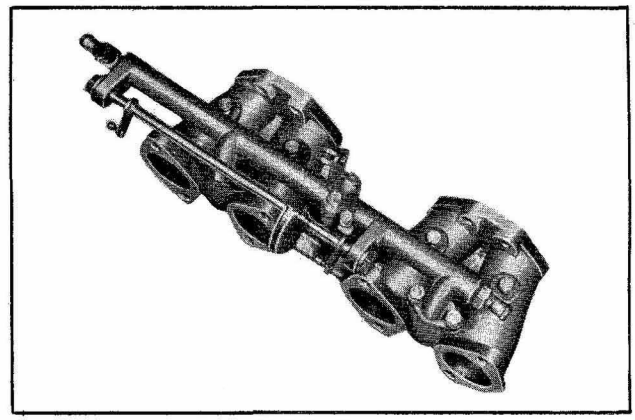


Fig. EM-36

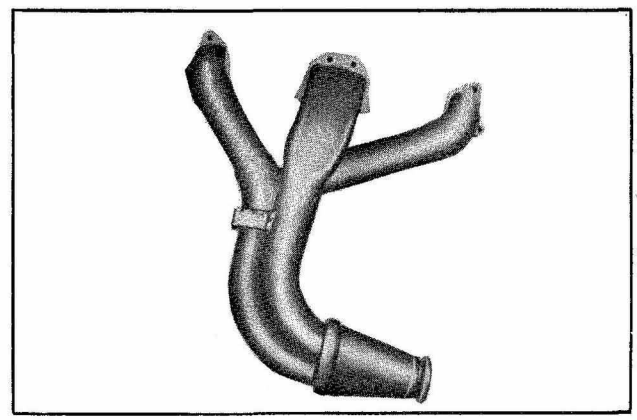


Fig. EM-37

Replace

1. Clean Gasket flanges on Cylinder head and Manifold.
2. Check for cracks on Manifold.
3. Position new gasket over manifold studs on Cylinder head and carefully install Exhaust manifold in position, making sure the gasket is in place.
4. Install nuts and clamps while holding manifold in place and tighten nuts to 1.4 ~ 2.8 kg-m (10.1 ~ 20.2 ft-lb.).
5. Reverse steps 1-3 of removal procedure to complete installation.

THE TOP OF ENGINE

Camshaft and Rocker Arm-Remove and Replace

1. Remove Rocker Arm Cover.
2. Disconnect Camshaft sprocket at Camshaft front end and support Camshaft sprocket temporarily with a screw to Camshaft chain guide as shown in Fig. EM-38.

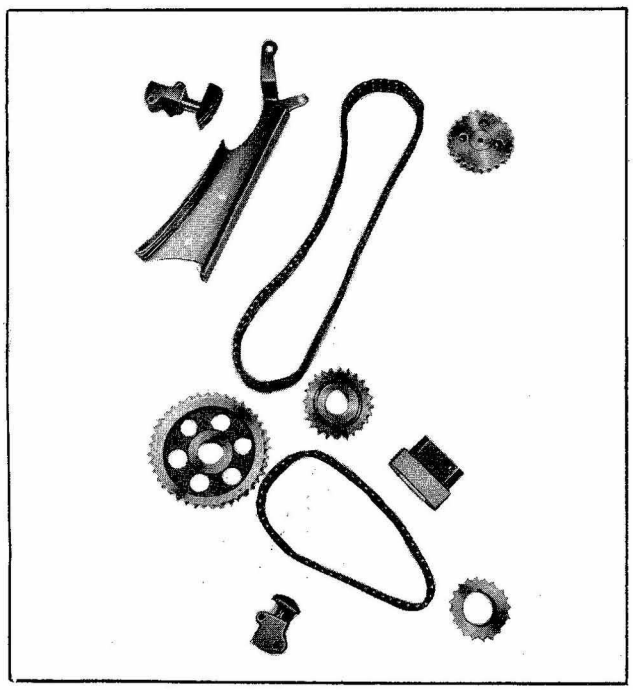


Fig. EM-38

3. Remove all camshaft bearing caps.

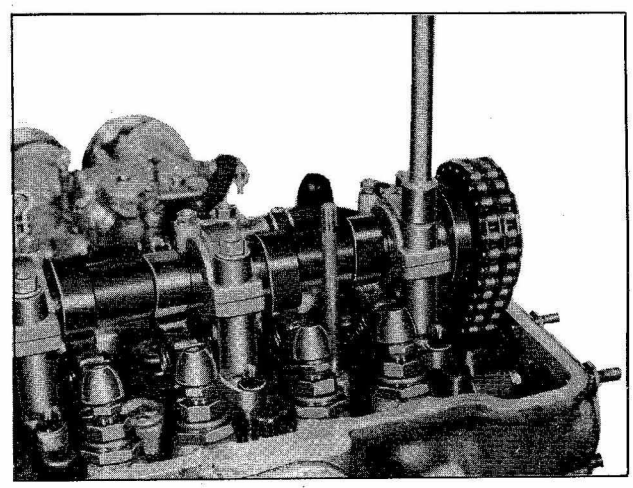


Fig. EM-39

4. Remove Camshaft.

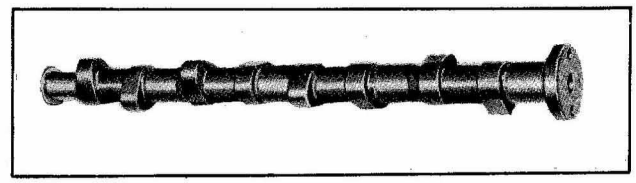


Fig. EM-40

5. Remove all rocker arms.

   On replacement it is more effective to install Rocker arms by pressing down Valve springs after the installation of Camshaft.

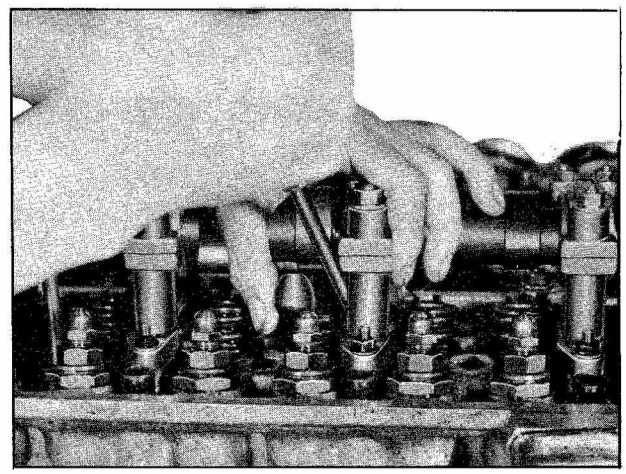


Fig. EM-41

Inspect Camshaft condition

Camshaft Bend

(Measure Center Journal with Both end journals supported).... less than 0.01 mm (0.0004 in.)

Camshaft Journal to Bearing Clearance (at room temperature)

No.1 ~ No.4 Journal ... 0.023 ~ 0.052 mm (0.0009 ~ 0.0020 in.)

No.5 Journal ..... 0.021 ~ 0.047 mm (0.0008 ~ 0.0019 in.)

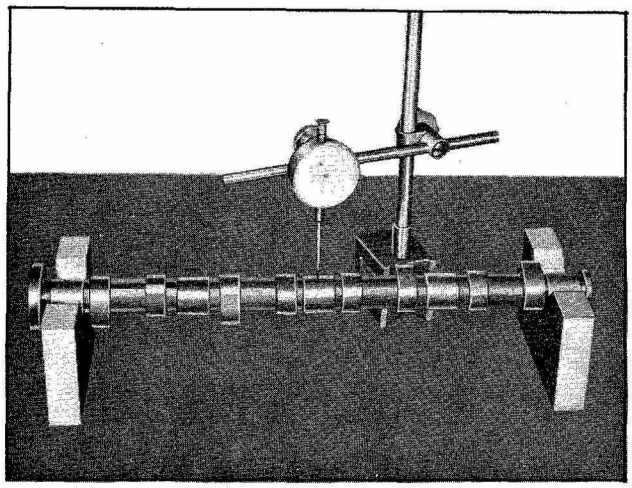


Fig. EM-42

After installation, Camshaft End play must be checked.

Camshaft End Play..... 0.1 ~ 0.3 mm (0.0039 ~ 0.0118 in.)

Tightening torque of Camshaft bearing cap nuts is 1.8 kg-m (13.0 ft-lb.) for Large nuts and 0.7 kg-m (5.1 ft-lb.) for Small nuts. Tightening torque of Camshaft sprocket to Camshaft bolts is 1.8 kg-m (13.0 ft-lb.). Tightening torque of Rocker arm cover bolts is 0.6 ~ 0.7 kg-m (4.3 ~ 5.1 ft-lb.).

Caution: Never remøve Lower Camshaft Bearings unless you have a suitable machine for boring Camshaft Bearing in line. If you once remove Camshaft Bearings, the bearing centers will be out of alignment and the recondition is very difficult without center boring.

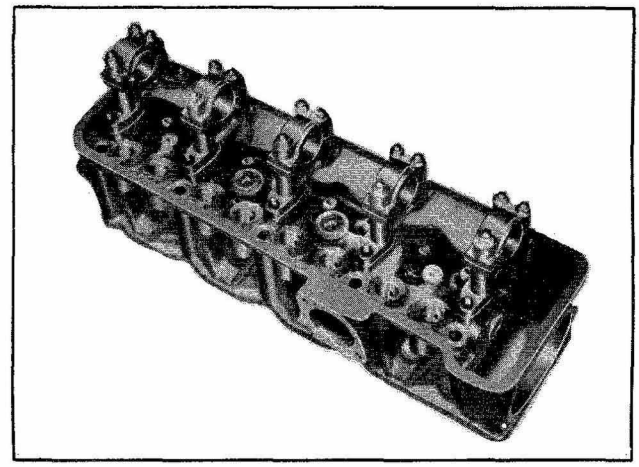


Fig. EM-43

Cylinder Head-Remove and Replace

Remove

1. Disconnect Radiator and Heater hoses.
2. Remove Air Cleaner.
3. Disconnect Fuel and vacuum lines at carburetors.
4. Remove Intake manifold and Carburetors as an assembly.
5. Remove Exhaust manifold.
6. Remove Rocker arm cover assembly.
7. Disconnect Camshaft sprocket at camshaft front end, and support camshaft sprocket temporarily to chain guide with a screw.
8. Remove Cylinder head front plate.
9. Remove Upper chain tensioner.
10. Remove two nuts securing Cylinder Head to Timing Chain Cover.

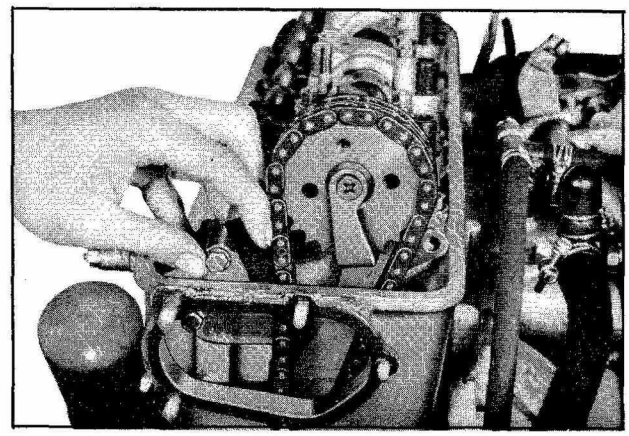


Fig. EM-44

11. Remove Cylinder head bolts, Cylinder head and Gasket.

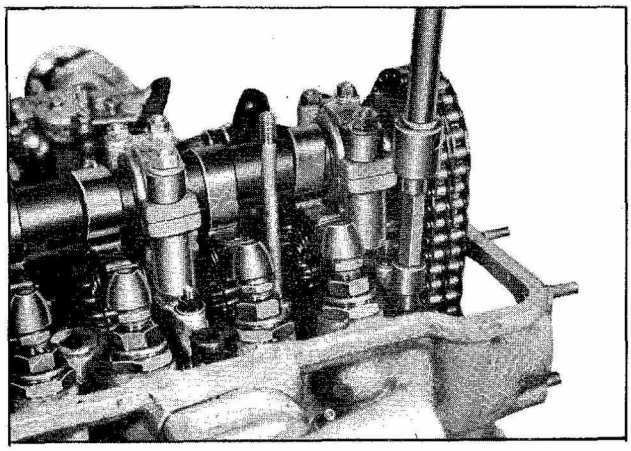


Fig. EM-45

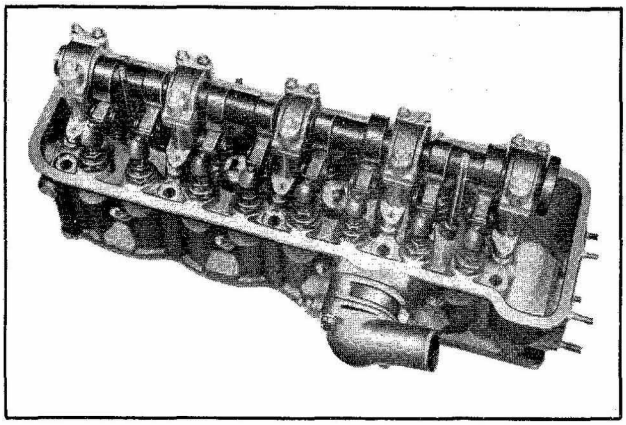


Fig. EM-46

12. Clean Gasket surfaces of cylinder head and block.

Replace

1. Place a new cylinder head gasket in position over dowel pins in cylinder block.

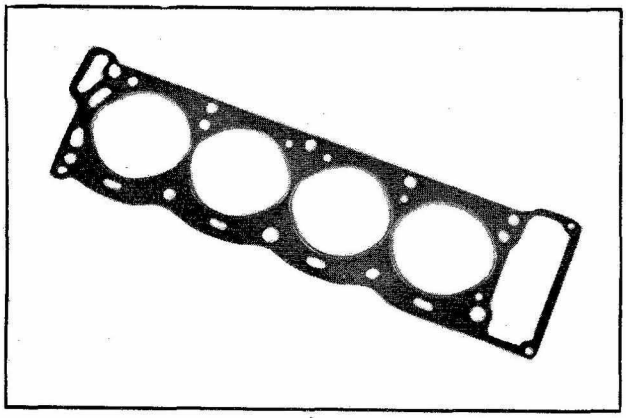


Fig. EM-47

2. Carefully guide Cylinder head into place over dowel pins and gaskets.
3. Start all bolts in threads.
4. Tighten Cylinder head at first round to 6.0 kg-m (43.3 ft-lb.) with a torque wrench. Follow the sequence shown in Fig. EM-48. The final torque should be 9.0 kg-m (65.1 ft-lb.)

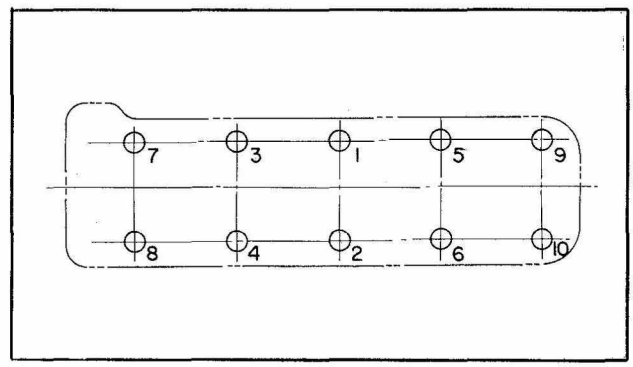


Fig. EM-48 Cylinder Head Bolt Tightening Order

5. Reverse steps 1-9 removal to complete installation procedure using new gasket and seals as required.

Cylinder Head and Valves-Recondition

Disassemble

1. Remove Cylinder head and Gasket as previously described.
   Place Cylinder head on two blocks of wood to prevent damage.
2. Remove Rocker arms and Camshaft.
3. Remove Lash adjusters.

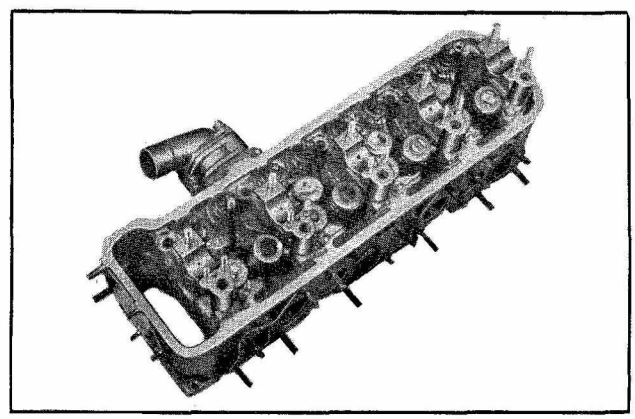


Fig. EM-49

4. Using Valve Lifter, compress the valve springs and remove valve keys.
   Remove spring caps, springs and spring seats with oil seals.

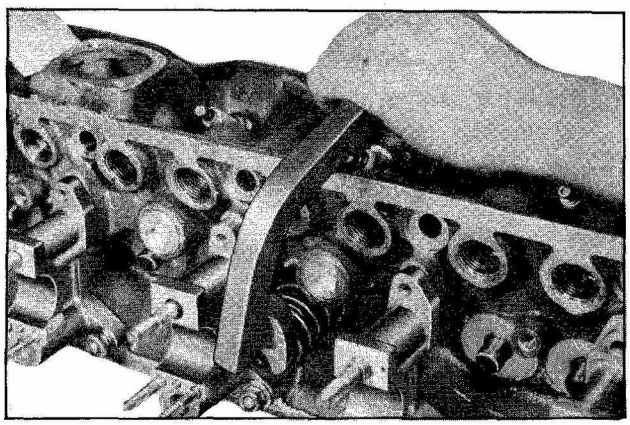


Fig. EM-50

5. Remove Valves from bottom of cylinder head and place them in a rack in their proper sequence so they can be assembled in their original positions.

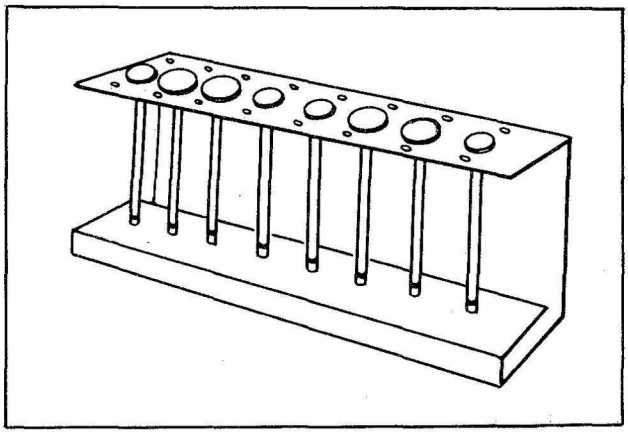


Fig. EM-51

Clean and Inspect

1. Clean all carbon from combustion chambers and valve ports.
2. Thoroughly clean the valve guides.
3. Clean all carbon and sludge from rocker arms.
4. Clean valve stems and heads on a buffing wheel.
5. Clean carbon deposits from head gasket mating surfaces.

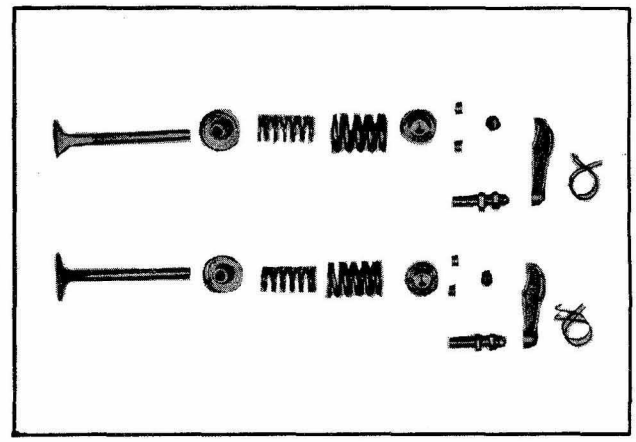


Fig. EM-52

6. Wash all parts in cleaning solvent and dry them thoroughly.
7. Inspect Cylinder head for cracks in the exhaust ports, combustion chambers, or external cracks to the water chamber.
8. Inspect Valves for burned heads, cracked faces or damaged stems.
9. Check fit of valve stems in their respective bores.

Fitting Valve Stems to Guides

The valve stem to guide clearance is 0.015 ~ 0.043 mm (0.0006 ~ 0.0017 in.) for intake valves and 0.045 mm ~ 0.073 mm (0.0018 ~ 0.00029 in.) for exhaust valves.

Wear limit of clearance is 0.15 mm (0.0059 in.).

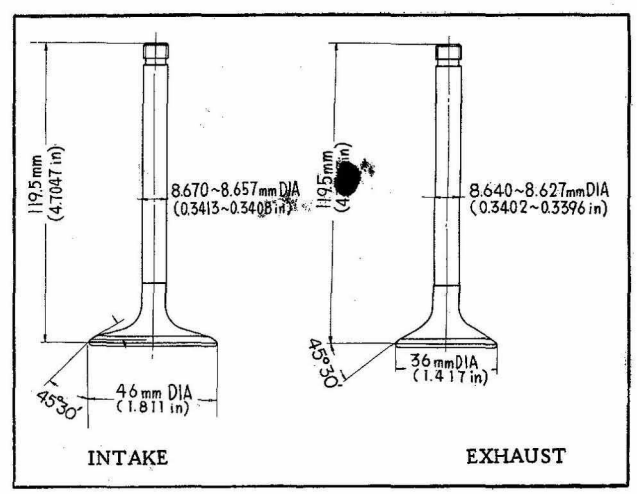


Fig. EM-53

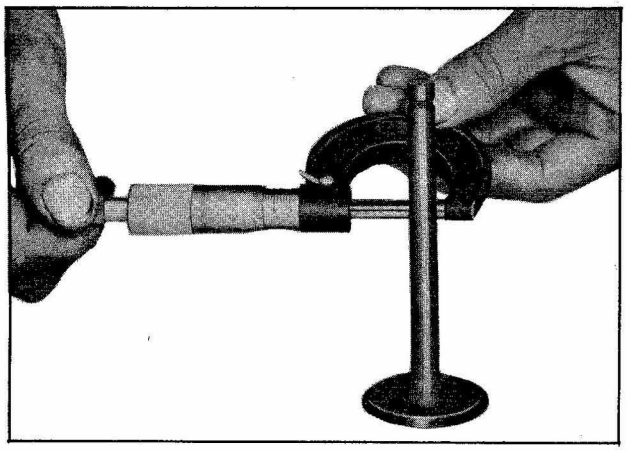


Fig. EM-54

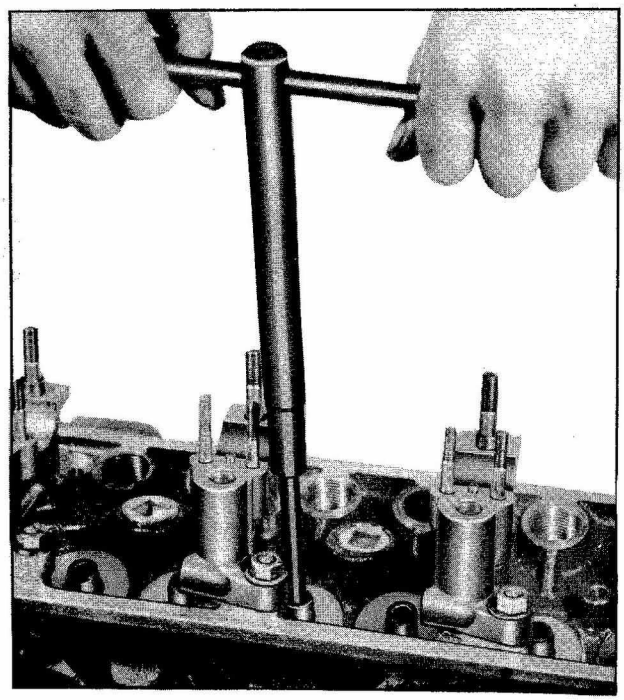


Fig. EM-55

The intake and exhaust valve stem diameters are shown in Fig. EM-53. Valve guides with 0.25 mm (0.0098 in.) oversize diameter are available. The same valve stem to guide clearance applies for oversize valve guides.

Reamers are required to enlarge valve guide holes to fit the valve stems.

When reamer is turned through valve guide, it will size the hole to fit valve stem according to above limits.

Valve Guides-Remove and Replace

Remove

1. Rest Cylinder head with its machined face upwards on a suitable stand.
2. Drive a valve guide downwards from the combustion space with a suitable-sized drift.

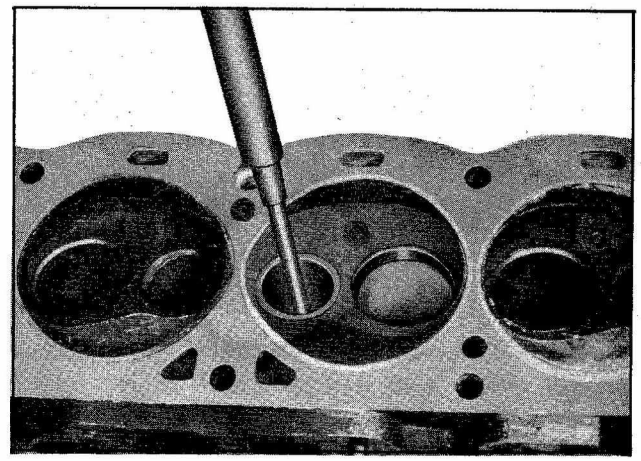


Fig. EM-56

Replace

1. Heat the cylinder head to a temperature of 150 ~ 160°C (302 ~ 320° F).

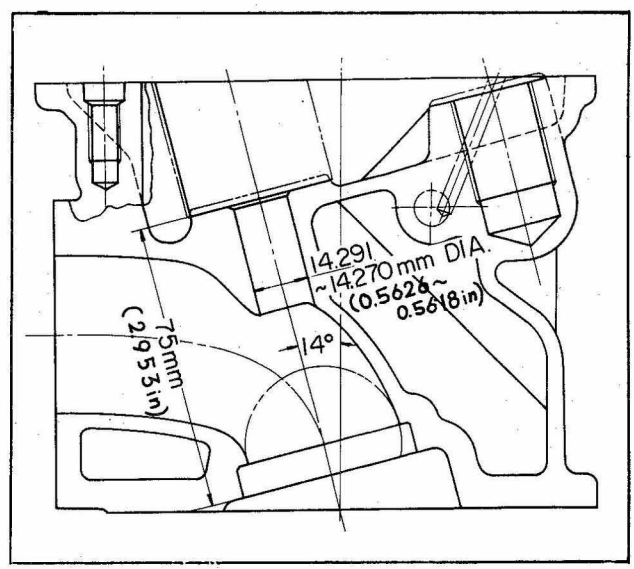


Fig. EM-57 Sectional View of Cylinder Head

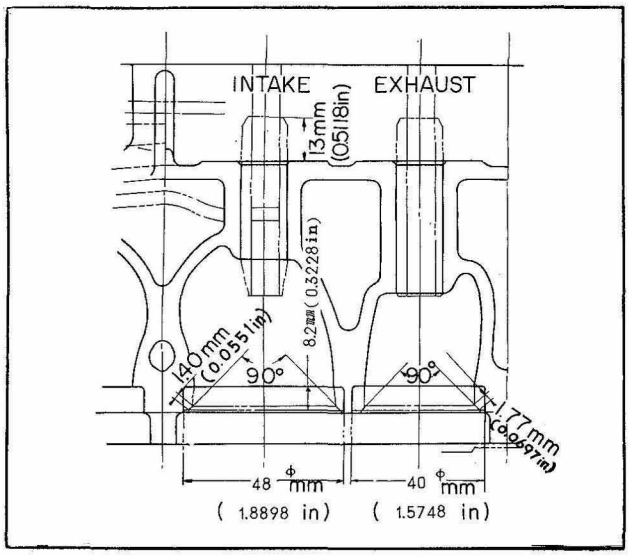


Fig. EM-58 Sectional View of Cylinder Head

2. Rest the cylinder head with its machined face downwards on a clean surface.
3. Press the new valve guide in from the top of the cylinder head.

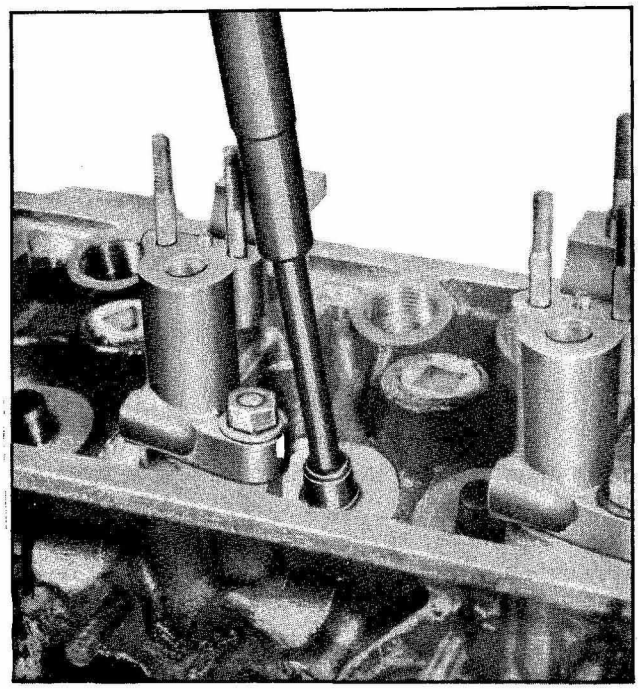


Fig. EM-59

The exhaust valve guides must be inserted with the end having the small chamfer at the top and the intake valve guides should have their taper ends at the bottom.

The valve guides should be driven into the combustion space until they are 13 ± 0.1 mm (0.512 ± 0.004 in.) above the machined surface of the spring seat.

Interference fit of valve guide into Cylinder head is 0.022 ~ 0.050 mm (0.0009 ~ 0.0020 in.) for both intake and exhaust valve guides.

Valve Seat Inserts-Remove and Replace

Remove

Old inserts can be removed by boring out until the insert collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the insert recess in the cylinder head.

Replace

1. Check the valve recess diameter.
2. Select a suitable valve seat insert and check its outside diameter.
3. Machine the cylinder head recess diameter to the best possible finish concentric to the valve guide center so that the insert will have the correct interference fit.

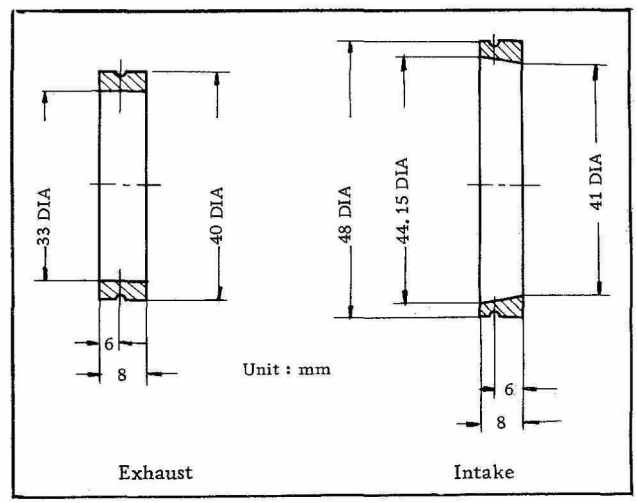


Fig. EM-60 Valve Seat Insert

4. Heat the cylinder head to a temperature of 150 ~ 160°C (302 ~ 320°F).
5. Fit the insert ensuring that it beds on the bottom face of its recess.

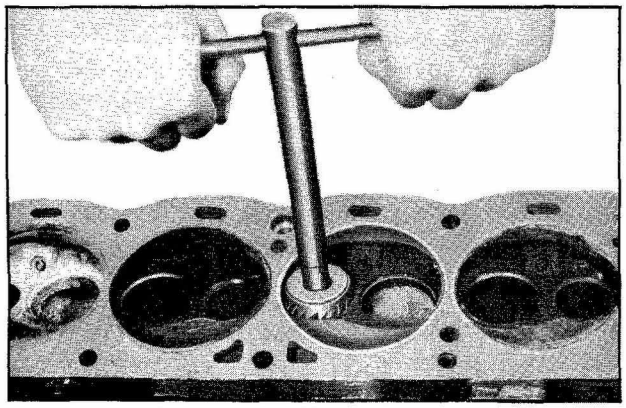


Fig. EM-61

6. The valve seats newly fitted should be cut or ground at an angle of 45° to a width of 1.40 mm (0.055 in.) for Intake and 1.77 mm (0.069 in.) for Exhaust.

   Interference fit of Valve seat into Cylinder head valve recess.

   Intake ..... 0.081 ~ 0.113 mm (0.0032 ~ 0.0044 in.)
   Exhaust ..... 0.064 ~ 0.096 mm (0.0025 ~ 0.0038 in.)

Valves and Seats-Recondition

Valves should be ground on a special bench grinder designed specifically for this purpose and valve seats should be ground with reputable power grinding equipment having stored of the correct seat angle and a suitable pilot which pilots in the valve stem guide.

1. The seating of the cylinder head must be machined to the dimensions given in Fig. EM-58. Each valve seat insert should have an interference fit of 0.081 ~ 0.113 mm (0.0032 ~ 0.0044 in.) for Intake and 0.064 ~ 0.096 mm (0.0025 ~ 0.0038 in.) for Exhaust and must be pressed as previously mentioned. After fitting, grind or machine the new seating to the dimensions given in Fig. EM-62.

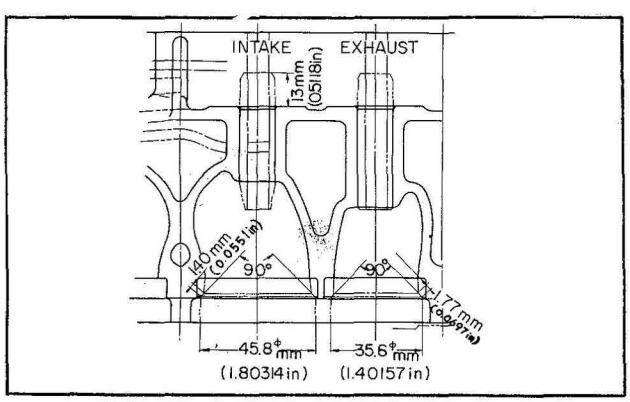


Fig. EM-62 Sectional View of Cylinder Head

2. The intake valve seat angle is 45° with a face angle of 45° 30'. The exhaust valve has a seat angle of 45° with a face angle of 45° 30'. This will provide hairline contact between valve and seat to provide positive sealing and reduce build up of deposits on seating surfaces.

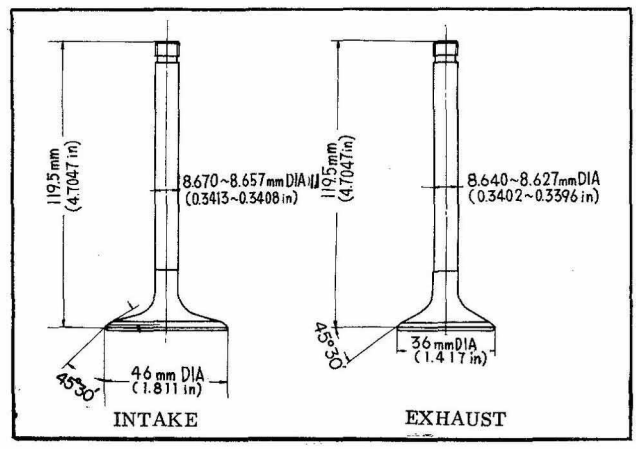


Fig. EM-63

3. Valves may be refaced until remaining margine is down to 0.5 mm (0.0196 in.) then the valve must be replaced.
   The valve stem tip when worn can be resurfaced and rechamfered. However, never remove more than 0.5 mm (0.0196 in.).

Valve Spring

Whenever valve springs are removed, they should be tested according to the specifications listed below.

Use valve spring tester and replace all springs not within specifications.

	Outer Spring	Inner Spring
Free Length	49.7 mm (1.96 in.)	48.4 mm (1.91 in.)
Valve Closed	41.2 mm at 32.3 kg (1.62 in. at 71.1 lb.)	39.2 mm at 13.3 kg (1.54 in. at 29.3 lb.)
Valve Open	29.6 mm at 76.4 $^{+2.0}_{-4.0}$ kg (1.17 in. at 168.1 $^{+4.41}_{-8.82}$ lb.)	27.6 mm at 29.9 + 1,8 kg (1.09 in. at 65.8 ± 3.96 lb.)

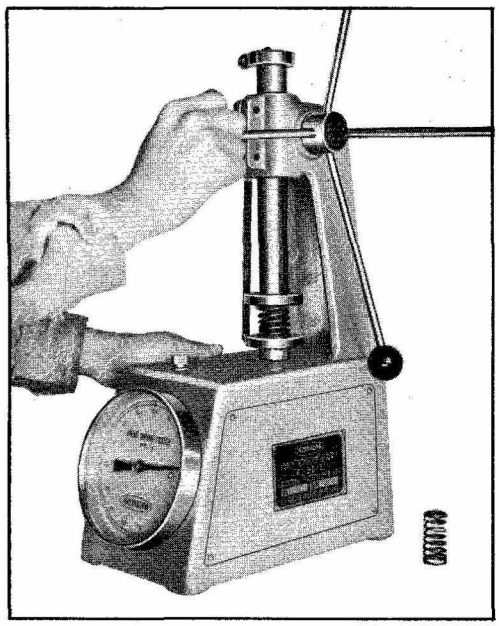


Fig. EM-64

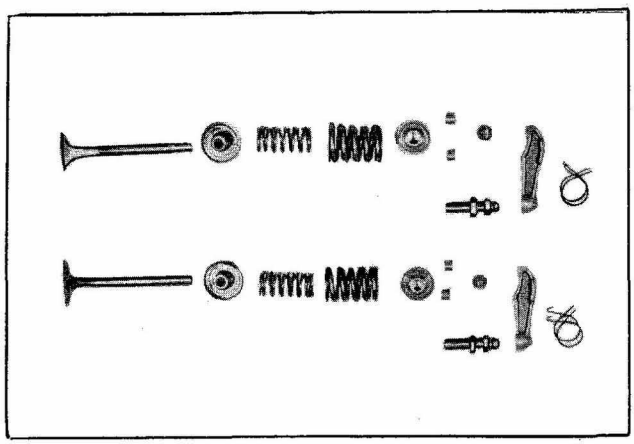


Fig. EM-65

Reassemble

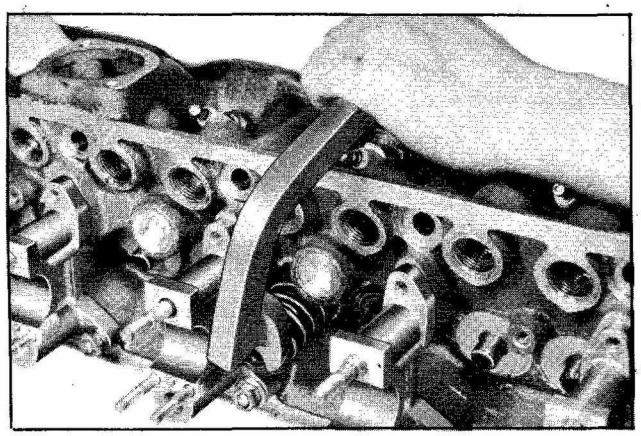


Fig. EM-66

1. Starting with No. 1 cylinder place exhaust valve in the port and place valve spring seat with lip-seal and valve spring and cap in position.
   Then using suitable spring compressor, compress spring and insall valve keys.
   See that the keys seat properly in valve stem groove.
2. Assemble remaining valves, valve spring seats, valve springs, spring caps and valve keys in cylinder head.

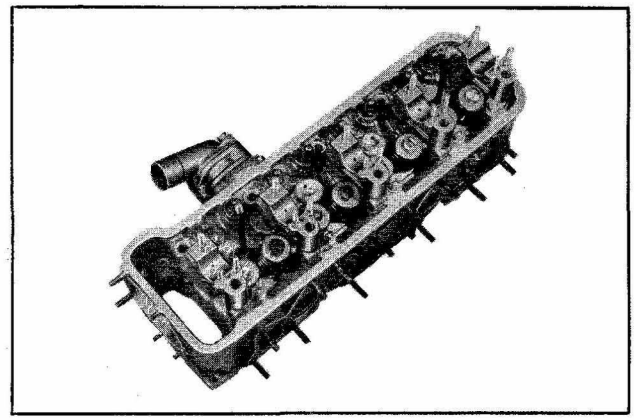


Fig. EM-67

3. Assemble Lash adjusters.
4. Install Camshaft.
5. Install Camshaft bearing caps and tighten Large nuts (M8) to 1.8 kg-m (13.0 ft-lb.) and Small nuts (M6) to 0.7 kg-m (5.1 ft-lb.).
6. Check End play. {0.1 ~ 0.3 mm (0.0039 ~ 0.0118 in.)}.
7. Install Rocker arms by pressing down the valve springs.

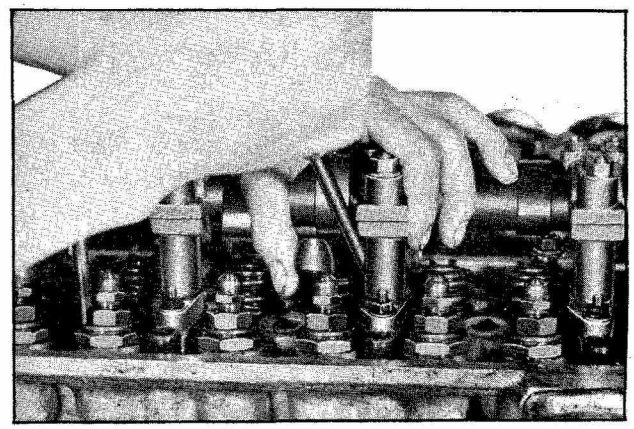


Fig. EM-68

Valve Rocker Clearance-Adjust

If the engine is to give its best performance and the valves are to retain their maximum useful life, it is essential to maintain the correct valve clearance.

Provision for adjusting the valve clearance is made in the rocker arm by an adjustable screw and lock nut.

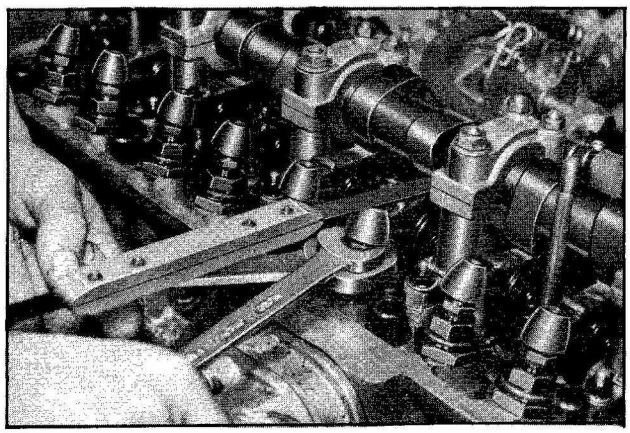


Fig. EM-69

The rocker adjusting screw is released by slackening the hexagon lock nut with a end wrench while holding the screw against rotation with a end wrench.

The valve clearance can then be set by carefully rotating the rocker screw while checking the clearance with a feeler gauge. This screw is the re-locked by tightening the hexagon lock nut while again holding the screw against rotation.

Caution: Do not adjust the valve clearance with Engine running because the rocker arms and valves are forcibly lubricated from Camshaft oil gallery.

Valve Rocker Clearance (Hot)
Exhaust Valve ..... 0.3 mm (0.0079 in.)
Intake Valve ..... 0.2 mm (0.0118 in.)

THE FRONT OF ENGINE

Water Pump-Remove and Replace

1. Remove Upper radiator shroud.

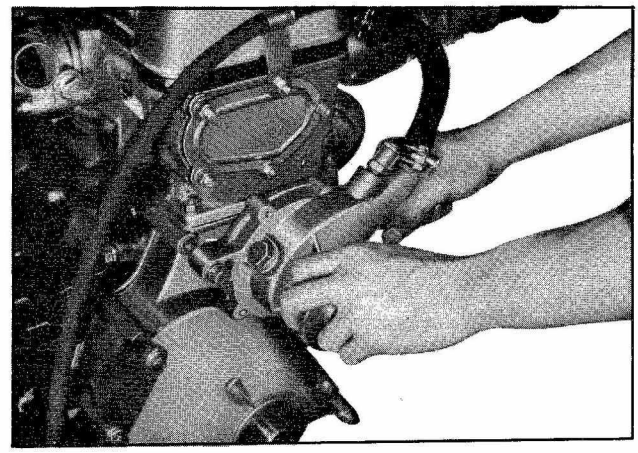


Fig. EM-70

2. Loosen Alternator at adjusting bracket and pivot bolt and remove Fan belt from Fan pulley.
3. Remove Fan, Fan pulley and Spacer.
4. Remove four screws securing Water pump to the front of Engine.
5. Remove Water pump.

Replacement is a reversal of the above procedure.

Vibration Damper-Remove and Replace

1. Loosen Alternator at adjusting bracket and pivot bolt and remove Fan belt from Vibration Damper.

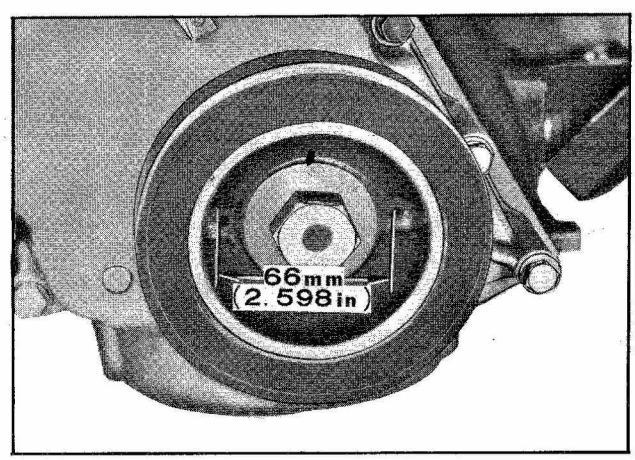


Fig. EM-71

2. Remove Crank Pulley Bolt from Crankshaft.
3. Remove Vibration Damper with Special Tool.

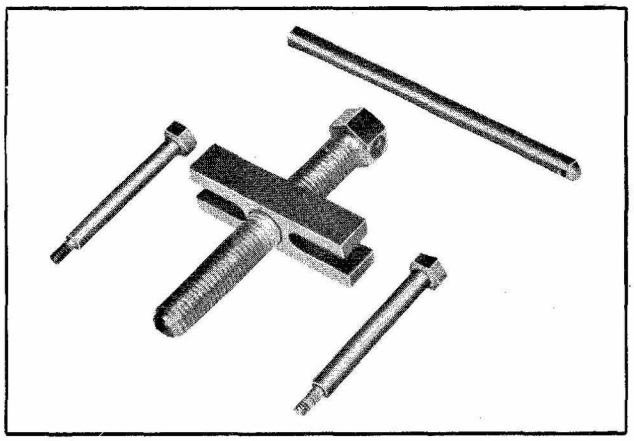


Fig. EM-72

Replacement is a reversal of the above procedure.

Vibration Damper is not repairable in the field. It is only serviced as a complete assembly.

Tighten Crank Pulley Bolt to 20 kg-m (144.6 ft-lb.) torque. A loose Vibration Damper or damage to the damper cushion may be misdiagnosed as loose engine bearings.

Timing Chain Cover-Remove and Replace

1. Remove Alternator.
2. Remove Cylinder head, Intake and Exhaust manifold.

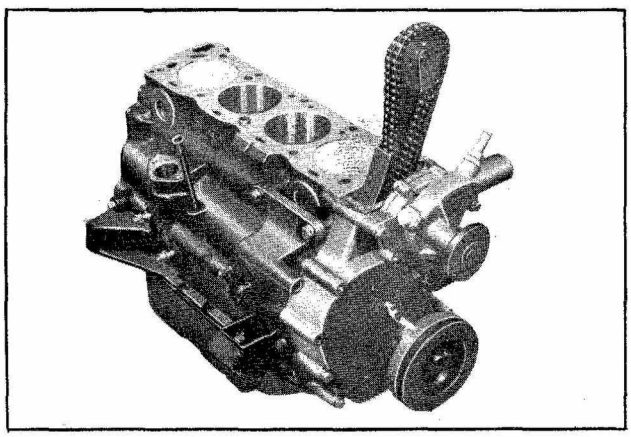


Fig. EM-73

3. Remove Fan, Fan pulley and Fan belt.
4. Remove Vibration Damper.
5. Remove Water pump.

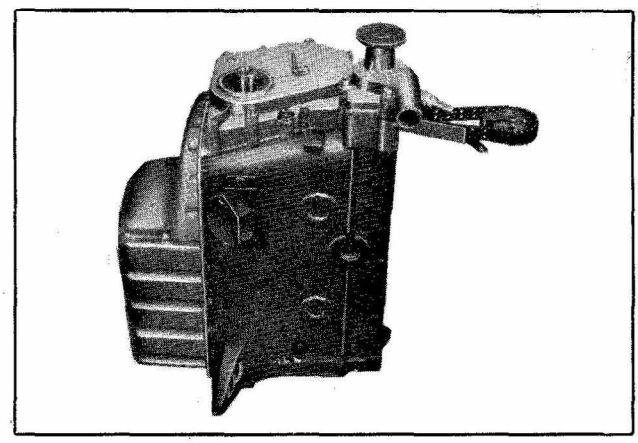


Fig. EM-74

6. Remove all screws securing Oil pan to Timing chain cover and Cylinder Block.
7. Remove Oil pan.
8. Remove Timing chain cover.

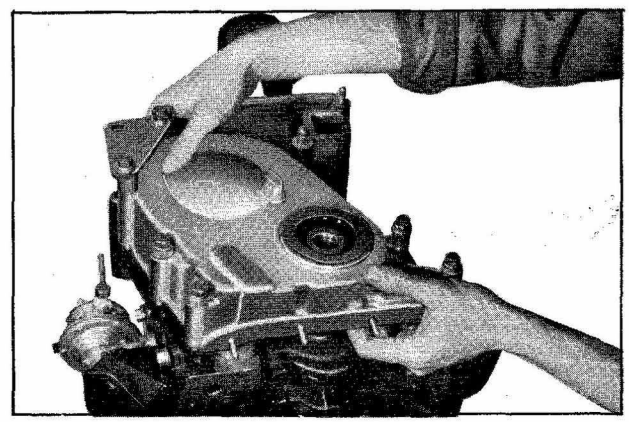


Fig. EM-75

Replacement is a reversal of the above procedure.

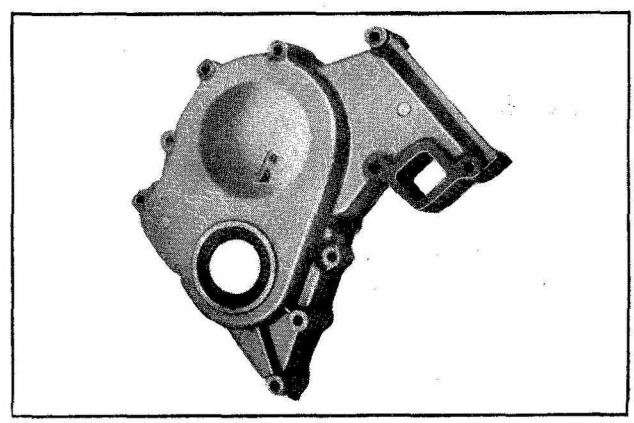


Fig. EM-76

Timing Chains and Sprockets-Remove and Replace

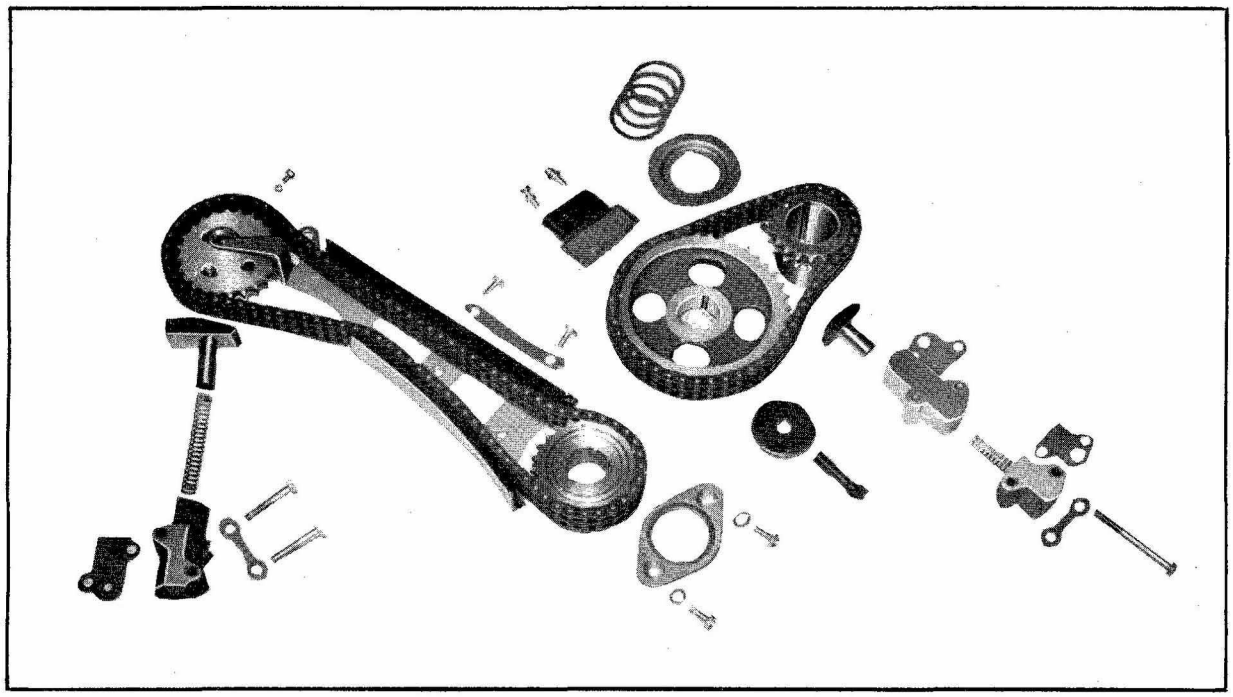


Fig. EM-77

Removing Timing Chains

1. Remove Timing chain cover as previously mentioned.

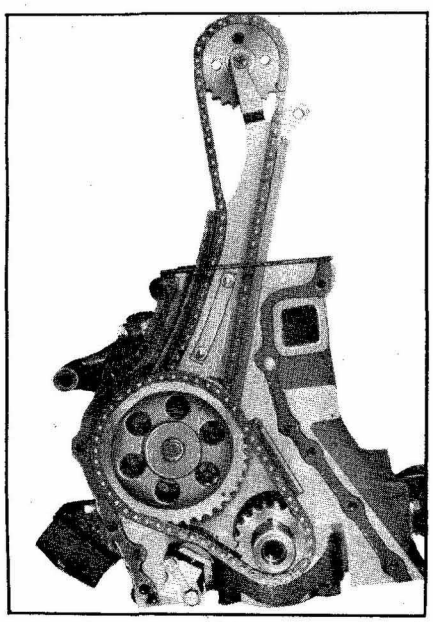


Fig. EM-78

2. Remove Lower chain tensioner.

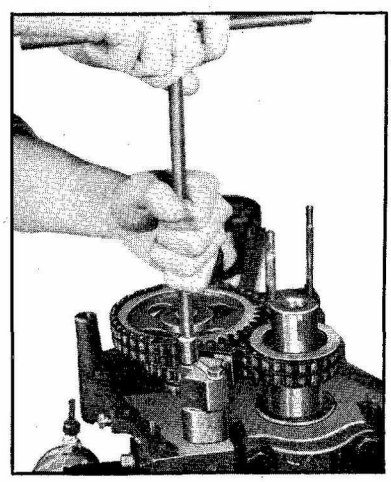


Fig. EM-79

3. Remove Jackshaft chain with Crankshaft sprocket and Jackshaft sprocket-Front.

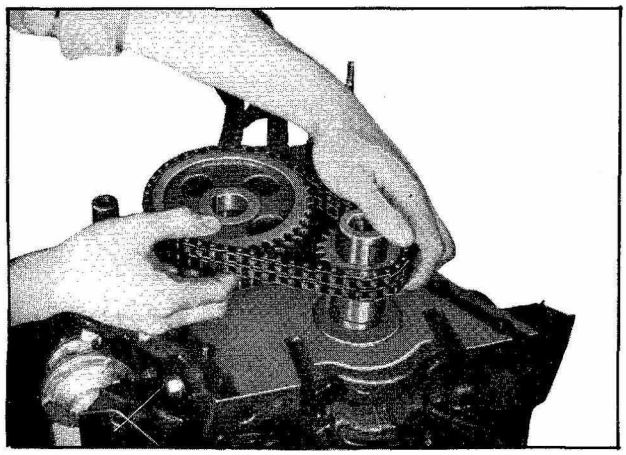


Fig. EM-80

4. Remove Camshaft sprocket and install small screw securing Camshaft sprocket to Timing chain guide into its original place of Camshaft sprocket.

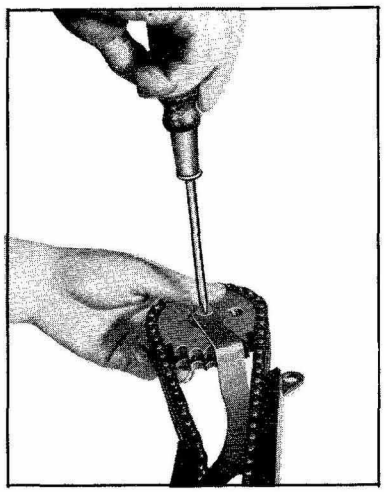


Fig. EM-81

5. Remove Camshaft chain.
6. Remove Jackshaft sprocket-Rear.

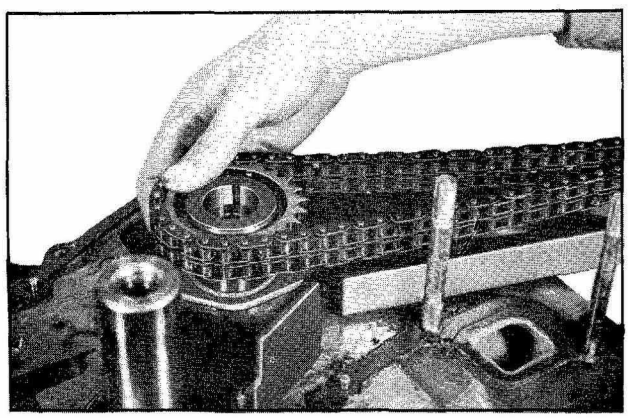


Fig. EM-82

7. Remove all Timing chain guides.

Replacement is a reversal of the above procedure.

Align the timing marks according to the following procedure.

Tighten Screw-Jackshaft Front sprocket to Jackshaft to 4.5 ~ 5.0 kg-m (32.5 ~ 36.2 ft-lb.) torque.

Aligning Timing Marks

Valve timing is determined by the relation between Crankshaft sprocket and Jackshaft sprocket and the relation between Jackshaft sprocket and Camshaft sprocket.

To obtain the correct valve timing, assemble Timing chains and Sprockets as follows.

1. Place Camshaft sprocket and Jackshaft sprocket-Rear into Camshaft chain, aligning the timing marks of Sprockets with those of Timing chain.

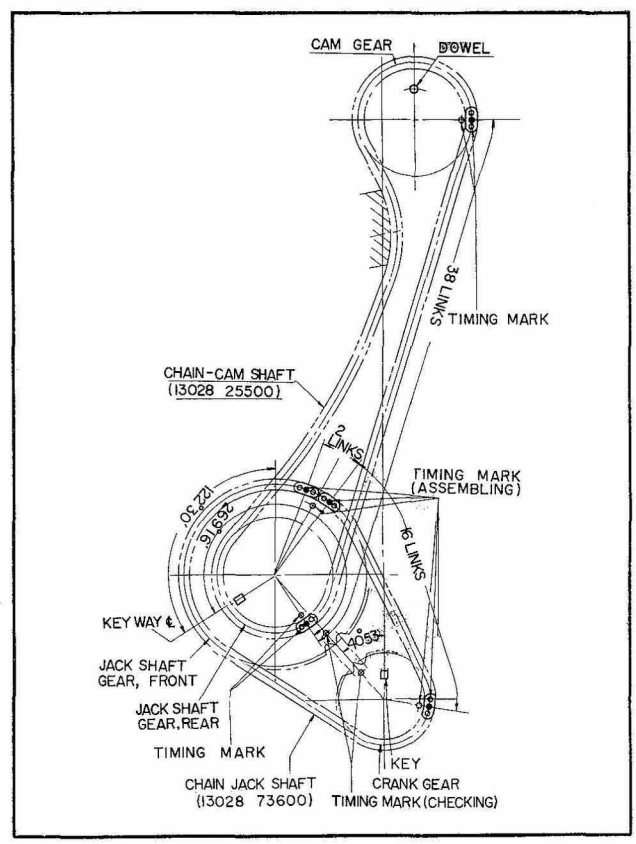


Fig. EM-83

2. Keeping Sprockets in this position engage Jackshaft Sprocket Keyway with the key on Jackshaft.

3. Support Camshaft sprocket temporarily to Chain guide with a screw.

4. Place Jackshaft sprocket-Front and Crankshaft sprocket into Jackshaft chain, aligning the timing marks of Sprockets with those of Timing chain as shown in Fig. EM-83.

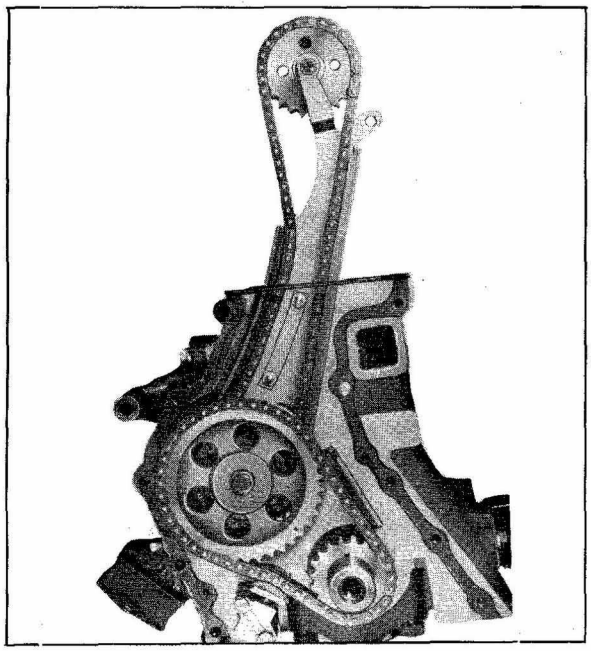
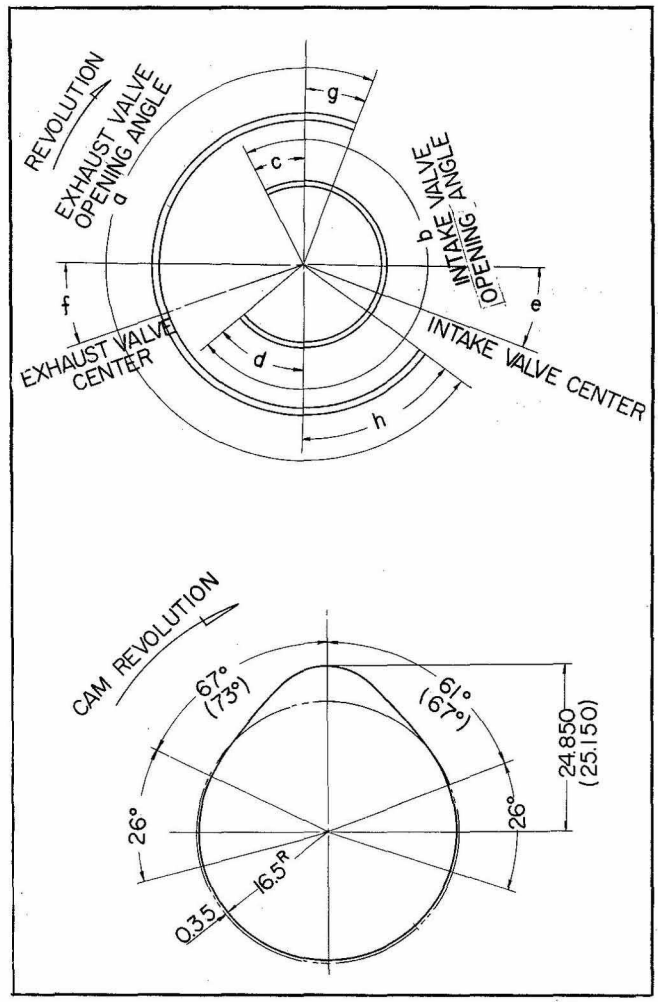


Fig. EM-84

5. Install Timing chain and Sprocket assembly engaging each keyway with the keys on Jackshaft and Crankshaft.
Push the sprockets onto the shafts as far as they will go and secure Jackshaft sprocket with the lock washer and bolt. Tighten to 4.5 ~ 5.0 kg-m (32.5 ~ 36.2 ft-lb.) torque.

Unit: degree

	FOR SU	FOR SOLEX
a	256	280
b	256	280
c	18	30
d	58	70
e	20	20
f	20	20
g	18	30
h	58	70



( ) shows for Solex Carburetor

Fig. EM-85 Valve Timing Diagram

To check the assembly, rotate Crankshaft until the key on Crankshaft is on the highest position (No.1 Piston is on its T.D.C.). In this case, the "O" marks on Jackshaft and Crankshaft sprockets must be on a line drawn through the center line of each shaft.

Timing Chain Tensioner-Remove and Replace

Upper Tensioner

1. Remove Rocker arm cover.
2. Remove Cylinder head front cover plate.

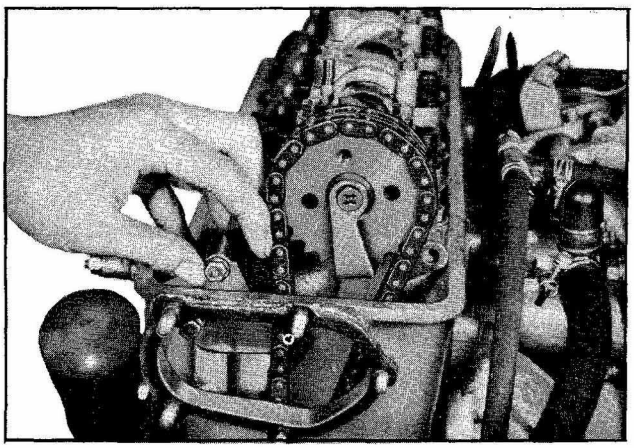


Fig. EM-86

3. Remove two screws securing Chain tensioner to Cylinder head.
4. Remove Chain tensioner and Spacer plate.

Replacement is a reversal of the above procedure. Use new gaskets.

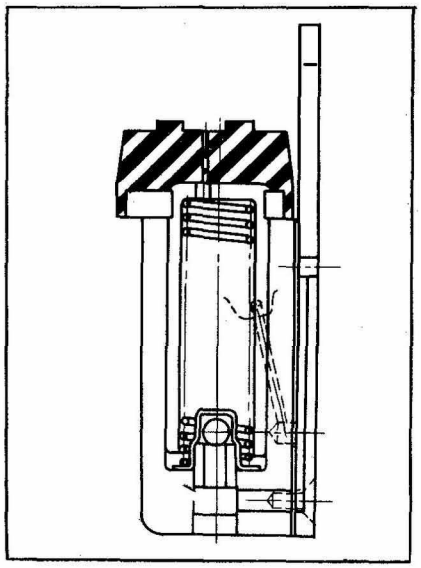


Fig. EM-87

Lower Tensioner

1. Remove Timing chain cover as previously mentioned.
2. Remove two screws securing Chain tensioner to Cylinder block
3. Remove Chain tensioner.

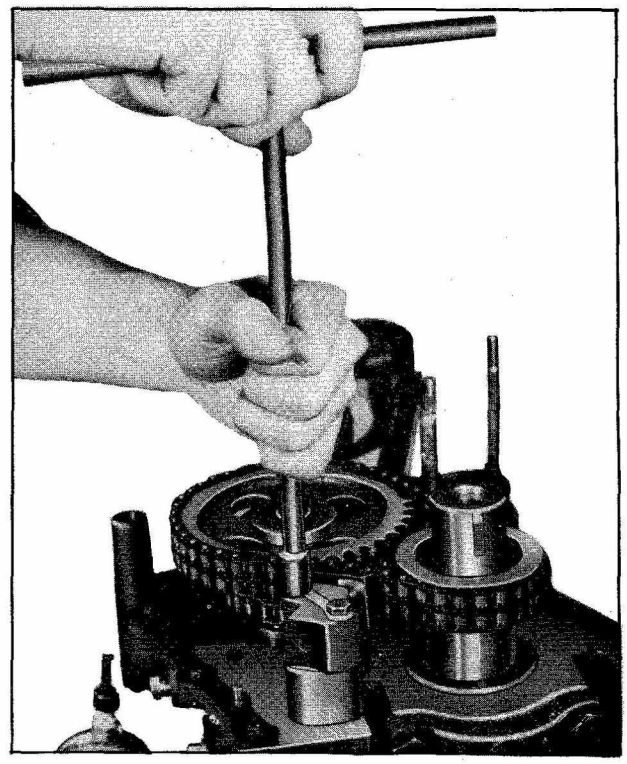


Fig. EM-88

Replacement is a reversal of the above procedure. Use new gaskets.

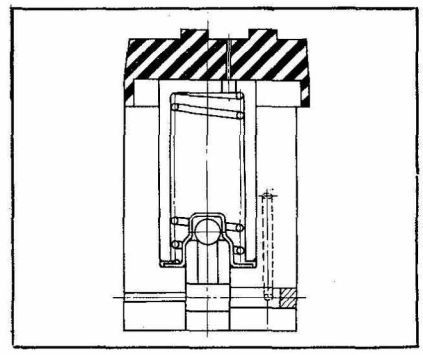


Fig. EM-89

THE REAR OF ENGINE

Flywheel-Remove and Replace

1. Remove Clutch assembly by unscrewing the six bolts and spring washers securing Clutch cover to Flywheel. Release the bolts a turn at a time to avoid the distortion of the cover flange. Three dowels locate Clutch cover on Flywheel.

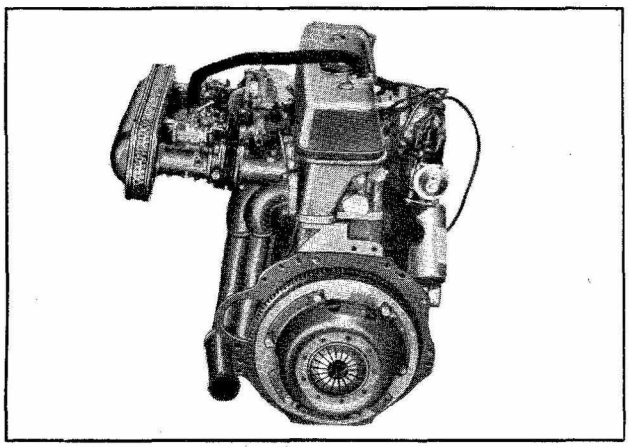


Fig. EM-90

2. Unlock and remove the twelve bolts securing Flywheel to Crankshaft and remove Flywheel.

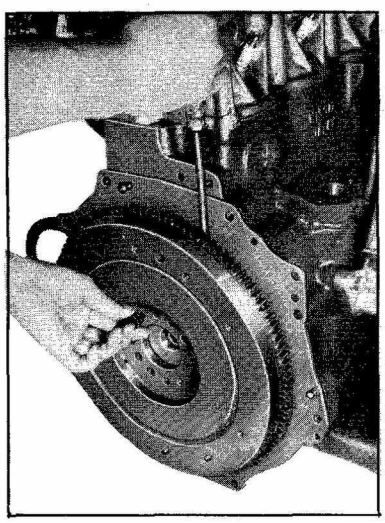


Fig. EM-91

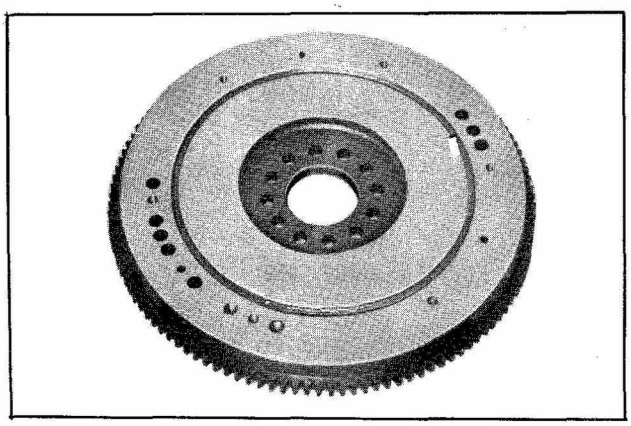


Fig. EM-92

Replacement is a reversal of the above procedure.

Tighten Flywheel bolts to 8 kg-m (57.8 ft-lb.) torque.
Tighten Clutch cover-Flywheel bolts to 2.5 ~ 3.5 kg-m (18.1 ~ 25.3 ft-lb.) torque.

Starter ring gear can be replaced by placing Flywheel in an arbor press with steel blocks equally spaced around the gear and pressing Flywheel through.

To install new Starter ring gear, firstly heat it to 200 ~ 300°C (390 ~ 570°F) to expand the inside diameter so that it can be pressed over Flywheel.

THE BOTTOM OF ENGINE

Oil Pan-Remove and Replace

1. Drain Engine Oil.
2. Unscrew Bolts and Nuts securing Oil pan to Cylinder block and Timing chain cover.

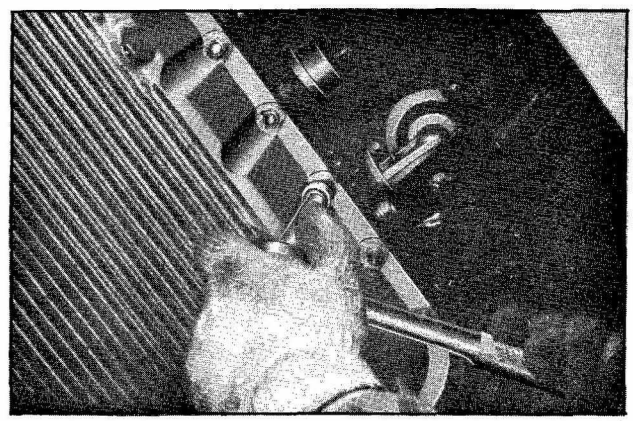


Fig. EM-93

3. Remove Oil Pan.

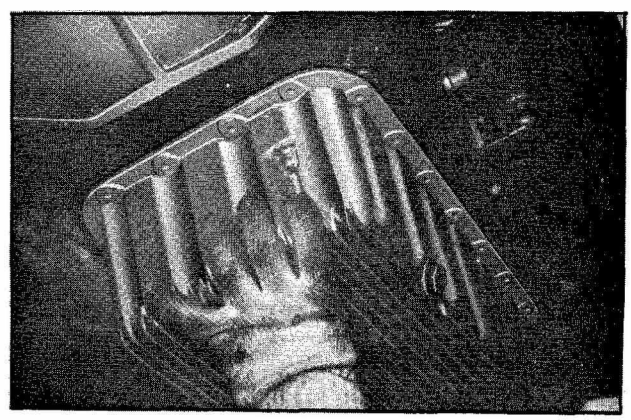


Fig. EM-94

When installing Oil pan, replace the old gasket to the new one.

Tighten Oil pan bolts and nuts to 0.5 kg-m (3.6 ft-lb.) torque.

Oil Pump-Remove and Replace

Oil pump is driven by the distributor drive shaft.

However, Oil pump removal or replacement will not affect Distributor timing as Distributor drive gear remains in mesh with Jackshaft gear.

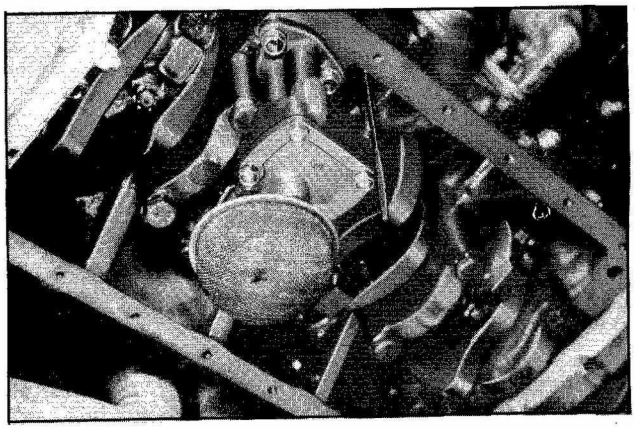


Fig. EM-95

1. Remove Oil pan as previously mentioned.
2. Unscrew the bolt and stud nut securing Oil pump to Cylinder block and remove Oil pump.

When refitting Oil pump, use a new Gasket.

Tighten Oil pump to Cylinder block bolts and nuts to 0.8 ~ 1.0 kg-m (5.8 ~ 7.2 ft-lb.) torque.

THE INSIDE OF ENGINE

Connecting Rod and Piston Assembly-Remove and Replace

Remove

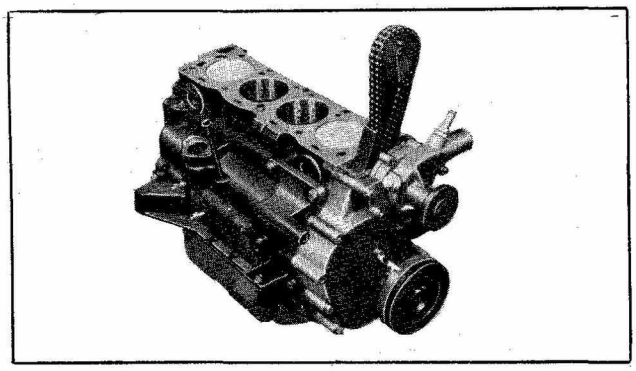


Fig. EM-96

1. Remove Cylinder head, Intake and Exhaust manifolds as previously mentioned.
2. Remove oil pan.
3. Check Connecting rod and Piston for cylinder number identification and if necessary, mark them.
4. Remove Big End Bearing caps.

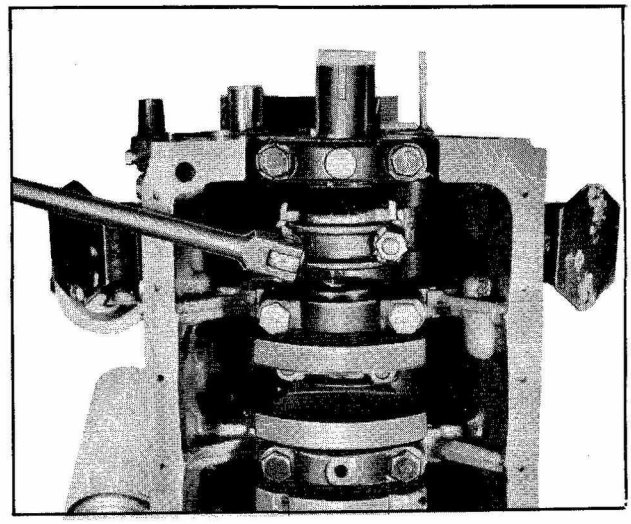


Fig. EM-97

5. Carefully remove Connecting rod and Piston assembly by pushing out and refit the bearing cap.

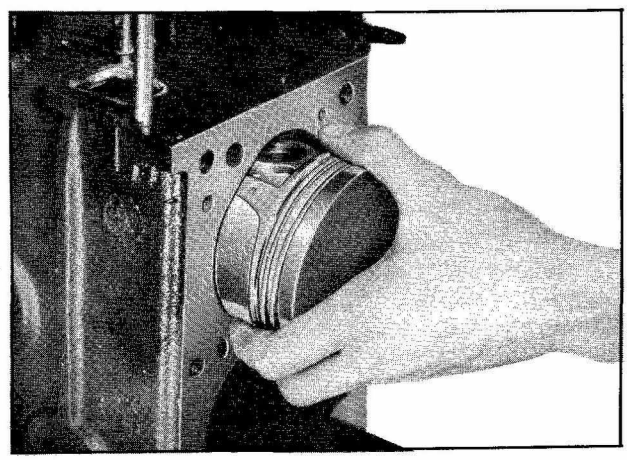


Fig. EM-98

Connecting Rod and Piston-Disassemble and Reassemble

1. Remove Piston rings using suitable piston ring remover.

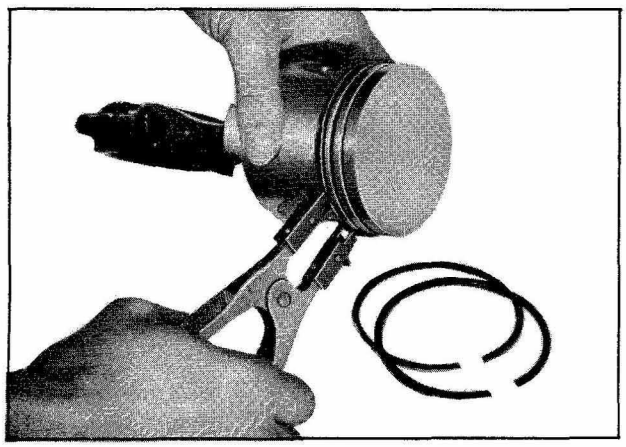


Fig. EM-99

2. Remove Piston pin snap rings.

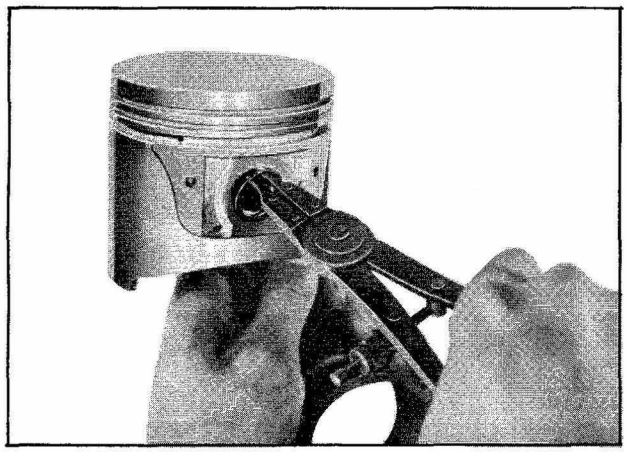


Fig. EM-100

3. Push out Piston pin and take off Connecting rod.

Assembling is a reversal of the above procedure.

Connecting rod to piston pin fitting should be a thumb push fit.

Clean and Inspect

1. Clean carbon, varnish, and gum from piston surfaces, including underside of piston head. Clean ring grooves, and oil holes in oil ring groove, using suitable cleaning tool and solvent.
2. Clean piston pin, rod, cap, bolts and nuts in suitable solvent. Reinstall cap on connecting rod to assure against subsequent mixing of caps and connecting rods.

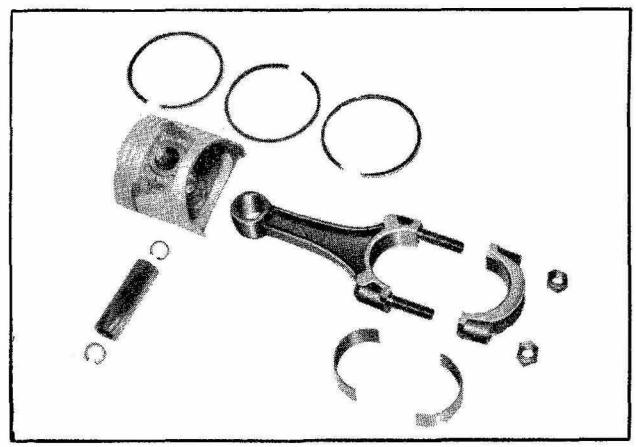


Fig. EM-101

3. Carefully examine piston for rough or scored bearing surfaces; cracks in skirt or head; cracked, broken, or worn ring lands; and scored, galled, or worn piston bosses. Damaged or faulty pistons should be replaced.
4. Inspect piston pin for scoring, roughness, or uneven wear and proper fit.

Piston Pin-Fit

The piston pin is a push fit into Connecting rod and Piston at room temperature.

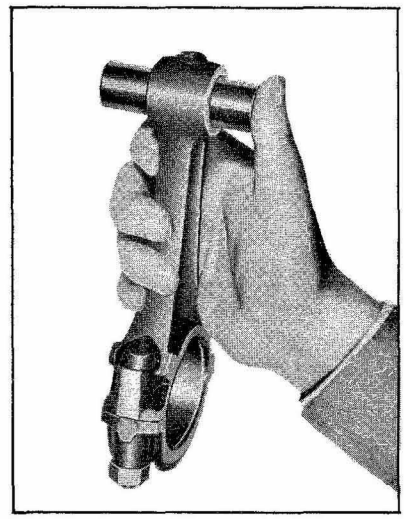


Fig. EM-102

Check the wear of the bushing at the connecting rod small end.

When fitting the pin, all parts must be free of nicks and burrs.

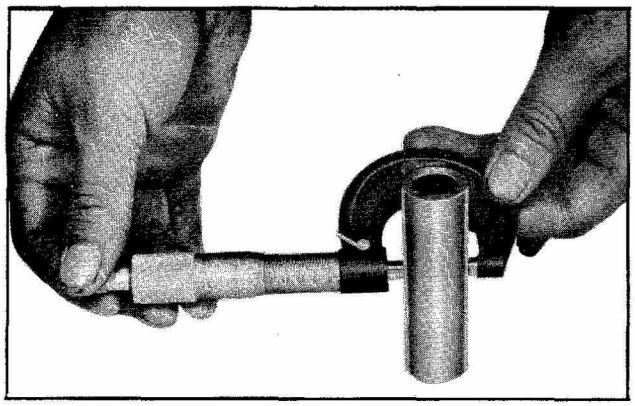


Fig. EM-103

The piston pin to piston pin hole clearance is 0.006 ~ 0.012 mm (0.0002 ~ 0.0005 in.).

The piston pin to connecting rod bushing clearance is 0.025 ~ 0.035 mm (0.0010 ~ 0.0014 in.).

Cylinder Bores-Inspect

Inspect Cylinder bores for out-of-round or excessive taper, with an accurate cylinder gauge at top, middle and bottom of bore.

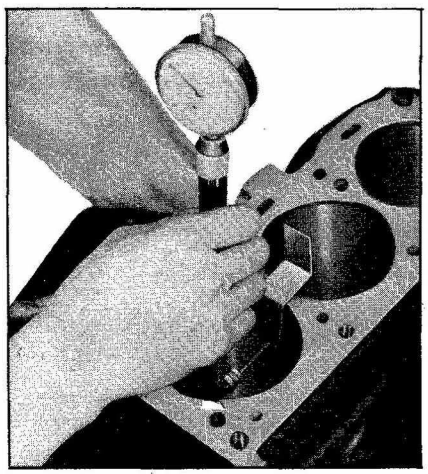


Fig. EM-104

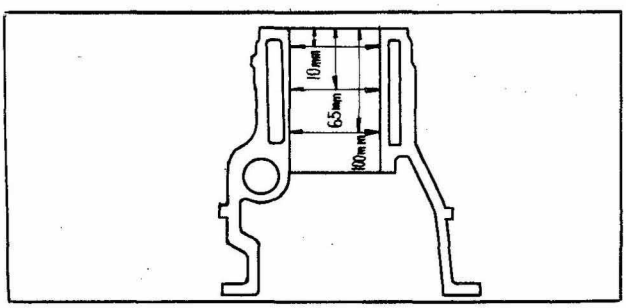


Fig. EM-105

Measure Cylinder bore parallel and at right angles to the center line of Engine to determine out-of-round.

Variation in measure from top to bottom of Cylinder indicates the taper in Cylinder.

The standard diameter of Cylinder bores is $87.200 \frac{+0.050}{0}$ mm ($3.4331 \frac{+0.0020}{0}$ in.).

Cylinder Bore Grade List (Production Use)

Standard Bore 87.200 mm DIA. (at 20°C)

Unit: 1/1000 mm

Grade Mark	①	②	③	④	⑤
Cylinder Grade	0~10	10~20	20~30	30~40	40~50

Cylinder Out-of-round 0.015 mm (0.0006 in.)
Cylinder Taper 0.02 mm (0.0008 in.)

Boring and Honing

If a piston in excess of 0.25 mm (0.01 in.) oversize is to be installed, cylinder should be bored, rather than honed, to effect a true bore.

When honing to eliminate the possibility of honing taper into the cylinder when installing 0.25 mm (0.01 in.) oversize, full strokes of the hone in cylinder should be made in addition to checking measurement at top, middle and bottom of bore repeatedly.

When boring, always be sure crankshaft is out of way of boring cutter when boring each cylinder.

Crankshaft bearings and other internal parts must be covered or taped to protect them during boring or honing operation. When taking final cut with a boring bar, leave 0.025 mm (0.001 in.) on the diameter for finish honing to give required piston to cylinder clearance specifications.

By measuring the piston to be installed at sizing points and adding the mean of clearance specification, the finish hone cylinder measurement can be determined. It is important that both block and piston be measured at normal room temperature, 20°C (68°F).

After final honing and before piston is checked for fit; each cylinder bore must be thoroughly cleaned.

Use soapy water solution and wipe dry to remove all traces of abrasive. If all traces of abrasive are not removed, rapid wear of new rings and piston will be result.

Piston-Fit and Replace

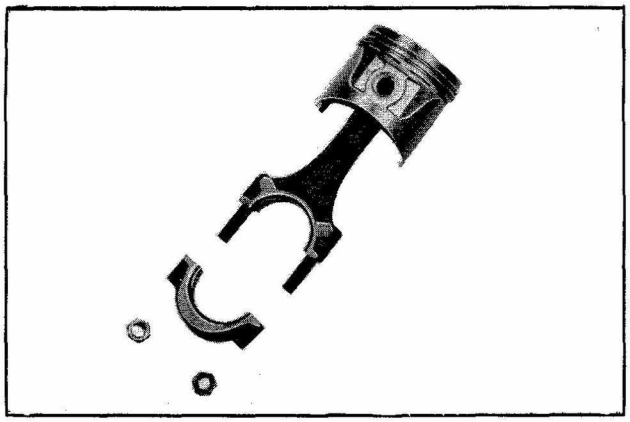


Fig. EM-106

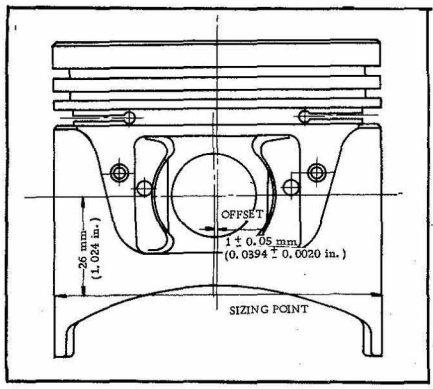


Fig. EM-107

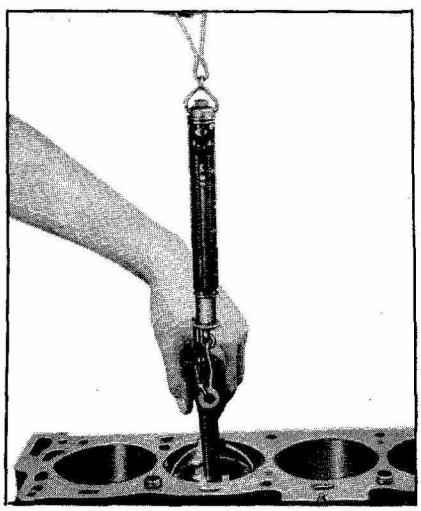


Fig. EM-108

Pistons should be fitted in bores by actually measuring fit. Clearance between Piston and Cylinder bore should be 0.030 mm to 0.050 mm (0.0012 ~ 0.0020 in.)

This clearance can be checked easily by using a feeler gauge 0.04 mm (0.0016 in.) and a spring scale as shown in Fig. EM-108.

Extracting Force ..... 0.5 ~ 1.5 kg (1.10 ~ 3.31 lb.)

If Cylinder bores have been reconditioned or if Pistons are being replaced, reconditioning of Bores and fitting of Pistons should be closely coordinated.

If Bore has been honed, it should be washed thoroughly with hot, soapy water and stiff bristle brush.

Using a cylinder checking gauge, measure Cylinder bore crosswise of block to find smallest diameter. Record smallest diameter of each bore.

Measure Piston skirt perpendicular to Piston pin hole and at sizing point indicated in Fig. EM-107.

Make sure the micrometer is in full contact.

As Pistons are measured they should be marked for size identification and measurements recorded.

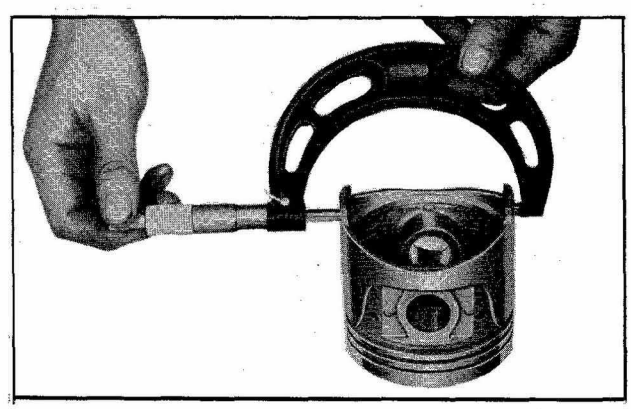


Fig. EM-109

If there is excessive clearance between Cylinder bore and Piston which was installed in that bore, a new Piston should be used.

After all measurements have been made, match new Pistons with Cylinders where they will fit with proper clearance. Honing Cylinder bore may be necessary to effect a proper fit. When properly mated, mark Pistons with Cylinder numbers they fit so they will not become mixed.

Piston Grade List (Production Use)

Unit: 1/1000 mm

Grade Mark	①	②	③	④	⑤
Piston Grade	0～10	10～20	20～30	30～40	40～50

ref. Standard Piston Dia. for production use

$87.160 \frac{+0.050}{0}$ mm ($3.4315 \frac{+0.0020}{0}$ in.)

Proper diameter of Piston is determined by adding above values to the standard diameter of Piston.

Piston For Service Unit: mm

Piston size	Outside Diameter (H)
STD	87.180 ~ 87.230
25 Oversize	87.410 ~ 87.460
50 Oversize	87.660 ~ 87.710
75 Oversize	87.910 ~ 87.960
100 Oversize	88.160 ~ 88.210
150 Oversize	88.660 ~ 88.710

Connecting Rod Alignment

Whenever new rings are installed or new pistons and piston pins are replaced, it is necessary to align the connecting rods and pistons as assemblies to insure true operation in the cylinder bore.

Misaligned rods will cause uneven piston and ring wear which will result in oil consumption. The connecting rod should be inspected for a twisted or bent condition.

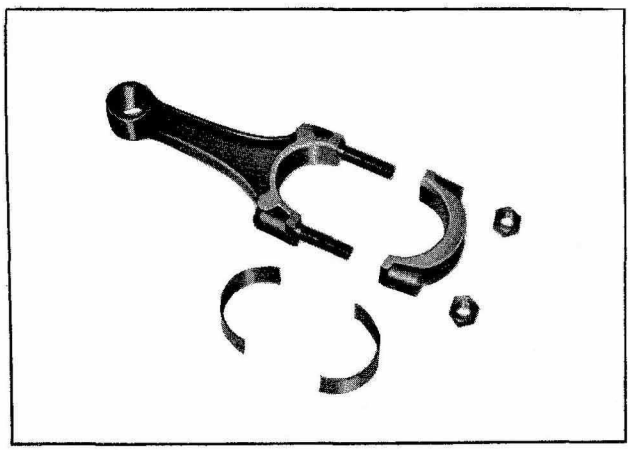


Fig. EM-110

Connecting Rod Bend should be smaller than 0.04 mm (0.0016 in.) per 100 mm (3.94 in.) length.

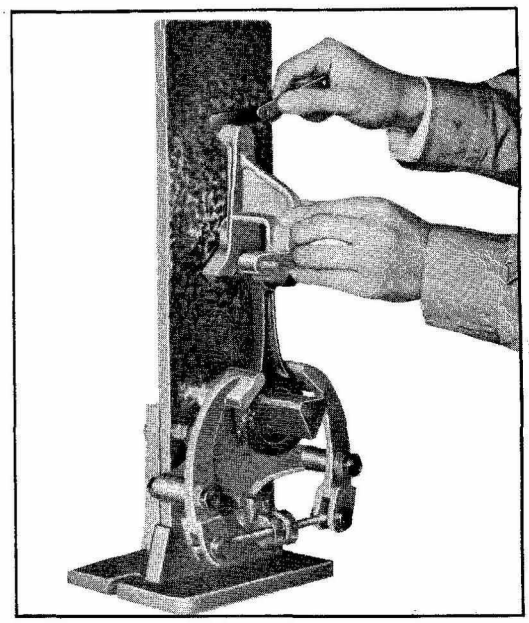


Fig. EM-111

Piston Rings-Remove and Replace

If no special piston ring expander is available, use a piece of thin steel such a smoothly ground hacksaw blade or a disused feeler gauge.

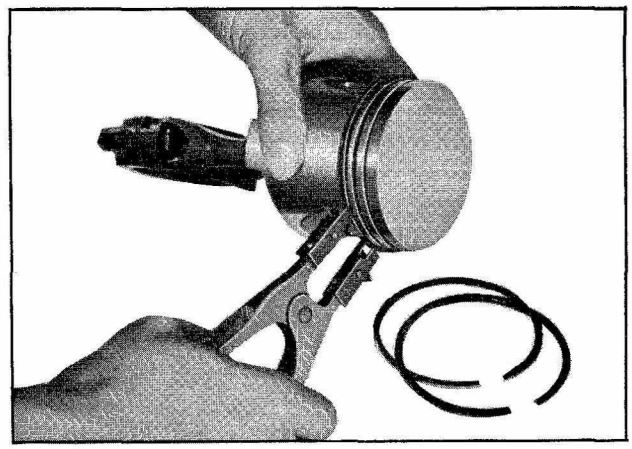


Fig. EM-112

1. Raise one end of the ring out of its groove. Insert the steel strip around Piston, applying slight upward pressure to the raised portion of the ring until it rests on the land above the ring grooves. It can then be eased off Piston.
2. Do not remove or replace the rings over

Piston skirt, but always over the top of Piston.

3. Before fitting new rings, clean the grooves in Piston to remove any carbon deposit. Care must be taken not to remove any metal, or sideplay between the ring and groove will result, with consequent excessive oil consumption and loss of gastightness.
4. Cylinder bore glazing should be removed before fitting new rings to a worn bore.
5. When refitting the rings, note that the taper of the compression rings is different between the top and second rings and each ring marked with the letter for correct assembly.

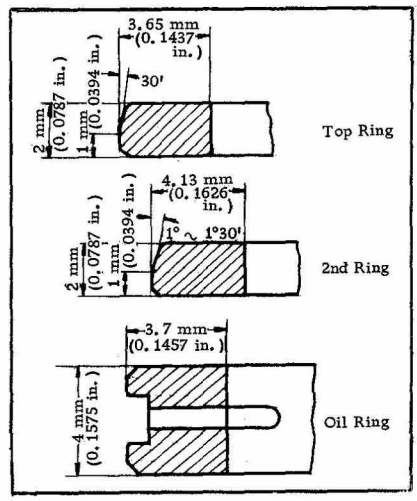


Fig. EM-113

Piston Ring Oversize

Top Ring, Second Ring and Oil Ring

Ring Size Mark	STD	25	50	75	100	150
Outside Diameter	87.200 mm (3.4331 in.)	87.450 mm (3.4429 in.)	87.700 mm (3.4527 in.)	87.950 mm (3.4626 in.)	88.200 mm (3.4724 in.)	88.700 mm (3.4921 in.)

Ring Side Clearance and Ring Gap Checks

New rings must be tested in Cylinder bore to ensure that the ends do not butt together. Ring gap and side clearance should be checked while installing rings as follows:

1. Check pistons to see ring grooves and oil return holes have been properly cleaned.
2. Place ring down at bottom of ring traveled part of cylinder bore in which it will be used. Square ring in bore by pushing it into position with head of piston.
3. Measure gap between ends of ring with feeler gauge. Gaps should be as follows.

Top Compression Ring ..... 0.25 ~ 0.40 mm (0.0098 ~ 0.016 in.)
Second Compression Ring ..... 0.15 ~ 0.30 mm (0.0060 ~ 0.0118 in.)
Oil Ring ..... 0.14 ~ 0.29 mm (0.0055 ~ 0.0114 in.)

Incorrect ring gap indicates that wrong size rings are being used. If rings are selected according to the size of the bore, they should have proper gap. It should not be necessary to alter ring gap by filing.

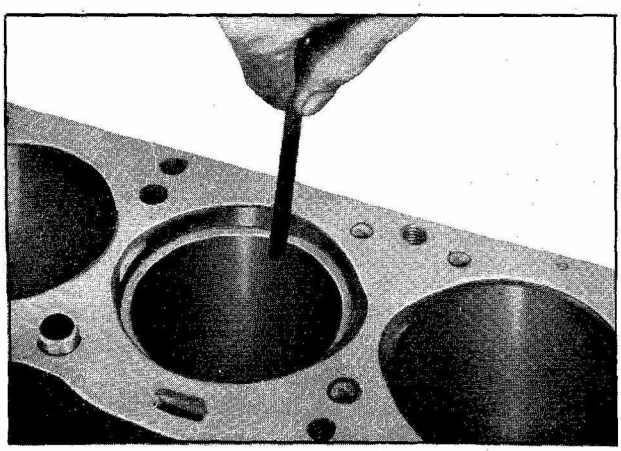


Fig. EM-114 Ring Gap

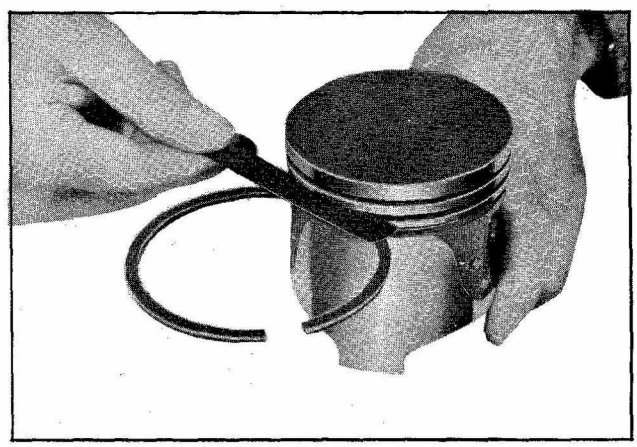


Fig. EM-115 Ring Side Clearance

4. Install rings on piston using suitable ring installing tool to prevent breakage or fracture of rings, or damage to pistons.

5. Measure side clearance of rings in ring groove as each ring is installed. Clearance with new pistons and rings should be as follows:

Top Compression Ring	0.040 ~ 0.073 mm (0.0016 ~ 0.0029 in.)
Second Compression Ring	0.030 ~ 0.063 mm (0.0012 ~ 0.0025 in.)
Oil Ring	0.025 ~ 0.063 mm (0.0010 ~ 0.0025 in.)

Connecting Rod and Piston Assembly-Replace

1. Using suitable piston ring compressor, insert Connecting Rod and Piston assembly into Cylinder so marking in top of Piston is facing front of Engine.

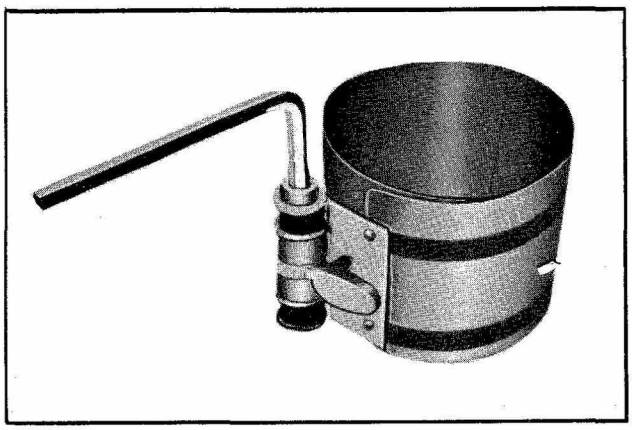


Fig. EM-116

2. From beneath Engine, pull Connecting rod with bearing into place against Crankpin.

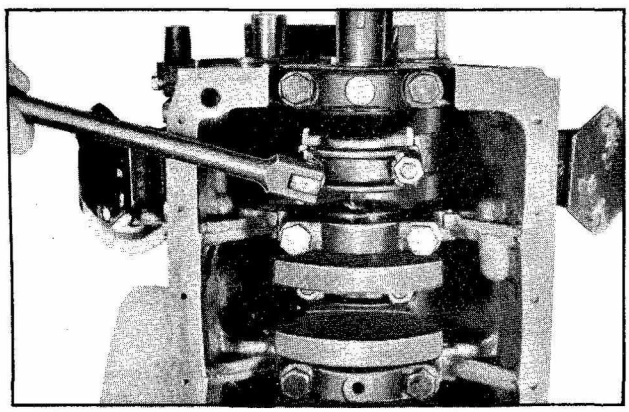


Fig. EM-117

3. Install Bearing Cap.
   Tighten cap nuts to 9 kg-m (65.1 ft-lb.).

4. Check Crankshaft rotation.

5. Install remaining Connecting rod and Piston assembly.

6. Check End play of Connecting rod big end.

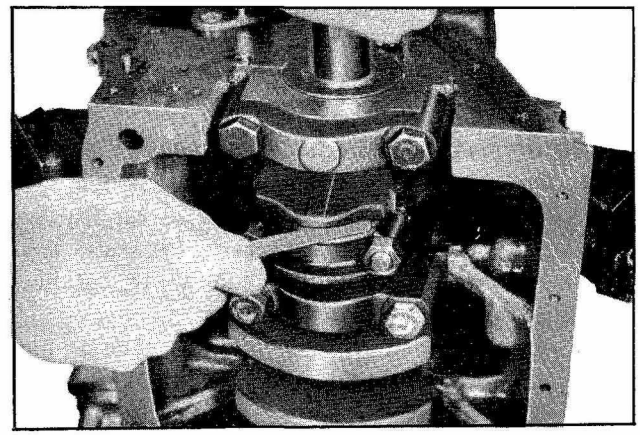


Fig. EM-118

7. Reversal procedure 1-2 of connecting rod and Piston assembly removal to complete installation procedure.
   End play of Connecting rod big end should be 0.2 ~ 0.3 mm (0.008 ~ 0.011 in.).

Connecting Rod Bearing-Remove and Replace

1. Remove oil pan.

2. Rotate Crankshaft as necessary to bring crankpin carrying bearing to be replaced straight toward bottom of block.

3. Remove Bearing cap.

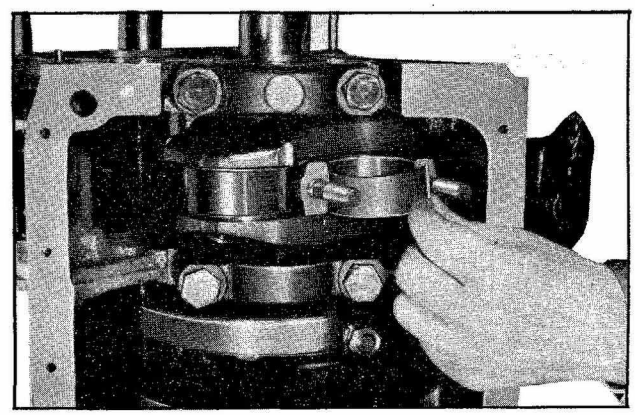


Fig. EM-119

4. Push Piston and rod assembly up far enough to remove upper bearing.
5. Remove Bearings from cap and rod.
6. Inspect Crankpin for damage, out-of-round and taper.

Replacement is a reversal of the above procedure. Check clearance with Plastigage as outlined below.

Connecting Rod Bearing Clearance

To determine the amount of bearing clearance, use a piece of Plastigage in the bearing cap. Then tighten the cap to torque specifications to compress the gauge. Remove the bearing cap and calibrate the width, of the plastigage with the scale furnished.

If the bearing clearance is excessive, a new standard or undersize bearing insert should be installed.

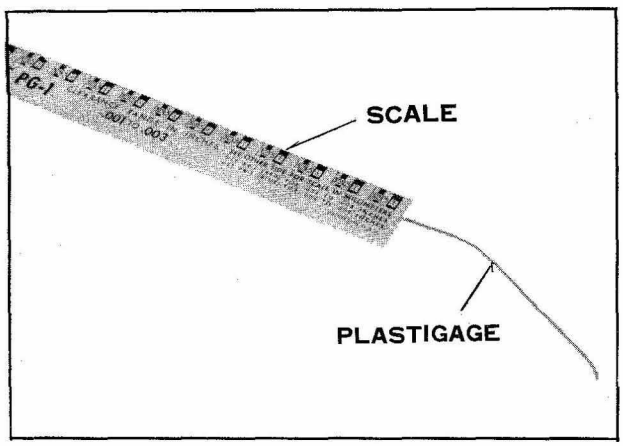


Fig. EM-120

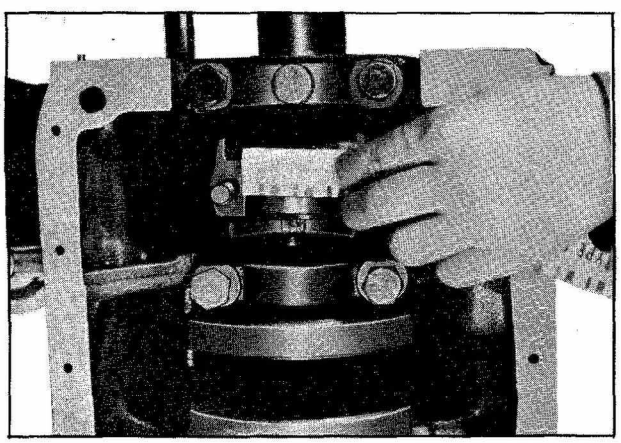


Fig. EM-121

The correct connecting rod bearing clearance is 0.034 ~ 0.086 mm (0.0013 ~ 0.0034 in.) at normal room temperature.

It is important that the connecting rod bearing cap bolt nuts be tightened to 9 kg-m (65.1 ft-lb.).

Jackshaft-Remove and Replace

1. Remove Cylinder Head and Oil pan.
2. Remove Timing chain cover, Timing chains and Sprockets.
3. Withdraw Distributor and Drive Gear.
4. Remove Fuel pump.
5. Take out the two set screws and shockproof washers which secure Jackshaft locating plate to Cylinder block and withdraw Jackshaft.

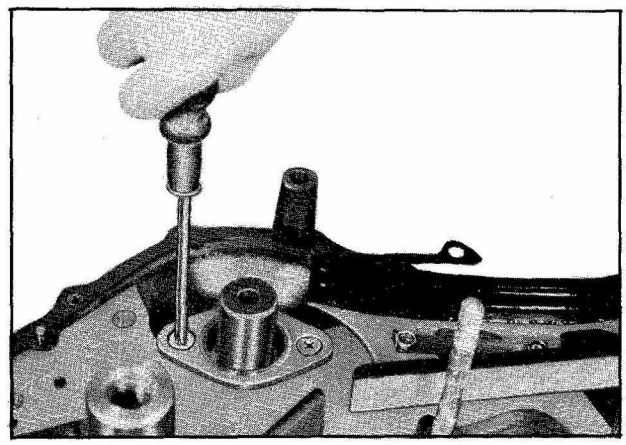


Fig. EM-122

Replacement of Jackshaft is a reversal of the above procedure.

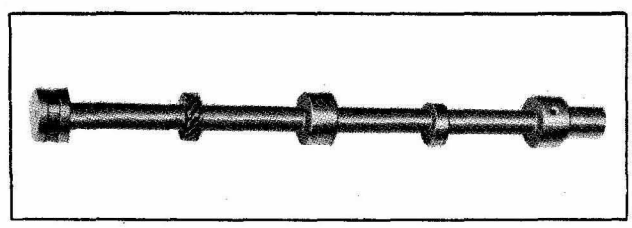


Fig. EM-123

Inspect the bend of Jackshaft and the bearing clearances.

Jackshaft Bend should be smaller than 0.02 mm (0.0008 in.), measuring as shown in Fig. EM-124.
Bend Limit is 0.05 mm (0.0020 in.).

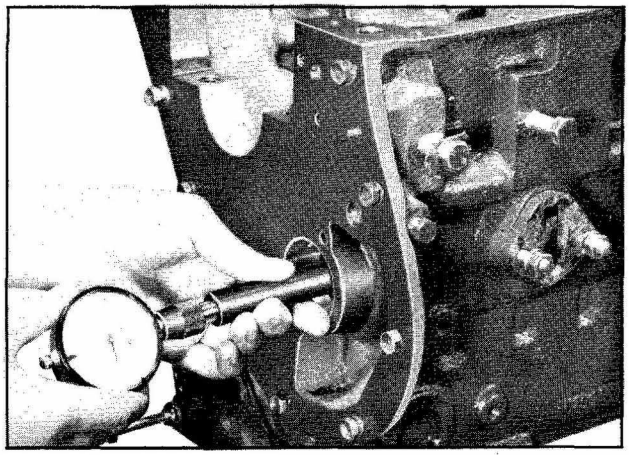


Fig. EM-124

Bearing Clearance
Front and Rear ..... 0.025 ~ 0.087 mm
(0.00098 ~ 0.00342 in.)
Center ..... 0.038 ~ 0.100 mm
(0.00150 ~ 0.00394 in.)

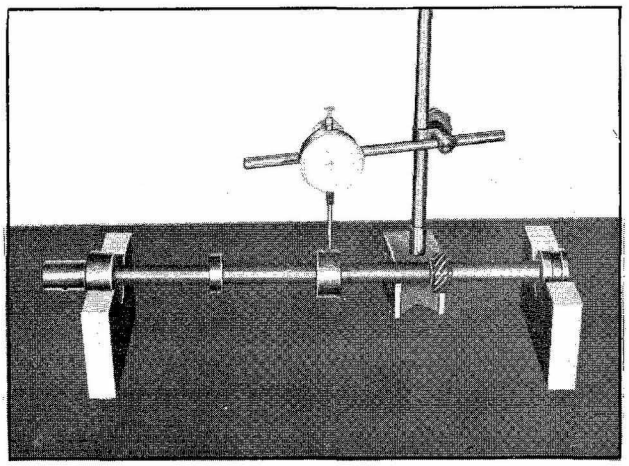


Fig. EM-125

Distributor Drive Gear-Refit

1. Turn Engine until No.1 Piston is at T.D.C. on its compression stroke. When the valves on No.4 Cylinder are "rocking" (i.e. exhaust just closing and inlet just opening), No.1 Piston is at the top of its compression stroke. If Engine is set so that the long notch in Crankshaft pulley is in line with the pointer on Timing chain cover, No. 1 Piston is exactly at T.D.C.

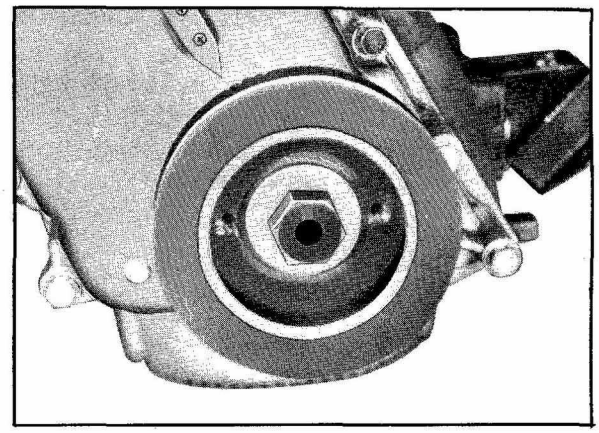


Fig. EM-126

2. Insert Drive gear shaft of Distributor at an angle to Engine, engaging the gear of Drive gear shaft with the gear on Jackshaft.

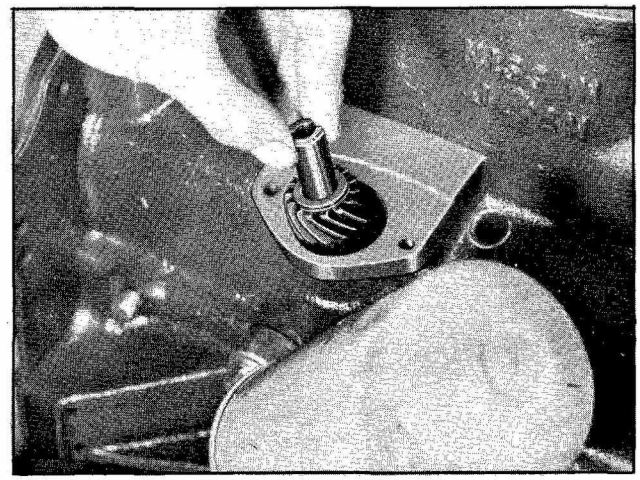


Fig. EM-127

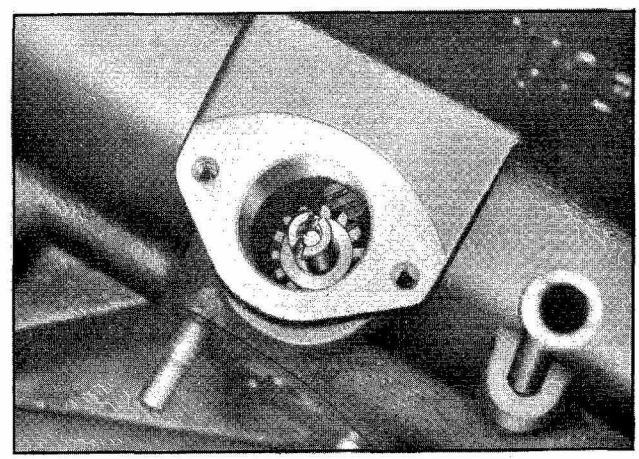


Fig. EM-128

During this assembly place the drive gear with the slot on its head just forward the vertical and finish by turning Drive gear shaft clockwise until its in 11 : 25 o'clock position.
At this time, the smaller of the semi-circles must be placed toward the front.

Crankshaft-Remove, Inspect and Replace

Remove

1. Remove Engine from vehicle.
2. Remove Transmission and Clutch from engine.
3. Mount Engine on a suitable stand.
4. Remove Fan, Fan pulley and Water pump.
5. Remove Cylinder head ass'y.
6. Remove Vibration damper.
7. Remove Oil pan, Oil pump and Timing chain cover.
8. Remove Chain tensioner and Crank Timing chain and Sprockets.

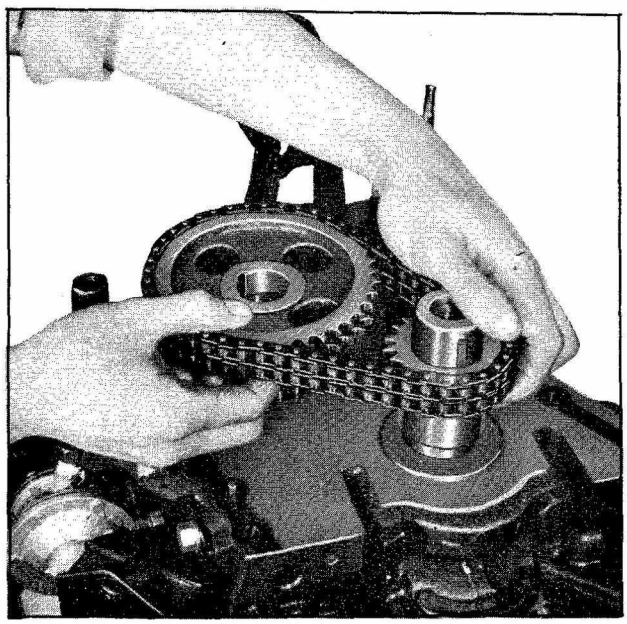


Fig. EM-129

9. Remove Flywheel.

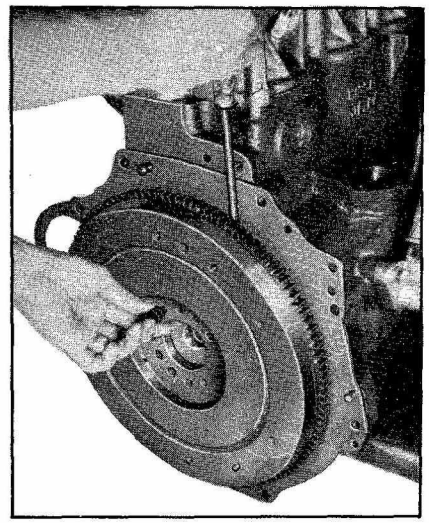


Fig. EM-130

10. Remove Connecting rod bearing caps with bearings and identify each for re-installation.
11. Remove Connecting rod and Piston assemblies.

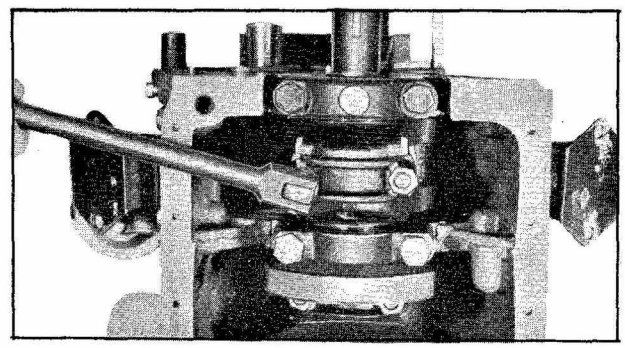


Fig. EM-131

12. Remove Main bearing caps with bearings and identify for reinstallation.

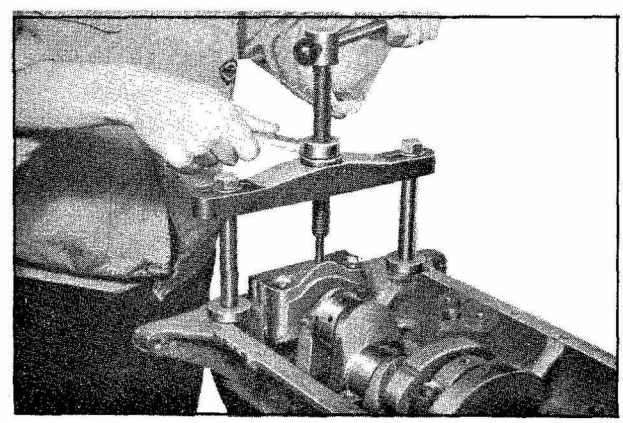


Fig. EM-132

13. Remove crankshaft.

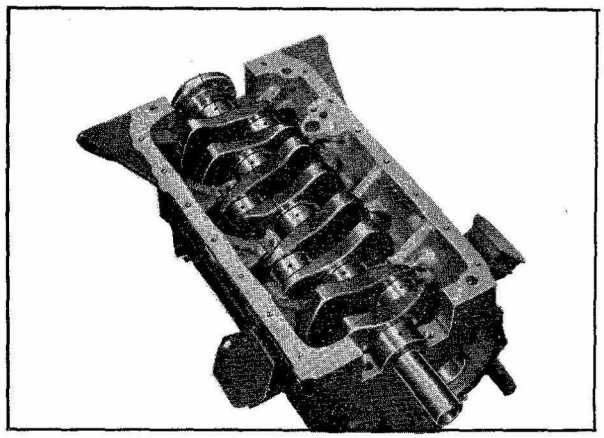


Fig. EM-133

Inspect

Inspect Crankshaft for wear and crack.

Check the bend of Crankshaft and the out-of round or excessive taper of Crankshaft main journal and Crankpin.

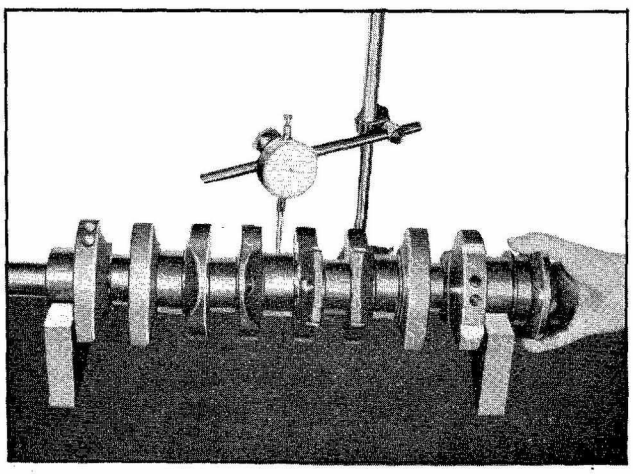


Fig. EM-134

Journal out-of-round ... less than 0.005 mm (0.0002 in.)

Crank Pin out-of-round ..... less than 0.005 mm (0.0002 in.)

Crankshaft Bend

Measure No. 2, 3, 4 Journal with No. 1 & 5 Journal supported ... less than 0.03 mm (0.0012 in.)

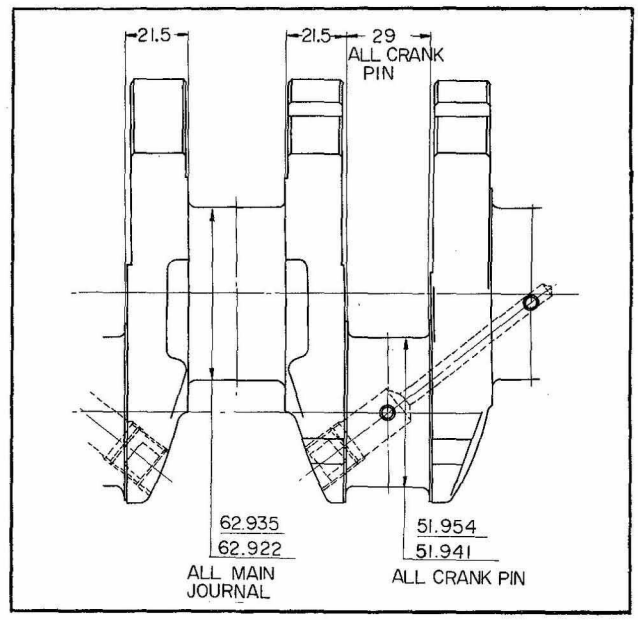


Fig. EM-135

Replace

1. With upper bearings installed, position Crankshaft in block.
2. Using new seals in rear main bearing cap install main bearing caps, but do not tighten cap bolts.

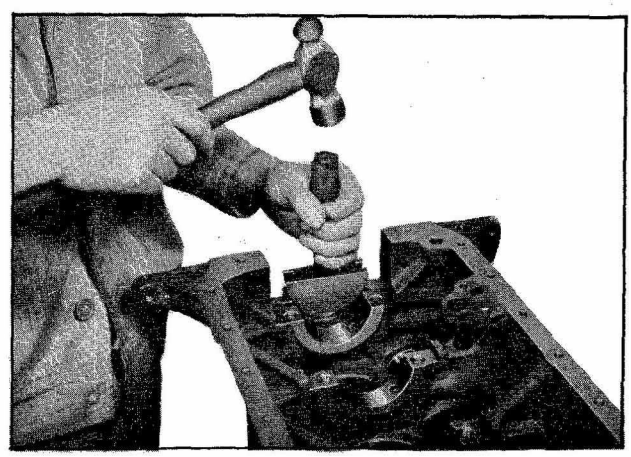


Fig. EM-136

3. Install Connecting rods (with upper bearings installed) and pistons into place.
4. Install Rod bearing caps (with bearings), but do not tighten nuts.
5. With a rubber mallet hit both ends of Crankshaft to center thrust bearing.

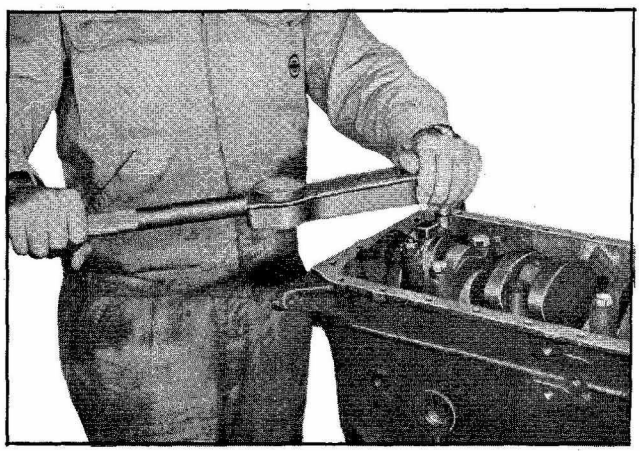


Fig. EM-137

6. Tighten Main bearing caps to 9 kg-m (65.1 ft-lb.) torque.
7. Check Crankshaft Free End Play.

   Crankshaft Free End Play should be 0.05 ~ 0.18 mm (0.002 ~ 0.007 in.) and the wear limit of End play is 0.3 mm (0.012 in.).

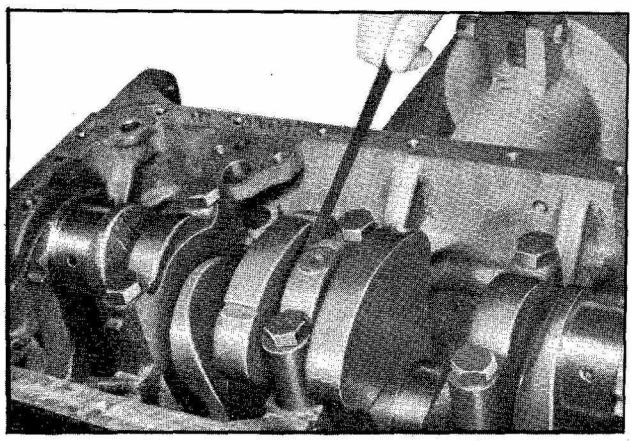


Fig. EM-138

8. Tighten Connecting rod bearing caps to 9 kg-m (65.1 ft-lb.) torque.
9. Install key from old crankshaft keyway in new crankshaft.
10. Install Timing chain and Sprockets.
11. Install Lower chain tensioner.
12. Install Timing chain cover.
13. Install Oil pump, Oil pan and Gasket.
14. Install Cylinder head ass'y.
15. Install Vibration damper and Water pump.
16. Install Fan pulley and Fan.
17. Attach Clutch and Transmission to Engine.
18. Install Complete assembly in Vehicle.

Main Bearings-Remove and Replace

The main bearings are of precision insert type and do not utilize shims for adjustment. If the clearances are found to be excessive, a new standard or undersize bearing insert, both upper and lower halves, will be required.
Main Bearings can be removed and replaced without removing Crankshaft as following.

Remove

1. Remove Oil pan.
2. Remove the bearing cap of the bearing to be replaced.
3. Loosen all of the other bearing caps.
4. Insert a small pin in the crankshaft oil hole. The head of this pin should be large enough so that it will not fall into the oil hole, yet thinner than the thickness of the bearing.

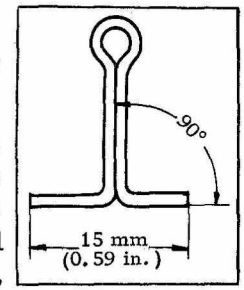


Fig. EM-139

5. With the pin in place, rotate the shaft so that the upper half of the bearing will rotate in the direction of the Crankshaft rotation. This will roll upper bearing shell out of Engine.

Replace

1. Oil new upper bearing shell and insert plain end of shell between crankshaft and indented or notched side. Rotate the bearing into place.
2. Install new bearing shell in bearing cap.
3. Tight all main bearing caps to 9.0 kg-m (65.1 ft-lb.) torque except the one replaced.
4. Check bearing clearance using Plastigage method as outlined below.
5. Install Oil pan using new gaskets and seals.

Main Bearing Clearance

The standard clearance can be accurately checked by the use of Plastigage.

Remove the bearing cap and wipe the oil from the bearing insert.

Place a piece of Plastigage across the full width of the bearing insert.

Install the bearing cap and tighten to 9.0 kg-m (65.1 ft-lb.) torque. Then remove the bearing cap and with the graduated scale, which is printed on the plastigage envelope, measure the width of the flattened plastigage at its widest point.

The correct main bearing clearance is 0.020 ~ 0.072 mm (0.0008 ~ 0.0028 in.).

The main bearing journal diameter is 62.942 ~ 62.955 mm (2.4780 ~ 2.4785 in.).

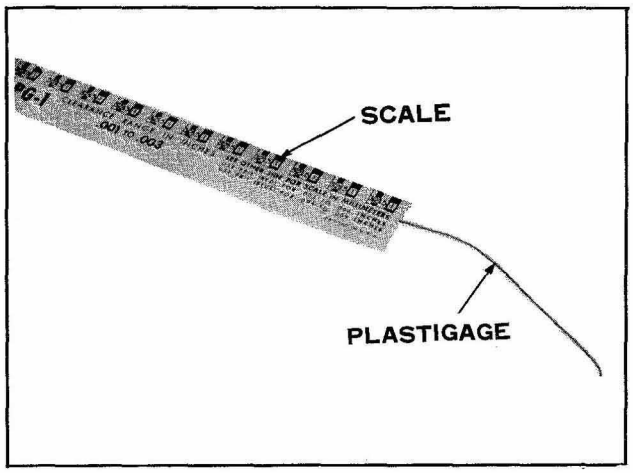


Fig. EM-140

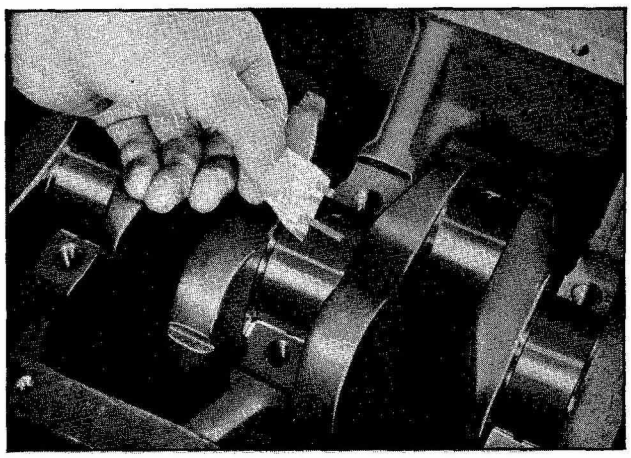


Fig. EM-141

Rear Main Bearing Oil Seal-Remove and Replace

Although the usual practice is to remove the crankshaft when the upper half of the seal is to be replaced, it is possible to do the job without removing the crankshaft.

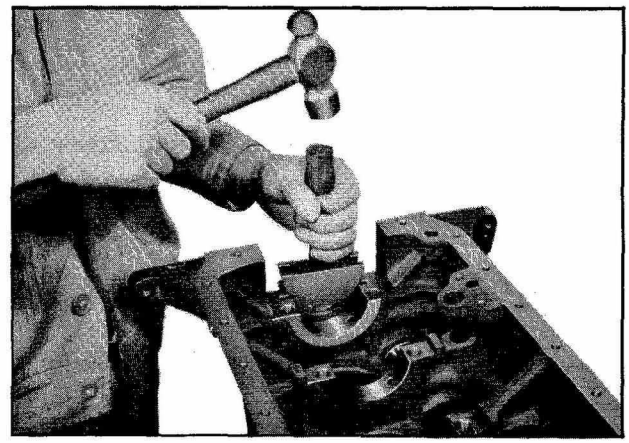


Fig. EM-142

1. Remove oil pan.
2. Remove Rear bearing cap using tool ST446 30000.

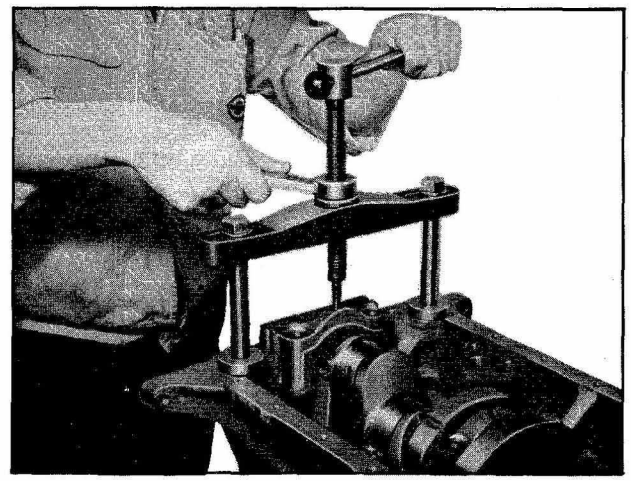


Fig. EM-143

3. Remove oil seal from groove of bearing cap and side oil seals, using a small screw-driver.
4. Place new seals in position so that both ends protrude above the cap. Tap the seal down into position with a smooth rounded tool. Then cut off the protruding ends of the seal.

5. To replace the upper half of seal, use needle-nose pliers to grasp the end of the seal which is most accessible. Pull the seal upward while rotating the crankshaft slowly in the direction that the seal is being removed.
6. To install the new seal, fasten a length of wire or strong string such as fishing line securely to one end of the new seal. Coat the seal with engine oil.
7. Pass the free end of the wire or string up over the crankshaft.
8. Then exert a firm, steady pull on the wire or string and at the same time rotate the crankshaft slowly in the direction of the pull.
9. When the installation is completed, trim the ends of the seal flush with the engine block.
10. Install Bearing cap and tighten it 9.0 kg-m (65.1 ft-lb.) torque.
11. Install Oil pan.

SERVICE DATA

GENERAL SPECIFICATION

Model	U20
Cylinder Arrangement	4 in line
Displacement	1982 c.c. (120.9 cu.in.)
Bore and Stroke	87.2 × 83 mm (3.4331 × 3.2677 in.)
Valve Arrangement	(S) OHC
Max. Brake Horsepower (HP/r.p.m)	Solex 150/6000 (SAE)
	SU 135/6000 (SAE)
Max. Gross Torque {kg-m (ft-lb.)/r.p.m.}	Solex 19.1 (138)/4800 (SAE)
	SU 18.2 (132)/4400 (SAE)
Firing Order	1-3-4-2
Engine Idle R.P.M.	700 R.P.M.
Compression Ratio	9.5
Engine Idle Manifold - Inches of Mercury at Specified Engine Idle R.P.M. (Sea Level)	Solex 230 ~ 260/700
	SU 460 ~ 480/700
Oil Pressure (Hot at 2,000 r.p.m)	2.0 kg/cm^2 (28.38 lb/in^2) at all temperature

TIGHTING TORQUE

Cylinder Head Bolts	1st- 6.0, 2nd- 8.7, final- 9.0 kg-m	(1st-43.4, 2nd-62.9, final-65.1 ft-lb.)
Connecting Rod Big End Nuts	9.0 kg-m	(65.1 ft-lb.)
Flywheel Fix Bolts	8.0 kg-m	(57.8 ft-lb.)
Main Bearing Cap Bolts	9.0 kg-m	(65.1 ft-lb.)
Camshaft Bearing Cap Nuts	M-8 1.8 kg-m	(13.0 ft-lb.)
	M-6 0.7 kg-m	(5.1 ft-lb.)
Camshaft Gear Nuts	1.8 kg-m	(13.0 ft-lb.)
Oil Filter Nuts	2.1 ~ 2.7 kg-m	(15.2 ~ 19.5 ft-lb.)
Oil Pan	0.5 kg-m	(3.6 ft-lb.)
Oil Pump	0.8 ~ 1.0 kg-m	(5.8 ~ 7.2 ft-lb.)
Crank Pulley Bolt	20 kg-m	(144.6 ft-lb.)
Jackshaft Sprocket Screw	4.5 ~ 5.0 kg-m	(32.5 ~ 36.2 ft-lb.)
Rocker Cover	0.6 ~ 0.7 kg-m	(4.3 ~ 5.1 ft-lb.)

SPECIFICATIONS

a) VALVE MECHANISM

Valve Clearance (Hot)	In. 0.2 mm	(0.0079 in.)
	Ex. 0.3 mm	(0.0118 in.)
Wear Limit of Dittoed Clearance	0.35 mm	(0.0138 in.)
Valve Head Dia. - Intake	$46^{+0.2}_{0}$ mm	($1.81^{+0.0079}_{0}$ in.)
- Exhaust	$36^{+0.2}_{0}$ mm	($1.42^{+0.0079}_{0}$ in.)
Valve Stem Dia. - Intake	$8.7^{-0.043}_{-0.030}$ mm	($0.343^{-0.0017}_{-0.0012}$ in.)
Valve Stem Dia. - Exhaust	$8.7^{-0.073}_{-0.060}$ mm	($0.343^{-0.0029}_{-0.0024}$ in.)
Valve Length - Intake	120.8 mm	(4.76 in.)
- Exhaust	120.8 mm	(4.76 in.)
Valve Lift	Solex 11.6 mm	(0.46 in.)
	SU 11.2 mm	(0.44 in.)
Valve Spring Free Length - Outer	49.7 mm	(1.96 in.)
- Inner	48.4 mm	(1.91 in.)
Valve Spring Loaded Length - Outer	29.6 mm/$76.4^{+2.0}_{-4.0}$ kg	(1.17 in./$168.1^{+4.41}_{-8.82}$ lb.)
- Inner	27.6 mm/29.9 ±1.8 kg	(1.09 in./65.8 ± 3.96 lb.)
Valve Spring Assembled Height - Outer	41.2 mm/32.3 kg	(1.62 in./71.1 lb.)
- Inner	39.2 mm/13.3 kg	(1.54 in./29.3 lb.)
Valve Spring Effective Turns - Outer	4.25	
- Inner	5.5	
Valve Spring Wire Dia. - Outer	4.6 mm	(0.18 in.)
- Inner	2.95 mm	(0.116 in.)
Valve Spring Coil Dia. - Intake	35.0 mm	(1.38 in.)
- Exhaust	24.2 mm	(0.95 in.)
Valve Guide Length - Intake	55.0 mm	(2.17 in.)
- Exhaust	55.0 mm	(2.17 in.)
Valve Guide Height From Head Surface	13.0 ± 0.1 mm	(0.512 ± 0.004 in.)
Valve Guide Inner Dia. - Intake	8.685 ~ 8.700 mm	(0.3419 ~ 0.3425 in.)
- Exhaust	8.685 ~ 8.700 mm	(0.3419 ~ 0.3425 in.)
Valve Guide Outer Dia. - Intake	14.313 ~ 14.326 mm	(0.5635 ~ 0.5640 in.)
- Exhaust	14.313 ~ 14.326 mm	(0.5635 ~ 0.5640 in.)
Valve Guide to Stem Clearance - Intake	0.015 ~ 0.043 mm	(0.0006 ~ 0.0017 in.)
- Exhaust	0.045 ~ 0.073 mm	(0.0018 ~ 0.0029 in.)
Valve Seat Width - Intake	1.40 mm	(0.055 in.)
- Exhaust	1.77 mm	(0.069 in.)
Valve Seat Angle - Intake	45°	
- Exhaust	45°	
Valve Seat Interference Fit - Intake	0.081 ~ 0.113 mm	(0.0032 ~ 0.0044 in.)
- Exhaust	0.064 ~ 0.096 mm	(0.0025 ~ 0.0038 in.)
Valve Guide Interference Fit - Intake	0.022 ~ 0.050 mm	(0.0009 ~ 0.0020 in.)
- Exhaust	0.022 ~ 0.050 mm	(0.0009 ~ 0.0020 in.)

b) CAMSHAFT AND TIMING CHAIN

Camshaft End Play	0.1 ~ 0.3 mm	(0.0039 ~ 0.0118 in.)
Camshaft Robe Lift	Solex 8.3 mm	(0.327 in.)
	SU 8.0 mm	(0.315 in.)
Camshaft Journal Dia. - 1st	29.964 ~ 29.977 mm	(1.1800 ~ 1.1802 in.)
- 2nd	29.964 ~ 29.977 mm	(1.1800 ~ 1.1802 in.)
- 3rd	29.964 ~ 29.977 mm	(1.1800 ~ 1.1802 in.)
- 4th	29.964 ~ 29.977 mm	(1.1800 ~ 1.1802 in.)
- 5th	24.966 ~ 24.979 mm	(0.9830 ~ 0.9834 in.)
Camshaft Bend (Measure Center journal with Both end journals supported)	less than 0.01 mm	(0.0004 in.)
Camshaft Journal to Bearing Clearance No.1~4	0.023 ~ 0.052 mm	(0.0009 ~ 0.0020 in.)
No.5	0.021 ~ 0.047 mm	(0.0008 ~ 0.0019 in.)
Camshaft Bearing Inner Dia. - 1st	$30\frac{+0.016}{0}$ mm	($1.18\frac{+0.0006}{0}$ in.)
- 2nd	$30\frac{+0.016}{0}$ mm	($1.18\frac{+0.0006}{0}$ in.)
- 3rd	$30\frac{+0.016}{0}$ mm	($1.18\frac{+0.0006}{0}$ in.)
- 4th	$30\frac{+0.016}{0}$ mm	($1.18\frac{+0.0006}{0}$ in.)
- 5th	$25\frac{+0.013}{0}$ mm	($0.98\frac{+0.0005}{0}$ in.)

c) ROCKER ARM LEVER RATIO ..... Approximately 1.4 : 1

d) CONNECTING ROD

Center Distance	144 ± 0.03 mm	(5.67 ± 0.001 in.)
Bearing Length	24 ± 0.1 mm	(0.94 ± 0.0039 in.)
Bearing Thickness	STD 1.493 ~ 1.506 mm	(0.0588 ~ 0.0593 in.)
Big End End Play	0.2 ~ 0.3 mm	(0.008 ~ 0.012 in.)
Connecting Rod Bearing Clearance	0.034 ~ 0.086 mm	(0.0013 ~ 0.0034 in.)
Connecting Rod Bend	Less than 0.04 mm per 100 mm length	(0.0016 in. per 3.94 in.)

e) CRANKSHAFT AND MAIN BEARING

Journal Dia.	62.942 ~ 62.955 mm	(2.4780 ~ 2.4785 in.)
Journal Taper & Out-of-Round	Less than 0.005 mm	(0.0002 in.)
Crankshaft Free End Play	0.05 ~ 0.18 mm	(0.002 ~ 0.007 in.)
Wear Limit of Dittoed Play	0.3 mm	(0.012 in.)
Crank Pin Dia.	51.941 ~ 51.954 mm	(2.0449 ~ 2.0454 in.)
Crank Pin Taper & Out-of-Round	Less than 0.005 mm	(0.002 in.)
Main Bearing Thickness	STD 1.822 ~ 1.835 mm	(0.0717 ~ 0.0722 in.)
Main Bearing Clearance	0.020 ~ 0.072 mm	(0.0008 ~ 0.0028 in.)
Wear Limit of Dittoed Clearance	0.12 mm	(0.0047 in.)
Crankshaft Bend	Less than 0.03 mm	(0.0012 in.)

f) JACKSHAFT

Journal Dia. - 1st	45.434 ~ 45.447 mm	(1.7887 ~ 1.7892 in.)
- 2nd	43.877 ~ 43.910 mm	(1.7274 ~ 1.7287 in.)
- 3rd	41.218 ~ 41.231 mm	(1.6228 ~ 1.6233 in.)
Jackshaft Free End Play	0.08 ~ 0.28 mm	(0.0031 ~ 0.0110 in.)

g) PISTON

Piston Dia. - STD	87.180 ~ 87.230 mm	(3.4323 ~ 3.4342 in.)
Oversize 1	87.410 ~ 87.460 mm	(3.4413 ~ 3.4433 in.)
Oversize 2	87.660 ~ 87.710 mm	(3.4512 ~ 3.4531 in.)
Oversize 3	87.910 ~ 87.960 mm	(3.4610 ~ 3.4630 in.)
Oversize 4	88.160 ~ 88.210 mm	(3.4709 ~ 3.4728 in.)
Oversize 5	88.660 ~ 88.710 mm	(3.4905 ~ 3.4925 in.)
Ellipse Difference	0.39 ~ 0.42 mm	(0.0154 ~ 0.0165 in.)
Ring Groove Width - Top	$2.0\frac{+0.050}{+0.030}$ mm	$(0.079\frac{+0.0020}{+0.0012}$ in.)
- Second	$2.0\frac{+0.040}{+0.020}$ mm	$(0.079\frac{+0.0157}{+0.0008}$ in.)
- Oil	$4\frac{+0.040}{+0.015}$ mm	$(0.157\frac{+0.0157}{+0.0006}$ in.)
Piston to Bore Clearance	0.030 ~ 0.050 mm	(0.0012 ~ 0.0020 in.)
Piston Pin Hole Off-Set	1 ± 0.05 mm	(0.03937 ± 0.0020 in.)

h) PISTON PIN

Pin Dia.	$22\frac{-0.013}{0}$ mm	$(0.866\frac{-0.0005}{-0}$ in.)
Pin Length	$72.6\frac{-0.1}{0}$ mm	$(2.858\frac{-0.0039}{-0}$ in.)
Piston Pin to Piston Clearance	0.006 ~ 0.012 mm	(0.0002 ~ 0.0005 in.)
Piston Pin to Connecting Rod Bushing Clearance	0.025 ~ 0.035 mm	(0.0010 ~ 0.0014 in.)

i) PISTON RING

Ring Height - Comp. Top	$2\frac{-0.023}{-0.010}$ mm	$(0.079\frac{-0.0009}{-0.00039}$ in.)
2nd	$2\frac{-0.023}{-0.010}$ mm	$(0.079\frac{0.0009}{-0.0009}$ in.)
- Oil	4 -0.010 mm	(0.157 -0.0009 in.)
Side Clearance - Comp. Top	0.040 ~ 0.073 mm	(0.0016 ~ 0.0029 in.)
2nd	0.030 ~ 0.063 mm	(0.0012 ~ 0.0025 in.)
- Oil	0.025 ~ 0.063 mm	(0.0010 ~ 0.0025 in.)
Ring Gap - Comp. Top	0.25 ~ 0.40 mm	(0.0098 ~ 0.016 in.)
2nd	0.15 ~ 0.30 mm	(0.0060 ~ 0.0118 in.)
- Oil	0.14 ~ 0.29 mm	(0.0055 ~ 0.0114 in.)

j) CYLINDER BLOCK

Cylinder Bore Out-of-Round	0.015	mm	(0.0006 in.)
Cylinder Bore Taper	0.02	mm	(0.0008 in.)
Block Head Surface Flatness	Less than 0.1	mm	(0.0039 in.)

k) CYLINDER HEAD

Head Surface Flatness	Less than 0.1	mm	(0.0039 in.)

LUBRICATION SYSTEM

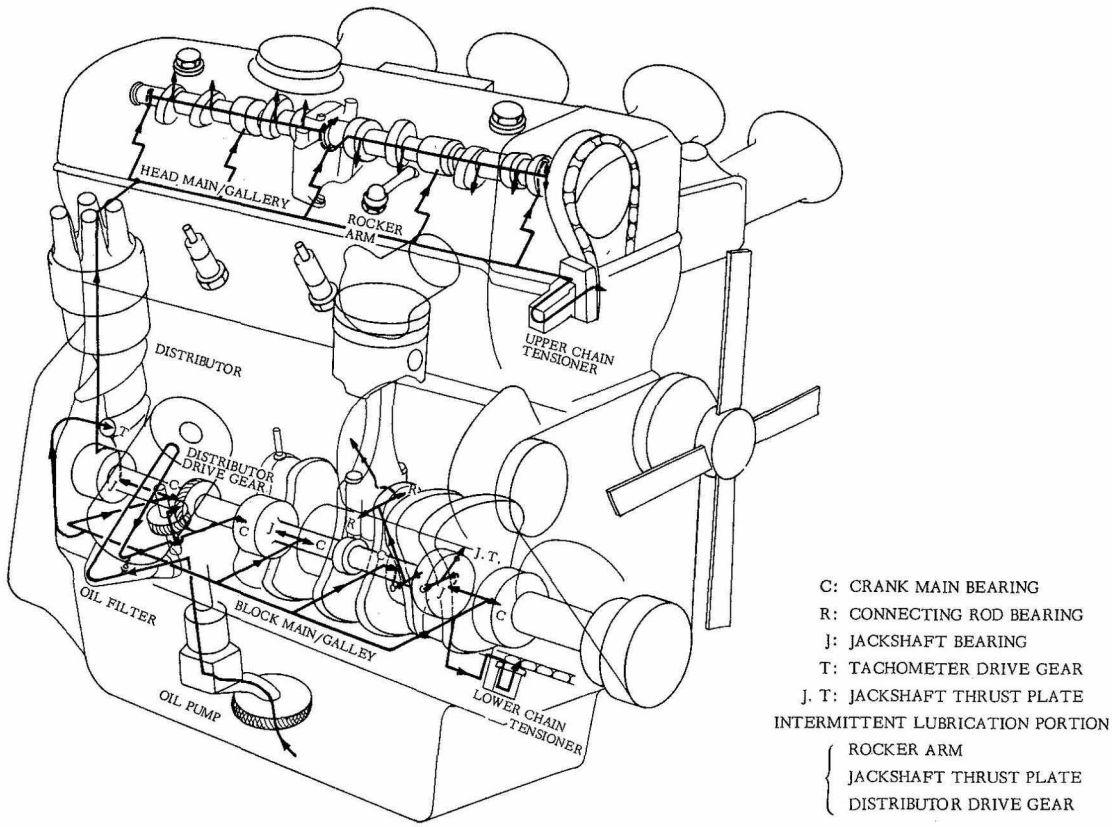


Fig. EL-1 Lubrication Circuit

The lubrication system is the full pressure type, except to the piston pins.

Pressure is supplied by a gear type, positive pressure pump mounted on a boss adjacent to the number four main bearing location.

Lubrication Circuit

Oil drawn through the inlet screen and tube to the inlet side of the oil pump is driven between the gears and pump body, to the pressure outlet portion of the oil pump where it is routed through an oil gallery to the inlet side of the full flow oil filter and then into the main oil gallery.

Each main bearing and Jackshaft bearing is supplied with lubrication from the main oil gallery.

Holes drilled in each crankshaft throw direct lubrication to the connecting rod bearings. Oil throw off from jet holes on connecting rods lubricates the cylinder walls and piston pins.

Oil from the lubrication system enters the lower chain tensioner and holds the pad against the chain by its pressure and spring. Lubrication is supplied to the crankshaft timing chain through a small channel in the slipper pad.

Furthermore lubrication is supplied to the cylinder head main oil gallery through the Jackshaft rear end bearing location and five camshaft bearings on the cylinder head are fed directly from this gallery.

Rocker arm and Valve lubrication is supplied intermittently by a flow of oil through the oil gallery in the camshaft and the small channel at the base circle portion of each cam.

To this oil gallery lubrication is supplied through the No. 1, No. 3 and No. 5 camshaft bearing locations as shown in Fig. EL-1.

From the front end of the cylinder head main gallery Oil is supplied to the upper chain tensioner and lubricates the camshaft timing chain through a hole in the slipper pad of the chain tensioner.

Oil Pressure

Engine Revolution \ Temperature	at 80° C (176° F)	at 100° C (212° F)	at 110° C (230° F)
Idling 700 r.p.m.	1 kg/cm^2(14.19 lb/in^2)	0.7 kg/cm^2(9.93 lb/in^2)	0.6 kg/cm^2(8.51 lb/in^2)
2,000 r.p.m.	3.9 kg/cm^2(55.34 lb/in^2)	2.6 kg/cm^2(36.89 lb/in^2)	2.2 kg/cm^2(31.22 lb/in^2)
2,400 r.p.m.	4.6 kg/cm^2(65.27 lb/in^2)	3.2 kg/cm^2(45.41 lb/in^2)	2.8 kg/cm^2(39.73 lb/in^2)
6,000 r.p.m.	5.2 kg/cm^2(73.79 lb/in^2)	4.8 kg/cm^2(68.11 lb/in^2)	4.6 kg/cm^2(65.27 lb/in^2)

Oil Pump

The oil pump ass'y is installed to bottom of the cylinder block by a bolt and a stud nut and driven by the distributor drive shaft ass'y.

The oil pump is the gear type. A slot provided at the top of the drive gear is engaged with a dog clutch at the lower end of the distributor drive shaft ass'y and the oil pump is thus operated by a gear on Jackshaft through the distributor drive shaft ass'y.

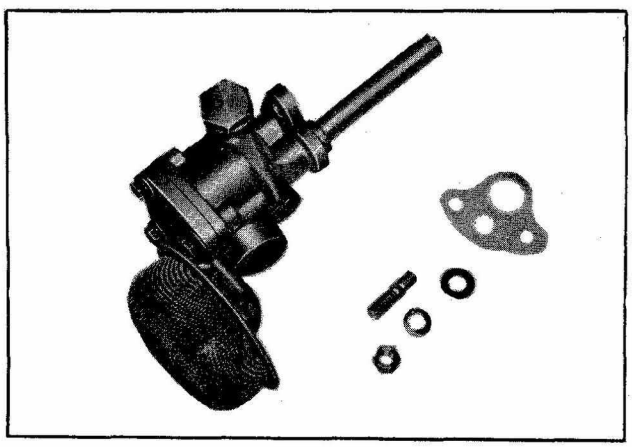


Fig. EL-2

Disassembly

1. Remove the Oil pump from the engine.
2. Remove four bolts and spring washers securing Oil pump cover to Oil pump body.
3. Remove Oil pump cover and detach Oil strainer.
4. Extract Oil pump drive gears and drive shaft.
5. Remove Relief valve cap screw and Relief valve.

   Assembling is a reversal of the above procedure.

Oil Pressure Relief Valve

The oil pressure relief valve is not adjustable. In the released position, the valve permits oil to by-pass through a passage in the pump cover to the inlet side of the pump.

The Valve should be examined to ensure that the relief spring has not lost its tension.

Tightening torque

Bolts-Pump cover to Body ... 0.8 ~ 1.0 kg-m (5.8 ~ 7.2 ft-lb.)

Bolts-Pump cover to Oil strainer ..... 0.8 ~ 1.0 kg-m (5.8 ~ 7.2 ft-lb.)

Cap Nut-release valve ..... 3.0 ~ 3.5 kg-m (21.69 ~ 25.31 ft-lb.)

Oil Pressure at Idling (700 r.p.m.) ..... Over 0.5 kg/cm^2 (7.10 lb/in^2) at all temperature

Relief Valve Spring Free Length ..... 62.3 mm (2.453 in.)

Relief Valve Spring Pressure Length ..... 31.9 mm (1.256 in.)

Opening Pressure ... 4.5 kg/cm^2 (63.86 lb/in^2)

Gear Side Clearance ..... 0.04 ~ 0.11 mm (0.0016 ~ 0.0043 in.)

Tip Clearance-Gear to Pump Cover ..... 0.150 ~ 0.230 mm (0.0060 ~ 0.0091 in.)

Gear Backlash ..... 0.3 ~ 0.4 mm (0.0118 ~ 0.0157 in.)

Oil Filter

A full flow oil filter mounted on the lower right-hand side of the engine is accessible through the hood opening.

A by-pass valve incorporated in the filter mounting boss provides a safety factor in the event the filter becomes inoperative as a result of dirt or sludge accumulation.

Oil filter removal tool will facilitate removal at the recommended mileage intervals.

Apply a thin film of oil to the new filter gasket before installing.

Operate engine at first idle and check for leaks.

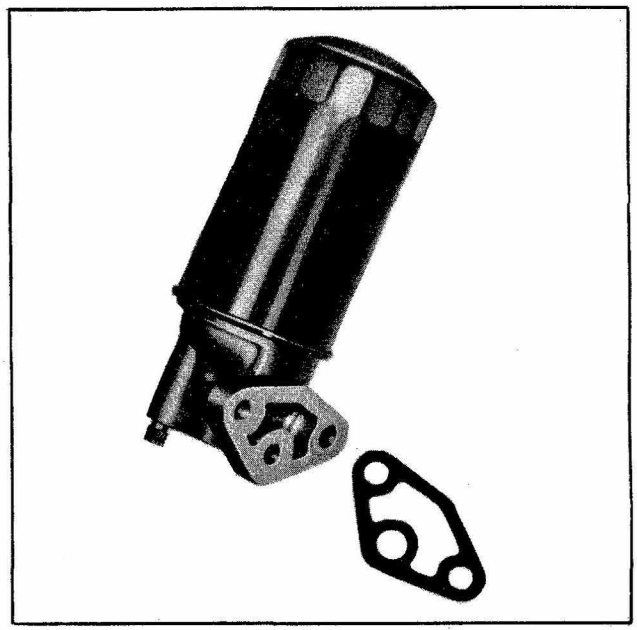


Fig. EL-3

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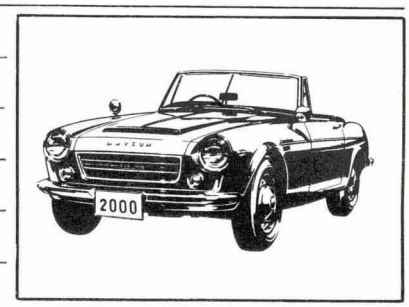
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FUEL SYSTEM

AIR CLEANER

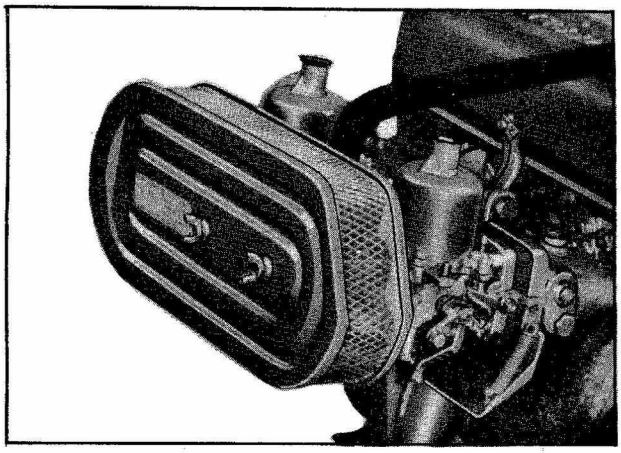


Fig. EF-1 For SU Caburetor

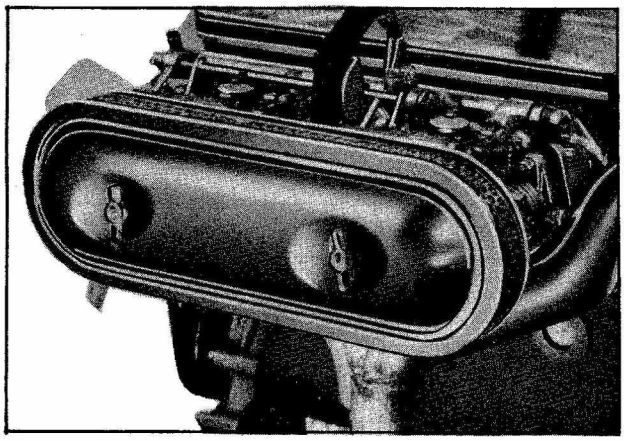


Fig. EF-2 For Solex Caburetor

The replaceable element type air cleaner is used as standard equipment.

The air cleaner is necessary to protect the fuel system as well as the working parts of the engine from abrasive clogging action of dust, dirt, and sediment normally present in the combustion air supply.

The air is taken into the air cleaner from the circumference. The air cleaner body is so designed to reduce to a very low level the noise of vibration periods emitted through the carburetor by the intake air rushing through to the intake system. The air cleaner also acts as a flame arrester in the event of a backfire through the carburetor.

In order for the air cleaner to function properly, it must be served periodically. A dirty element will restrict air flow to the carburetor and create an overly rich mixture condition and excessive fuel consumption as well as become unable to filter dust and dirt and thereby cause abnormal wear to the working parts of the engine.

Every 3,000 km (2,000 mile), remove the element and shake out accumulated dirt. Do not wash. Use compressed air and carefully blow out element in reverse direction of normal air flow. Install a new element every 40,000 km (24,000 mile).

More frequent cleaning and replacement is advisable when the vehicle is operated in dusty areas or unpaved roads. Accumulated dirt restricts air flow, reducing fuel economy and performance.

FUEL PUMP AND FUEL STRAINER

Function and Structure

The fuel pump, which is of the diaphragm type, is mechanically driven by the eccentric part of Jackshaft in the engine.

And the fuel strainer, separated from the fuel pump, is located at the front right side of the engine compartment.

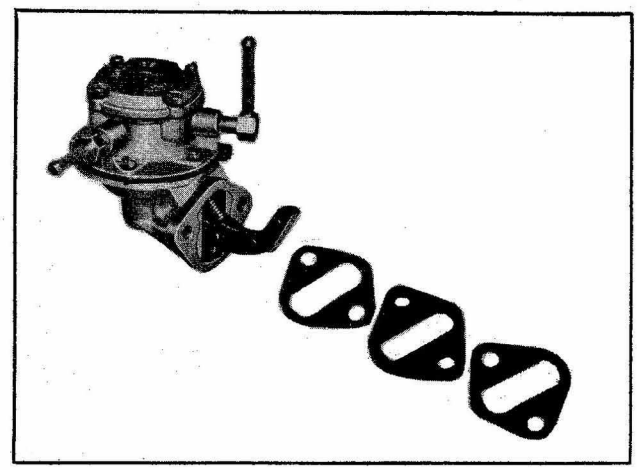


Fig. EF-3

The fuel pump draws gasoline from the tank through the fuel strainer and delivers it under pressure to the carburetor.

The fuel pump rocker arm is activated by an eccentric on the engine jackshaft and the dia-

phragm goes down against diaphragm spring and then is pushed up again by its spring.

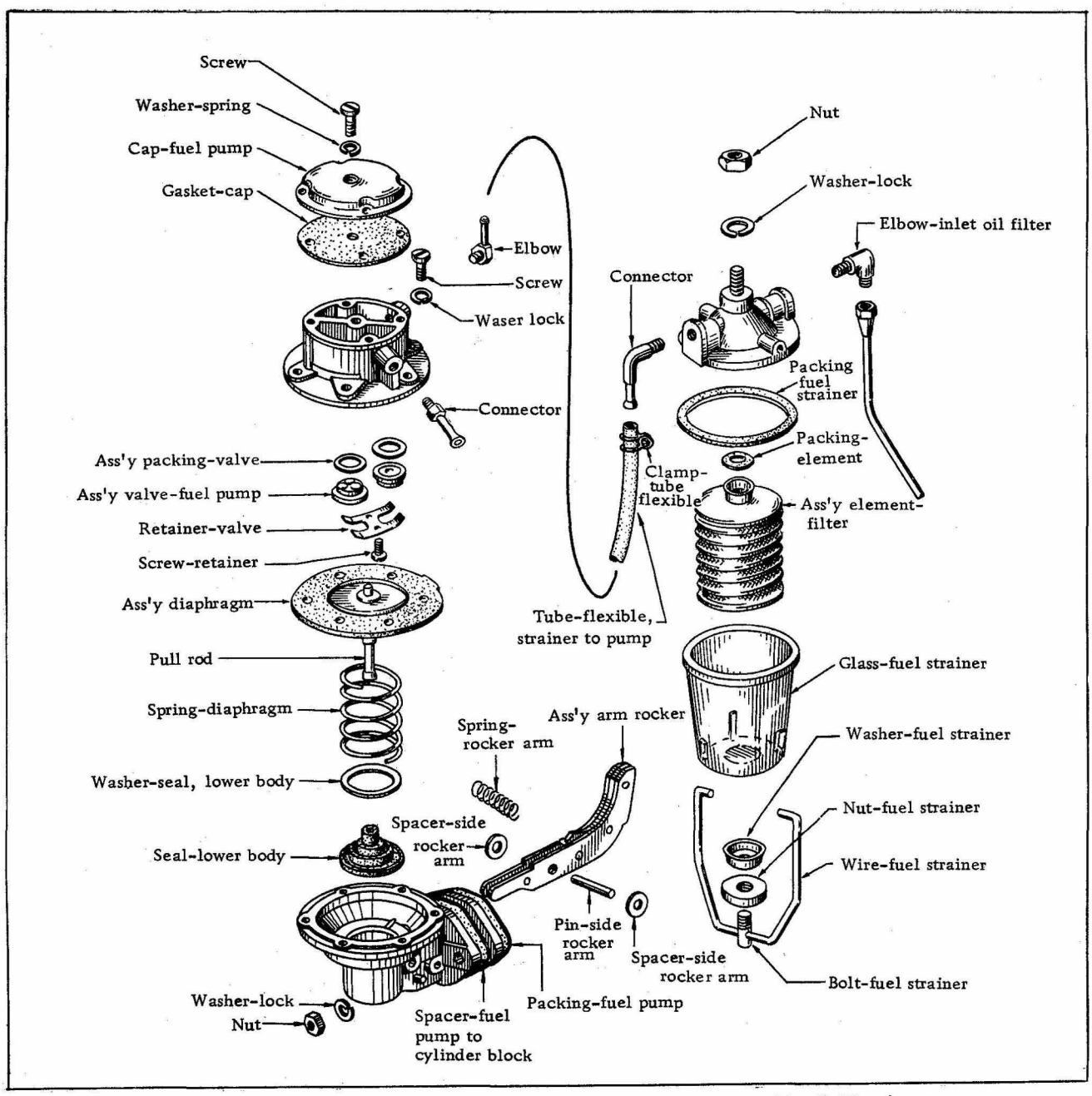
By this movements of the diaphragm and the functioning of the valves at the inlet and outlet of the pump chamber, gasoline is drawn up from the tank to the carburetor.

If the float chamber of the carburetor contains enough gasoline and the needle valve is closed, . gasoline is not allowed into the carburetor.

Thus gasoline is stored in the pump chamber and due to its pressure, the diaphragm is kept down and cannot return.

Under this condition, the rocker arm works in vain, as the rod remains low.

The rocker arm spring serves to prevent noise, keeping the rocker arm pushed against the eccentric of the engine jackshaft.



Fuel Pump *Fuel Strainer*

Fig. EF-4

Fuel Pump-Disassemble and Assemble

Disassemble

Remove Fuel pump assembly by unscrewing two attaching nuts and disassemble in the following order.

1. Separate Upper body and Lower body by unscrewing six body set screws.
2. Take off Cap and Cap gasket by removing Cap screws.
3. Unscrew Elbow and Connector.
4. Take off Valve retainer by unscrewing two valve retainer screws and two Valves are easily taken out.
5. To remove Diaphragm, Diaphragm spring, Lower body seal washer and Lower body seal out of Lower body, press down Diaphragm against force of Diaphragm spring and meantime incline Diaphragm so that a rectangular part in the lower end of Pull rod is unhooked from Rocker arm link.
6. Dirve out Rocker arm pin by using a press or hammer.

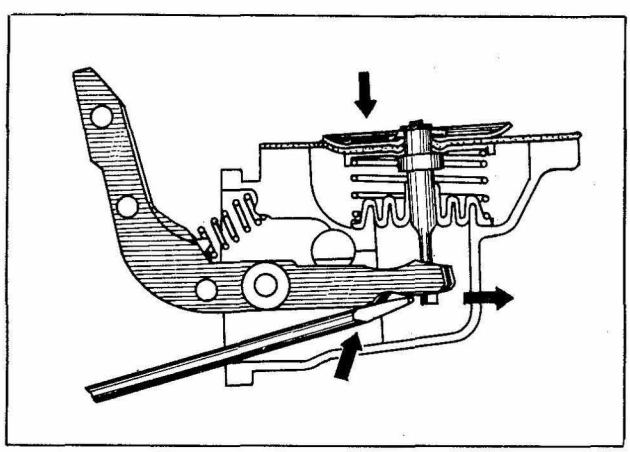


Fig. EF-5 Pull Rod Removal

Inspect

1. Check Upper body and Lower body for crack.
2. Check Valve assembly for wear of Valve and Valve spring. Blow Valve assembly by breath to examine function.
3. Check Diaphragm for small hole, crack and wear.
4. Check Rocker arm for wear at the portion to contact with Jackshaft.
5. Check Rocker arm pin for wear since the worn pin may cause oil leakage.
6. Check all other components for any abnormalities and change with new part depending on the condition.

Assemble

Assembly is a reversal of the disassembly procedure. In case of reassembly and reinstallation, following points should be noted.

1. Use new gaskets.
2. Lubricate Rocker arm, Rocker arm link, Rocker arm pin and Lever pin before installation.
3. To test the function, position Fuel pump assembly about 1 m (3 ft.) above fuel level with a pipe connecting Fuel pump and Fuel strainer and operate Rocker arm by hand. If the fuel is drawn up soon after Rocker arm is released, function of the pump is sufficient.

Fuel Pump Tests

Always check Fuel pump while it is mounted on the engine and be sure there is gasoline in the tank.

Capacity test; 800 cc (0.211 U.S.gal.) of fuel in one minute or less at 700 r.p.m. engine speed.

Vacuum test; at least 500 mm (21.6 in.) Hg (vacuum at 700 r.p.m. engine speed).

IMPORTANT: Fuel line from pump to carburetor must be disconnected so pump will operate at full capacity.

Pressure test; Connect a pressure gauge to a "T" fitting at the carburetor. The length of the hose on pressure gauge should not exceed 15 cm (6 in.).

Vent pump by allowing it to pump fuel for a few seconds unrestricted through the line into a container. This procedure is necessary to remove air and vapor that may be trapped in the pump.

Pressure specification is 0.24 kg/cm^2 to 0.30 kg/cm^2 (3.41 lb/in^2 to 4.26 lb/in^2) at 700r.p.m. engine speed.

SU TYPE TWIN CARBUETOR

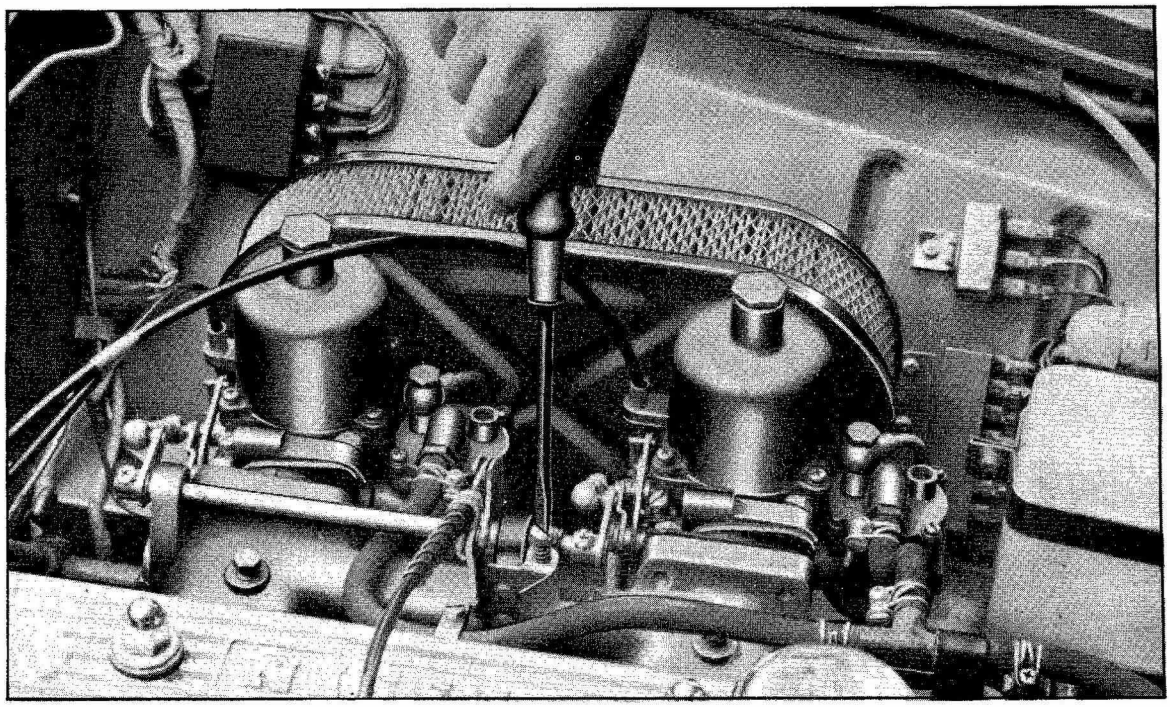


Fig. EF-6

STRUCTURE AND FUNCTION

Float Chamber

Fuel supplied from the fuel pump flows into the float chamber passing through the needle valve. The fuel level in the float chamber is always kept at a constant level by the operation of the needle valve and the float. The needle valve is made of special steel with high hardness and endures long time use without wear.

Venturi Control System

The suction chamber is installed on the upper side of the throttle chamber, in which the suction piston operates vertically.

Onto the top of the suction piston, vacuum of the venturi is transmitted through the suction hole, while atmospheric pressure acts on the lower side of the piston through the air hole to air cleaner.

The suction piston automatically makes vertical movement stabilized at a vacuum controlled by the weight of the piston, strength of the suction spring and the area of the large and small dia. of piston.

When the throttle valve is wide opened for high speed throttle position, the vacuum on the top of the suction piston increases and raises the venturi to wide open. When the air flow is little, the vacuum is low, then the venturi also opens little.

Weight of the suction piston and stength of the suction spring are selected so as the venturi opening will meet with any running conditions of the engine.

In order to produce rapid acceleration, oil damper is provided within the suction piston rod to restrict the speed of lift of piston on snap throttle opening.

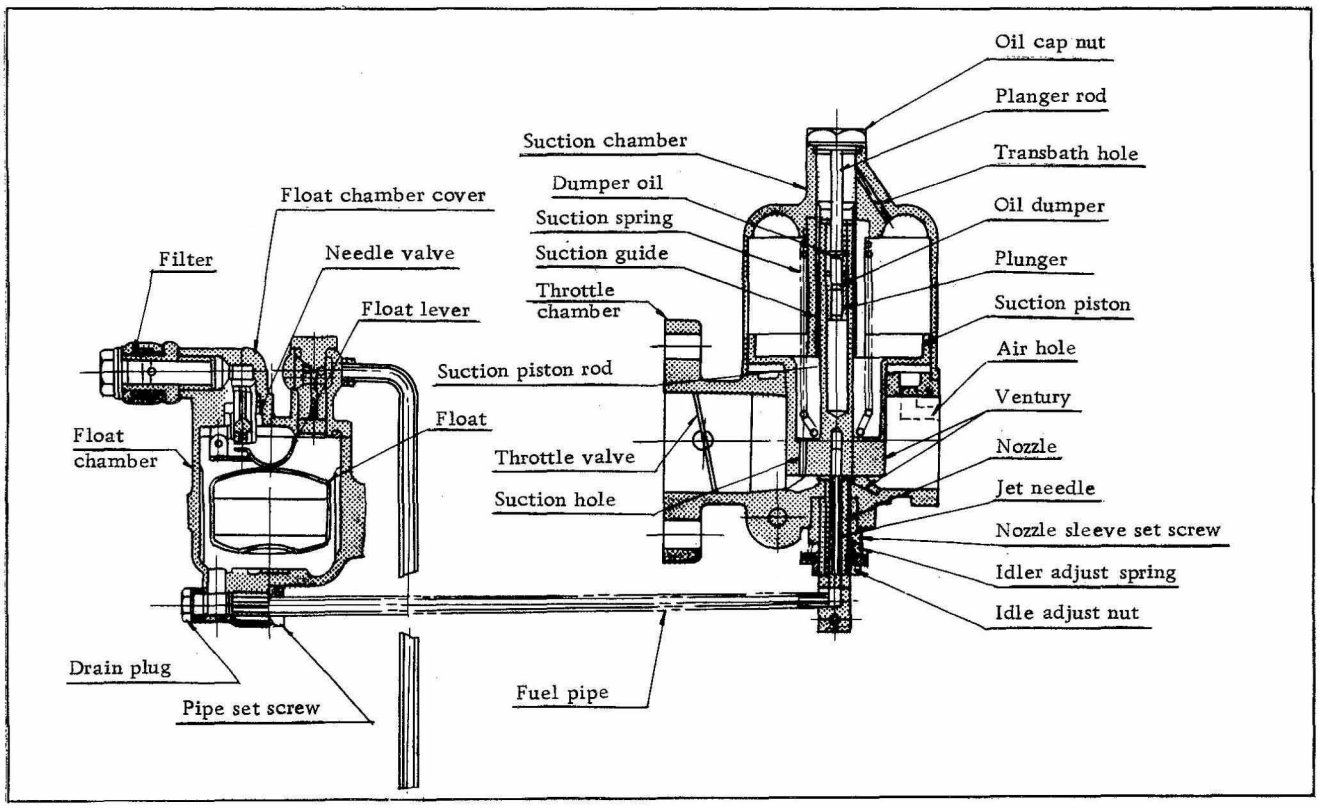
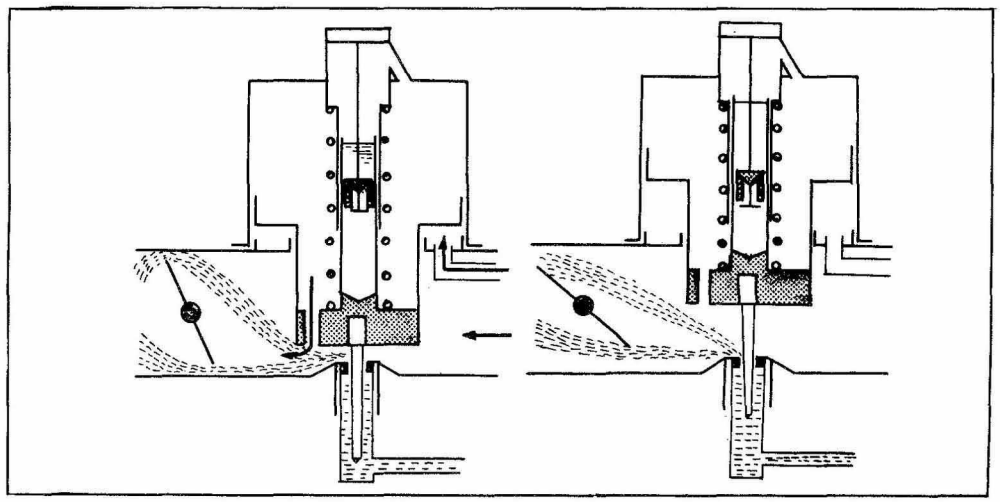


Fig. EF-7 Sectional View of Carburetor

Fuel Measuring System

Fuel supplied from the float chamber flows into the venturi through the gap between the nozzle and the jet needle by the vacuum generated at the venturi.

The jet neddle is fixed to the base of the suction piston and moves vertically in the nozzle together with the suction piston.

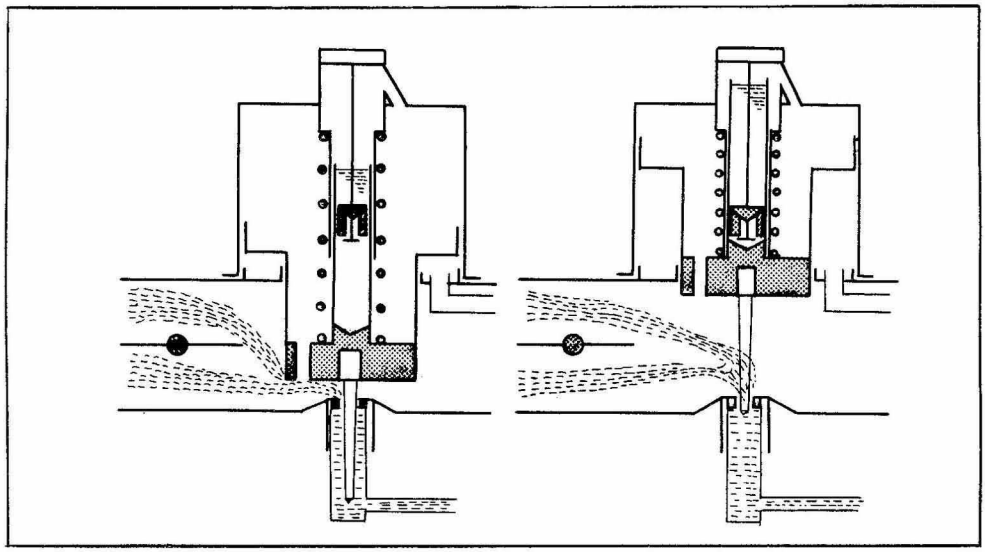


Idling Speed *Medium-Low Speed*

Fig. EF-8

The jet needle is tapered so that the gap between the nozzle and the jet needle varies and automatically changes flow of fuel. Form of the jet needle is determined so as to satisfy every condition of movement.

Operation of the suction piston and measurement of fuel at each condition, idling through full open, high speed are shown below.



Full Open High Speed *Full Open Low Speed*

Fig. EF-9

Starting Device

When the choke button is pulled out, the starter lever moves and pulls down the nozzle, then the gap between the nozzle and the jet needle is opened widely and rich fuel flows in. The throttle valve opens automatically about 6° with the synchronized linkage.

ADJUSTMENT AND HANDLING

Adjustment of Linkage Movement of Throttle Shaft and Fuel Close of Throttle Valve

Two carburetors are used in parallel, both throttle must be set and correctly synchronized, otherwise this will affect on consumption of fuel. The throttle shaft on the front side (F side) and that on the rear side (R side) operate at the same time with the auxiliary shaft provided on the engine side. Each throttle shaft has the throttle lever respectively and is connected to the lever of auxiliary shaft with adjustable connecting rod.

(1) To adjust full close of throttle valves of the carburetors on F and R sides, unscrew the both throttle adjust screws until the throttles are completely closed and change length of the connecting rod for the auxiliary shaft on one side.

(2) Fix the connecting rod on the R side to 70 mm (2.7559 in.) with the lock nut. (Overall length 84 ~ 86 mm).

(3) Turn the F side turn buckle of the connecting rod and adjust length so that the throttle valves on both sides are full closed.

(4) When the throttle valves on F and R sides are full closed, load upon the turn buckle disappears, which can be felt by the hand. When the connecting rod on the F side is too long and the return spring on the R side is too short, the return spring on the F side works, this can be felt on the turn buckle.

(5) When full close adjustment has been finished on both sides, lock the turn buckle on the F side with the lock nuts.

(6) Connect the throttle wire to the drum.

Idle Speed Adjustment

Slow running adjustment is conducted with the throttle adjust screw and the idle adjust nut after the engine has been warmed up.

(1) Tighten completely the idle adjust nuts of the carburetors on the F and R sides, then return three turns. Tighten 2-3 turns the throttle adjust screw of the carburetor on the F side and start engine.
Unscrew the throttle adjust screw of the carburetor on the R side so as the end of it is clear from the stopper and do not move it till the last.

(2) Return the F throttle adjust screw slowly, then the engine revolution slows gradually down and stop it just before the engine revolution becomes irregular.

(3) After that, screw in or out the idle adjust nuts of the carburetors on the F and R sides the same turns and stop them when the engine revolution is the most fastest and smooth.

(4) Further return the throttle adjust screw of the F side carburetor and slow down revolution, then the stable idling driving can be obtained.

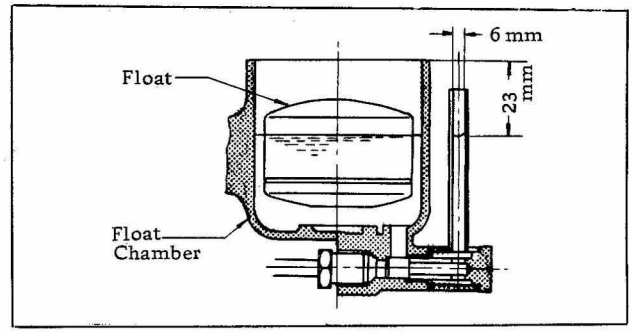
(5) Lastly screw in the throttle adjust screw of the R side carburetor to the point when the engine speed start to increase. Be careful not to screw in too much and further open the throttle valve. Adjustment of idling will affect consumption of fuel and acceleration.

Adjustment of Float Level

To measure the float level, remove the drain plug and insert the level gauge with the inside diameter 6 mm and conduct idling running of engine. If the fuel level shown on the glass tube stands at 22 ~ 24 mm (0.8661 ~ 0.9449 in.) from the top of the float chamber, it is the normal level.

When the level gauge is not available the following steps are taken for adjustment.

(1) Remove 4 ea of the set screw of the float chamber cover, the float chamber cover and the float lever can be removed together. Put the float chamber cover on a stand with the float lever upside.



Measuring Float Level

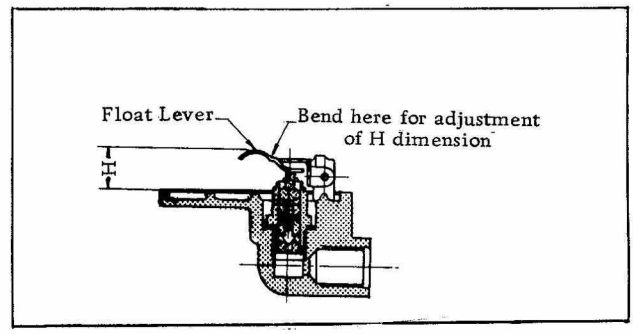


Fig. EF-10 Adjusting Float Level

(2) Lift the float lever with the finger and slowly lower down and stop it when the float lever seat just contact with the valve stem.

(3) In this case, dimension (H) between the contact point of the float lever and float and the fitting point of the float chamber cover is to be 14 ~ 15 mm (0.5512 ~ 0.5905 in.) as the standard.

(4) When the dimension is not right, bend the point shown in the figure for adjustment.

Adjustment of Starting Linkage Opening

Pull the choke button, then the starter lever moves and the nozzle is pulled down, while the throttle valve automatically opens 6° with linkage the most suitable opening for starting.

When resetting, fit the line marked on the connecting rod (c) to the arrow marked on the fast idle lever post, then the starting linkage opening can be adjusted.

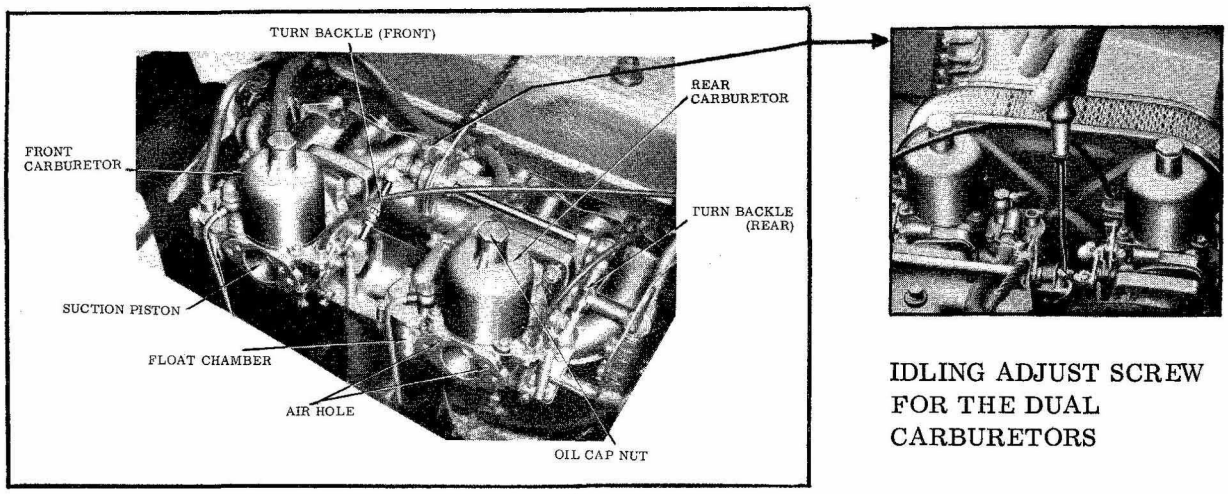


Fig. EF-11 Adjustment for Opening Degree at Connecting

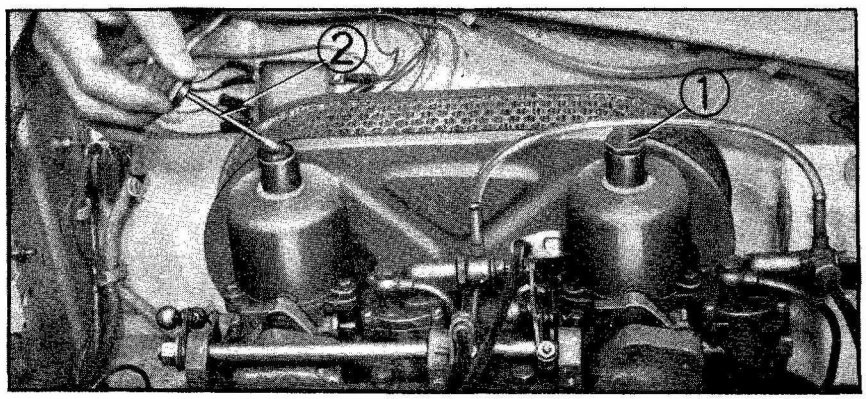
Inspection of Damper Oil

When the carburetor is installed to the engine or the engine is overhauled, check the damper oil without fail and add it if necessary.

If the damper oil is short, this affects acceleration and other movements, so that periodical inspection, every 2 ~ 3 months or about 3,000 km (2,000 mile), is necessary and add it when necessary.

To add the oil, remove the oil cap nut. Use the motor oil SAE#20 as the damper oil. Do not use those #30 up.

To check the damper oil level, remove the oil cap nut and if the oil level stands at 5 mm (0.1968 in.) or more from the grooves on the plunger rod, it is normal, however if the level is lower, add the oil. Be careful not to bend the rod when the oil cap nut is removed.



① Oil cap nut
② Plunger rod

Fig. EF-12 Inspecting Damper Oil

Periodical Inspection of Suction Chamber and Suction Piston

For normal operation of the suction piston to control the venturi area, it is necessary to conduct periodical maintenance for the suction piston and the suction chamber, as dust in the air is sucked in to some extent and accumulated on the piston.

To check movement of the suction piston without removing it from the engine, the following steps are taken.

(1) Remove the oil cap nut.

(2) Push up the lifter with the finger, the end of lifter will make contact with the underside of larger diameter of the suction piston at about 1.5 mm (0.0591 in.). Push up the lifter further, it will make a stop with the stopper.

(3) When the lifter is free of the finger, it returns with load of the lifter spring, then the suction piston also comes down and the stop pin at its front end hits against the fixed side of the venturi. This is known by the sound. If the piston moves smoothly up and down like that, it can be said to be in a good operative condition. This also assures that centering is good as explained in the following chapter.
To check bend of the plunger rod of oil cap nut, remove the air cleaner with the oil cap nut as it is, push up the suction piston by the finger and drop it freely. When push up, the finger will feel fairly heavily by action of the oil damper, but it will come down freely without action of the oil damper. If so, it can be said to be in a good condition. Conduct overhaul every 6 months.

DISASSEMBLY AND ASSEMBLY

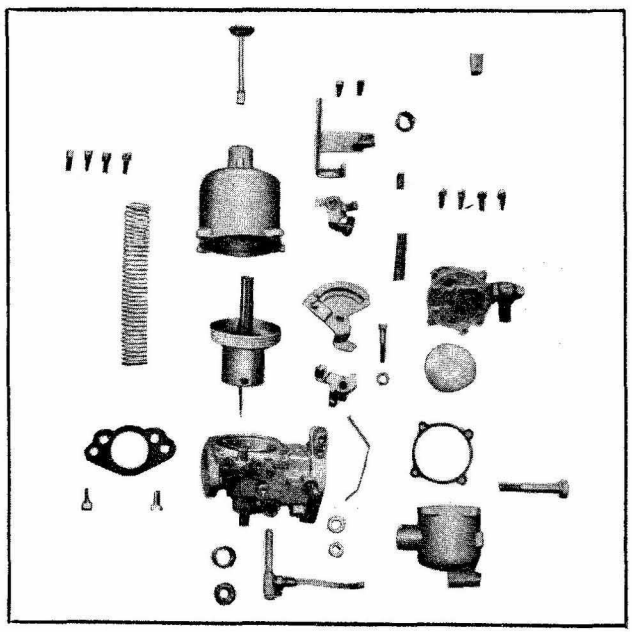


Fig. EF-13 Suction Piston & Suction Chamber

The float chamber for HJG-46W carburetor is of the same structure as ordinary carburetors, however, the venturi and fuel control systems are made up particularly of high precision parts, so that close attention must be paid for disassembly and assembly.

Suction Piston and Suction Chamber-Disassemble and Assemble

(1) Remove 4ea. of the set screw and separate the suction chamber.

(2) Remove the suction spring, nylon packing and the suction piston from the inside.

(3) The removed suction chamber and suction piston must be put on clean cloth placed on the level top of a desk. Do not make scratches on the inside of suction chamber and on the outside diameter of the suction piston. Do not bend the jet needle underside the suction piston.

(4) Do not remove the jet needle out of the suction piston if possible. When it is necessary to disassemble unavoidably, loosen the jet needle set screw then using plier within 2 mm (0.0787 in.) from the shoulder of the jet needle taking care of not making scratches and slowly pull it out, twisting so as not to bend it.

(5) Incorrect setting of the jet needle in the suction piston results in malfunction of idling and other performances. Proper setting of the jet needle is as follows. Set the jet needle so as its shoulder is on the same level with the underside of the suction piston small diameter as shown. Put a level plate at the small diameter and accord it to the shoulder of jet needle and fix the set screw.

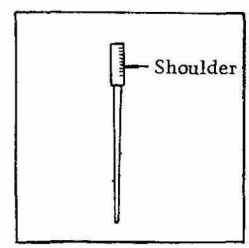


Fig. EF-14 Jet Needle

(6) Clean the suction chamber and suction piston with clean gasoline and flow them with air to eliminate oil and dust.

(7) When the suction chamber and suction piston have been cleaned, add 1 ~ 2 drops of thin

oil to the piston rod and assemble them. If oil sticks to the inside of suction chamber and the large diameter of suction piston, it will be the cause of trouble.

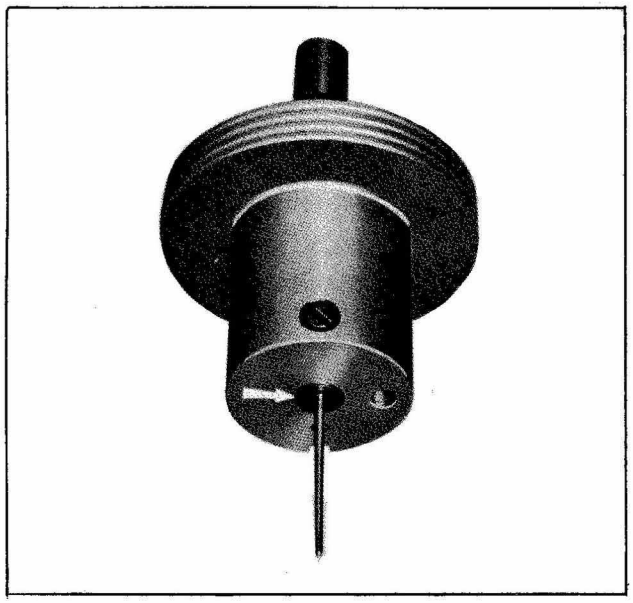


Fig. EF-15 Setting Jet Needle

Nozzle-Disassemble and Assemble

(1) Disassembly of Nozzle
Disassembly of the nozzle is simple, but the nozzle sleeve, washer and nozzle sleeve set screw are hard to reassemble, so that do not disassemble these items if possible.

A. Remove the starter return spring and the pins, 4 and 5 mm Dia. (the connecting rod is also removed for F side carburetor), and then the starter lever. Next, loosen the clip and remove the fuel pipe, then the nozzle can be taken off. In this case, every care must be taken not to injure or bend the jet needle remained.

B. Remove the idle adjust nut and idle adjust spring.

C. Remove the nozzle sleeve set screw and take off the washer and nozzle sleeve. The fuel measuring jet of nozzle is the most important part of the carburetor and processing of the hole is carried on very precisely and very strict inspection is conducted. Clean the nozzle with clean gasoline and blow it with dry air.

(2) Reassembly of Nozzle

A. Set the suction piston and suction chamber first (with the jet needle in the suction piston). Remove the oil cap nut and do not add damper oil.

B. Place the suction piston in full down position and then insert the nozzle until it hits the nozzle sleeve.

C. Move the nozzle sleeve and determine the position of it so as the jet does not hit the jet needle.

D. In this state, push up the suction piston by the finger and drop it slowly. If the suction piston stop pin drops smoothly until it hits against the venturi with a slight sound, tighten the nozzle sleeve set screw firmly.

E. Remove the nozzle, set the idle adjust spring and idle adjust nut in the nozzle sleeve, then insert the nozzle, insert the fuel pipe connected with the float chamber to the nozzle nipple and tighten the clip. Be careful not to twist the fuel pipe and tighten the clip at the swollen part of the nipple.

F. Install the starter lever with the pins, (the connecting rod is also installed on the F side) and finally hook the starter spring.

G. When assembly has been completed, make sure whether the suction piston drops smoothly.

(3) Disassembly of Float Chamber
Follow the order of disassembly described in the section, Adjustment of Float Level.

(4) Disassembly and Assembly of Linkage.
Do not deform each parts in processing. After the reassembly the synchronized linkage is to operate smoothly.

INSTRUCTIONS FOR BALANCING TWIN HITACHI HJG-46W VARIABLE VENTURI SIDE DRAFT CARBURETOR

Method Ⓐ

(1) Remove air cleaner.

(2) Disconnect throttle connections of both carburetors.

(3) On the front carburetor (nearest radiator) set idle screw so that tachometer reading is 600 r.p.m. If you do not have an instrument for balancing multiple carburetors, use a length of plastic hose, 1/2 inch diameter, and place at open horn of carburetor, and at your ear.
Listen to sound of air entering carburetor.

(4) Move to second carburetor and follow same procedure of listening to air entering this carburetor. If the sound is exactly the same as the front carburetor, then they are synchronized. If not, then adjust the idle screw until they have the same sound.

(5) Now if reading of the tachometer has changed, you must move both idle screws until you have both carburetors hissing the same tone and the r.p.m. is not more than 750 r.p.m.
You have now synchronized the throttle opening of dual carburetors.

(6) We will now proceed to adjust and synchronize the fuel flow of both carburetors. Start with the front carburetor adjustment.
With the engine running at 700 r.p.m., lift the piston of the rear carburetor 1/2 inch. (This will make the carburetor inoperative.) If engine stalls, then you must richen the front carburetor until it will keep the engine running as if it were firing only two cylinders, rough but a steady best.
Now repeat this same procedure or lifting the piston on the front carburetor, and adjust the mixture of the rear carburetor.

(7) You have now synchronized your air fuel ratio in both carburetors. You may find when this step is completed that r.p.m. has increased on your tachometer; if so, go back to step and correct your idle to 700 r.p.m.

(8) Next, adjust your throttle linkage connecting the carburetors with the throttle shaft mounted on the intake manifold.
Adjust the length of throttle link so that it will snap in place without changing r.p.m. on the front carburetor.
Do this same operation with the link to the rear carburetor.

Your engine should now run smoothly, providing the rest of your engine is properly tuned, such as valves, points, plugs, condenser, and ignition timing properly set.

Method Ⓑ

(1) Warm engine to normal operating temperatures.

(2) Turn the idle adjusting nut clockwise until closed, then return the nut about three turns.

(3) Turn the front carburetor throttle adjusting screw clockwise 2 or 3 turns.
Back off on the rear carburetor adjusting screw so it is off the stopper.

(4) Then start engine.

(5) Turn the front throttle adjusting screw until engine reaches about 600 r.p.m.

(6) Turn the idle adjusting screw turns either left or right until engine runs evenly.

(7) If the rotation of engine is too fast, slightly adjust the front throttle adjusting screw until engine speed is about 700 r.p.m.

(8) Normally a slight alteration of the idle adjust screw is again necessary.

(9) Set the rear carburetor throttle adjusting screw so it seats on the stopper.

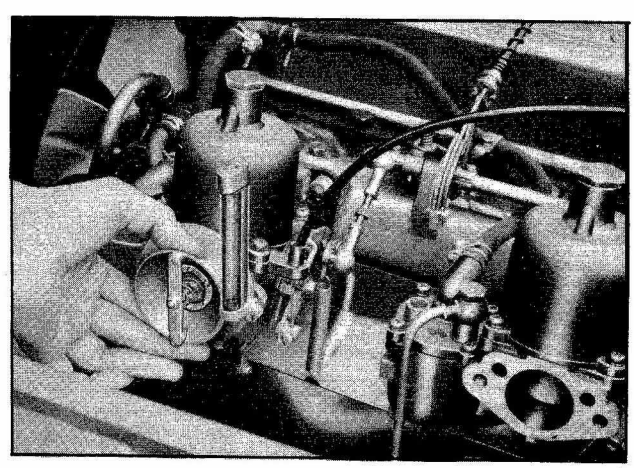


Fig. EF-16 Carburetor Balancing

Method ©

If you have an instrument for balancing multiple carburetors.

(1) Warm engine to normal operating temperatures.

(2) Remove air cleaner; disconnect linkage.

(3) Place an instrument for balancing over throat of one carburetor.
(Adjust the screw of air flow meter.)

(4) With the adjusting screw in open position, gradually turn down until float in transparent tube rises to, or near, any graduating mark line. (Tube to be kept vertical while in operation.)

(5) Without changing position of the adjust screw, place the same on remaining carburetor, adjusting each carburetor "throttle-stop-screw" to bring float to approximately same level as the above item (4).
If the idling speed is too fast, back off the throttle stop screw on one carburetor adjust an instrument for balancing to that carburetor, then rebalance the other carburetor. Then carefully reconnect linkage. Then the engine speed is increased just enough so the carburetor control arms do not touch the stop screws, then locking the accelerating control at a point that will not affect the linkage to the carburetor.
The linkage may then be checked and adjusted by using an instrument for balancing multiple carburetors in the same manner as for adjusting the idling screws.

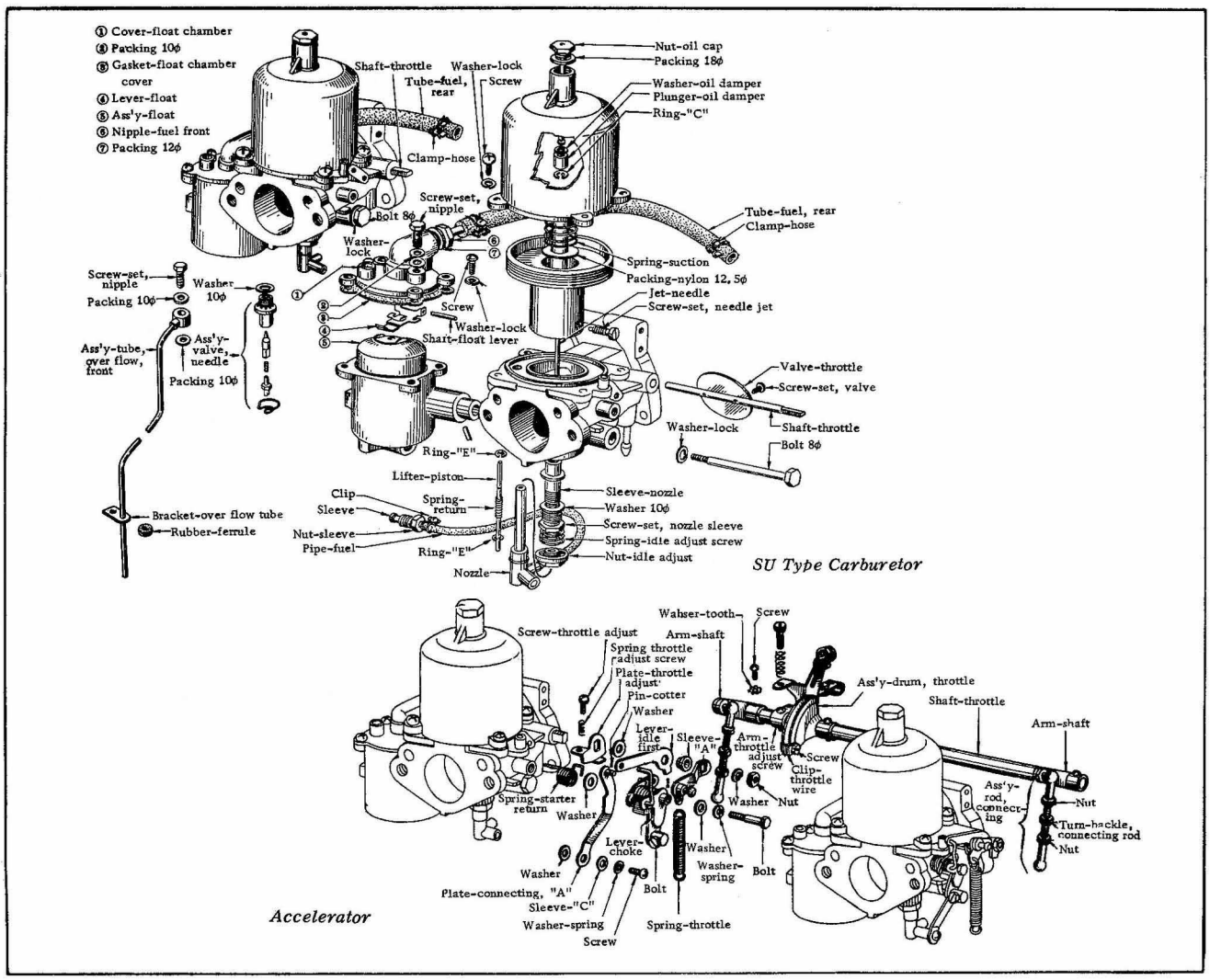


Fig. EF-17 Carburetor Component Parts

CAUSES AND REMEDY FOR TROUBLE

For troubles in the carburetor, causes and remedy for them are listed as follows. When the engine is in disorder, there may be the cause in the electric system, not in the carburetor. In such a case, check the electric system first and then adjust the carburetor.

Trouble	Cause	Remedy
Overflow:	Leak, deform of float	Replace
	Dust on needle valve seat	Clean
	Slack of needle valve	Retighten
	Defective seat of needle valve	Grind or replace
	Excessive pressure of fuel pump	Repair
	Sucking air in fuel pump	Repair
Excessive consumption of fuel:	Overflow	See the above
	Malfunction of suction piston	See last item
	Defect in nozzle return	Adjust
	Wear of jet needle	Replace
	Wear of nozzle jet	Replace
	Incorrect slow-adjust	Adjust
	Incorrect fitting of jet needle	Adjust
	Incorrect adjustment of throttle valve linkage	Adjust
Want of power:	Throttle valve not full open	Adjust
	Malfunction of suction piston	See last item
	Defect in nozzle return	Adjust
	Clog in nozzle or fuel line	Clean
	Incorrect fitting of jet needle	Adjust
	Clog in needle valve	Clean
	Malfunction of fuel pump	Adjust
Defect in idle:	Malfunction of suction piston	See last item
	Defect in nozzle return	Adjust
	Wear of jet needle	Replace
	Incorrect adjust of idle adjust nut	Adjust
	Wear of throttle shaft	Replace
	Air leak due to defective packing between manifold and carburetor	Replace gasket
	Incorrect adjust of throttle valve linkage	Adjust
	Slack in throttle lever linkage	Adjust or repair
Breathing:	Malfunction of suction piston	See last item
	Incorrect adjust of idle	Adjust
	Shortage in damper oil or use of inferior oil	Add. replace
	Incorrect fitting of jet needle	Adjust

Do not start:	Overflow	See preceding item
	Fuel not feed	Check pump
		Check fuel pipe
		Check needle valve
	Incorrect adjust of idle	Adjust
	Malfunction of suction piston	See last item
Malfunction of suction piston:	Deposit of dust or oil	Clean
	Adhesion of suction chamber and suction piston due to deform	Repair or replace
	Incorrect centering of nozzle	Adjust
	Bend of jet needle	Replace
	Bend of plunger rod	Repair

SOLEX 44PHH TYPE DUAL CARBURETOR

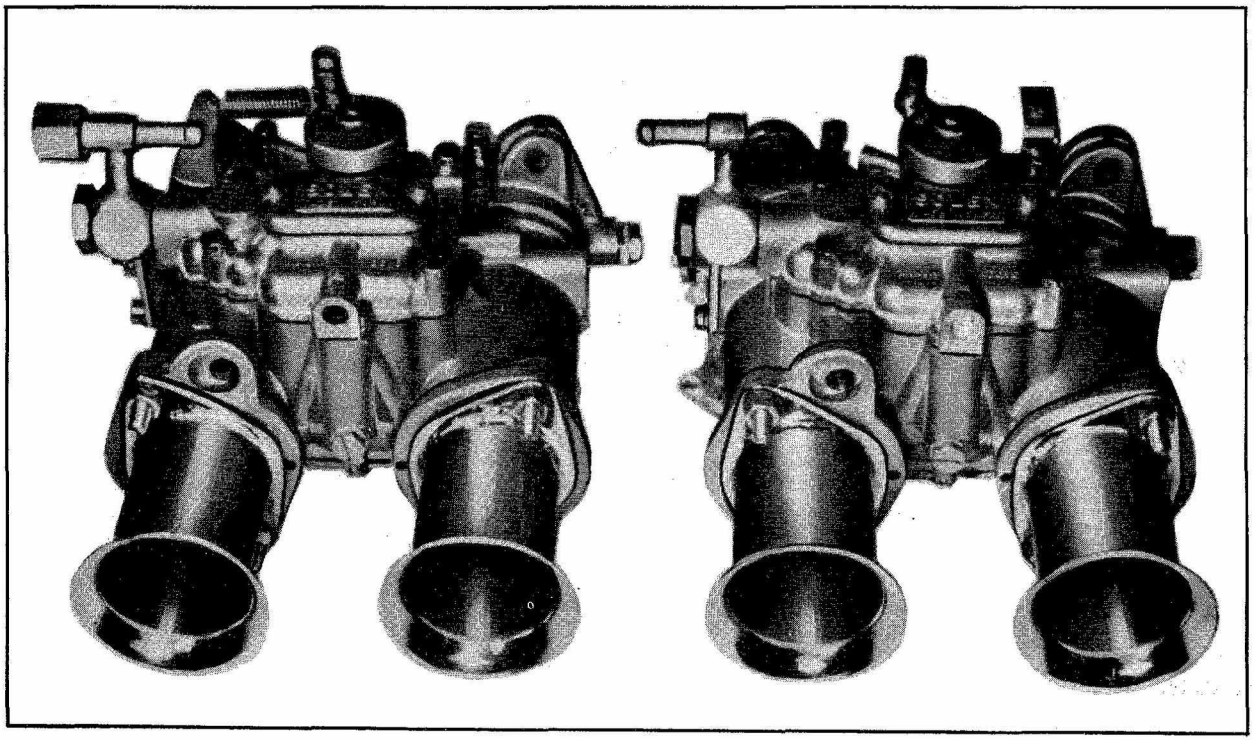


Fig. EF-18

GENERAL DESCRIPTION

Type 44PHH Carburetor is a Solex Carburetor developed for mounting on, in addition to general motor vehicles, sports cars and racing cars requiring rugged and high performances.

Its outstanding features are as follows:

1-1 Twin-bodies carburetor

So-called Twin-Chalk Carburetor, with two suction ports embodied in one Carburetor compactly.

1-3 High in suction coefficient

Starter is employed for the starting system instead of chalk valve to improve suction coefficient.

1-2 Strong against inclination

Designed to let it full maintain its performances even at excessive inclinations of the fuel level (from lateral turning of the car to quick acceleration). To be more concrete, Float hinge is installed at a position free from lowering in performances even at sharp lateral turnings by installing Jets at the center part and making Float the twin bodies type.

1-4 Exchangeable venturies and air funnel

Venturies and Air funnel are exchangeable, allowing this Carburetor to be a universal type usable on any types of Engines.

1-5 Easy to adjust

Major Jets are installed concentrated at the center, and can be easily exchanged by removing the Jet chamber cover.

1-6 Equipped with membrane type accelerator pump

Free from causing defective operation due to wear or sticking, unlike the piston type pump.

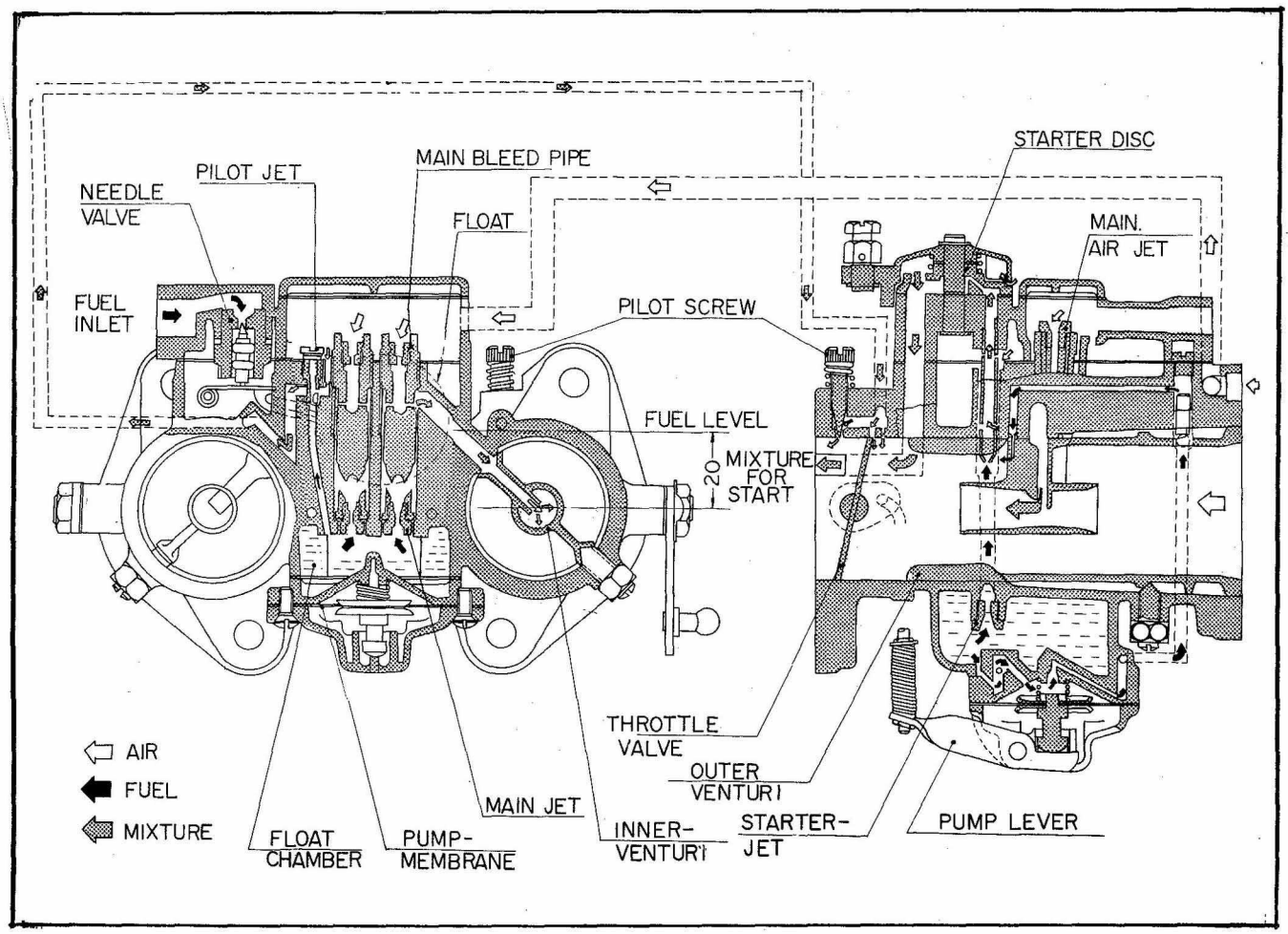


Fig. EF-19 44PHH Fuel Flow Chart

CONSTRUCTION AND FUNCTION

As Solex 44PHH TYPE Carburetor is a twin-bodies type, all functional parts are installed in twin, except for Float Chamber, Accelerator Pump and Starter Device which are installed one each and deliver the fuel equally to both suction ports.

The construction is mainly devided into the following five system, that is, Slow-running System, Main System at the middle and high speed running, Float system for maintaining the fuel level at the regular height, Accelerator Pump and Starter System for starting Engine in a cold condition.

Float System

This system is the device for maintaining the fuel level at the regular height when Engine is running and is composed of the functional parts, Float ② and Needle Valve ①. The construction is shown in Fig. EF-20. The fuel flows from Fuel tank by way of Fuel Pump and flows into Float Chamber ③ through Needle Valve ①. If a certain amount of the fuel is filled in Float Chamber ③, Float ② will be floated and the float valve will contact closely with the valve seat by the buoyancy of Float, cutting off the fuel flow and as the result the fuel level is always maintained to the regular height.

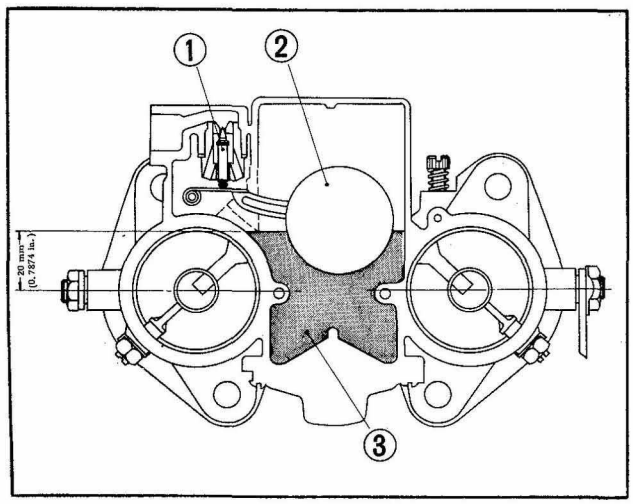


Fig. EF-20

Note: 1) The fuel level is set up to be 20 mm (0.7874 in.) above the center of Main Bore when the fuel pressure is 0.25 kg/cm^2 (3.55 lb/in^2).
As the Fuel level moves up and down with the change of the fuel pressure as shown in Fig. EF-21, be careful not to give a higher fuel pressure than needed which will cause a overflow of the fuel.

2) Adjust the fuel level by a suitable packing. A standard packing has a 1 mm (0.0394 in.) thickness and 0.5 mm (0.0197 in.) and 1.5 mm (0.0591 in.) packings are available for adjusting.

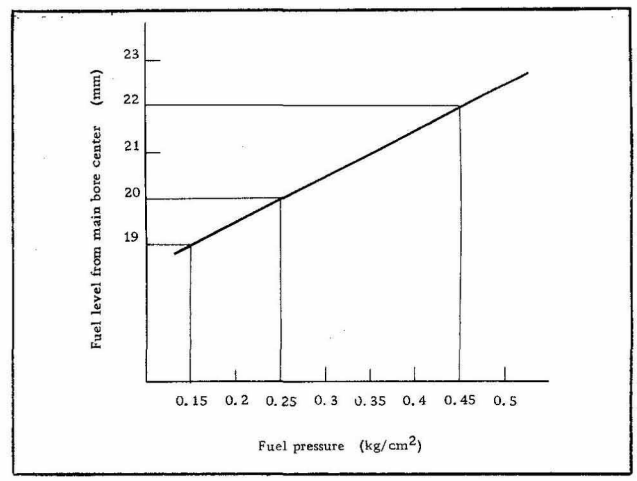


Fig. EF-21

Slow-Running System

This Slow-Running System supplies the mixture for Idling, Slow and Middle Speed running.

This system is composed of such functional parts as Pilot Jet ⑤, Pilot Air Jet ⑥, Pilot Outlet ⑦, Pilot Screw ⑧, By-pass ⑨, etc.

These functional parts are combined suitably to make a mixture of the optimum density and supply this optimum mixture to Engine.

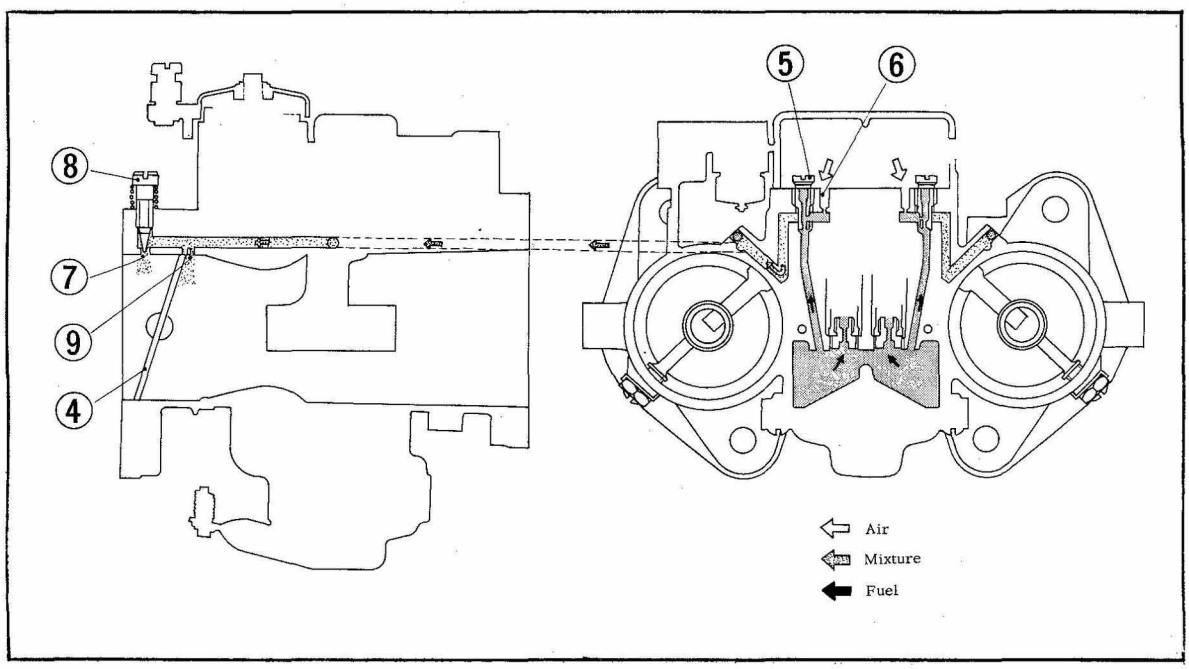


Fig. EF-22

The function of main parts are as follows,

1) Pilot Jet ⑤
This jet will measure the fuel quantity which should be sprayed out from Pilot Outlet ⑦ and By-pass ⑨.

2) Pilot Outlet ⑦ And Pilot Screw ⑧
Pilot Screw ⑧ is screwed into Pilot Outlet ⑦ section and adjust the density of the mixture for idling, varing the opening of Pilot Outlet ⑦ by the tapered end of Pilot Screw.

3) By-pass ⑨

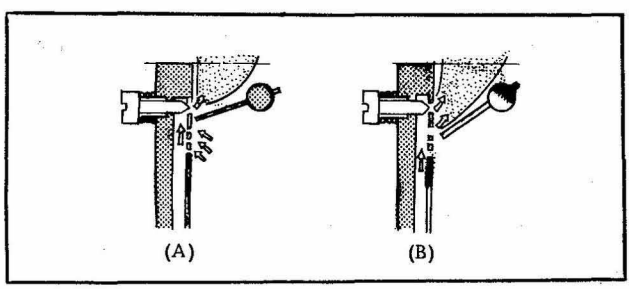


Fig. EF-23

By-pass ⑨ is composed of several small holes.

When the opening of Throttle Valve ④ is small as shown in Fig. EF-23(A) (Idling). The air will be sucked from these holes and make thin the density of the fuel, promoting the vaporization of the fuel.
When the opening of Throttle Valve becomes bigger as shown in Fig. EF-23(B) (Slow-Middle speed running), then the mixture will jetted out from By-pass holes as well as Pilot Outlet.

4) Pilot Air Jet ⑥
This jet measures the air quantity which is to be mixed with the fuel measured by Pilot Jet ⑤.

The opening of Throttle Valve for idling is very small, so the negative pressure of Engine will operate only on the engine side of Throttle Valve and the pressure to the vicinity of By-pass ⑨ will be nearly atmospheric pressure.

The negative pressure of Engine operates on Pilot Outlet ⑦.

The fuel measured in Pilot Jet ⑤ is mixed with the air measured in Pilot Air Jet ⑥ and furthermore mixed again with the air from By-pass, the fuel becomes a well-vaporized mixture of the rather thick density and flows into Pilot Outlet ⑦.

The mixture which flows into Pilot Outlet ⑦ is controled by Pilot Screw ⑧ and sprayed into Main Bore and, mixed with the air flows through Main Bore, the mixture will gain a optimum density and finally supplied to Engine.

In Slow and Middle speed running, it is not enough with the fuel only from Pilot Outlet ⑦ and the mixture from By-pass ⑨ will supplement the shortage.

That is, at first, the negative pressure operates only on Pilot Outlet ⑦ and after Throttle Valve opens more widely than as shown in Fig. EF-23(B), the negative pressure will operate also on the vicinity of By-pass ⑨ and the mixture will be jetted from By-pass holes, too.

As mentioned above, at first only Pilot Outlet ⑦ operates and No. 1 By-pass (nearest hole to Throttle Valve) and No. 2 By-pass operate successively according to the opening of Throttle Valve and as the mixture increase in proportion to the increase of the intake air, the mixture is always kept in a condition of the optimum density.

Main System

Main System supplies the fuel when the high power is needed such as in Middle and High speed running, Acceleration and Climing the hill.

The system is composed of such functional parts as Main Jet ⑩, Main Air Jet ⑫, Jet Block ⑬ and Inner Venturi ⑪.

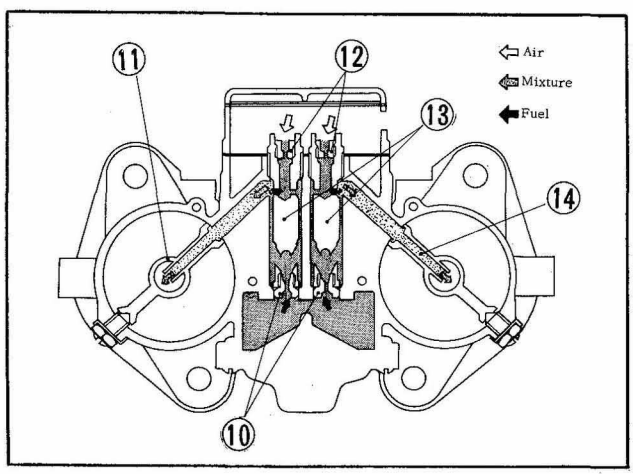


Fig. EF-24

1) Main Jet ⑩
This jet is used for measuring the fuel needed in Middle and High speed running, Acceleration and Climing.

2) Main Air Jet ⑫
This jet is used for measuring the air which will be mixed with the fuel measured in Main Jet ⑩.

When the engine revolution goes up and the opening of Throttle Valve exceeds 10%, then the speed of air-flow will be quickened and the negative pressure at Main Nozzle ⑭ grows up and the fuel began to be jetted from Main Nozzle ⑭

That is, the fuel measured in Main Jet ⑩ is mixed with the air measured in Main Air Jet ⑫ After the fuel becomes a well-vaporized mixture of the rather thick density, the mixture is sprayed into Main Bore and, mixed with the air flow through Main Bore, will gain a optimum density and finally will be supplied to Engine.

Accelerator Pump

When Accelerator pedal is pressed down sharply, the fuel to the Main system cannot follow the increase of the air flow and the mixture will thin its density temporarily.

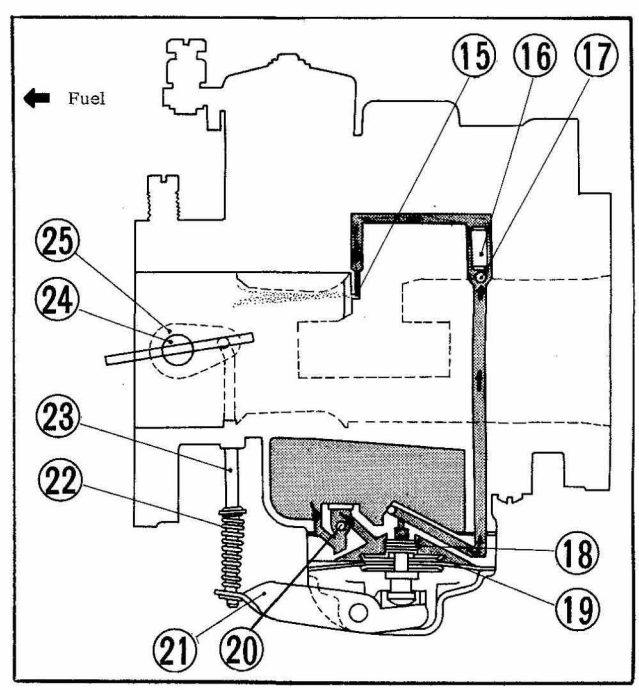


Fig. EF-25

This Accelerator Pump is the device for jetting the fuel to prevent the temporary thinning of the mixture and to improve the follow-up performance of Carburetor.

The construction is like that Rod Lever ㉕ is connected to Throttle Shaft ㉔ and to this Rod Lever ㉕, Pump Rod ㉓ and Pump Lever ㉑ are connected.

When Accelerator Pedal is pressed, Diaphragm ⑲ will be pushed up by way of Rod Lever ㉕ - Pump Rod ㉓ - Pump Lever ㉑.

The fuel in the pump chamber will flow toward Pump Jet ⑮ by the movement of Diaphragm ⑲.

That is, the fuel is devided to two passages and pushes up respective Outlet Check Ball ⑰ and Pump Weight ⑯ and finally is jetted into respective cylinder from Pump Jets ⑮ provided at respective Inner Venturi.

The working range of this pump is just from the opening of Throttle Valve to the 30% opening of that valve.

NOTE: Three holes are provided for Rod setting at the end of Pump Rod ㉓ and the hole at the middle is the standard for setting. When the increase of the fuel jet is required, use the upper hole.

Starter System

This carburetor employs Starter Device instead of Choke valve to increase the suction efficiency.

Starter Device is composed of the functional parts, Starter Jet ㉗ Starter Pipe ㉖ and Starter Disk ㉚.

Pull the Starter button of Dash-board, and Starter Disk ㉚ will be rotated and Fuel and Air passages will open. After Engine is started, Fuel will flow into Starter Pipe ㉖, being measured at Starter Jet ㉗. Some bleed holes are provided in Starter Pipe. A small quantity of air from these holes will be mixed with the fuel and promote the vaporizing of the fuel which will flow into Starter Disk ㉚.

The mixture which flows into Starter Disk ㉚ will be mixed again with the air and gain the optimum density and, after devided into two, flow into each cylinder.

In this Starter Device Throttle Valve will operate as Choke Valve of the conventional type carburetor, so if you press down the Accelerator pedal when starting, the negative pressure operating to Fuel Jet ㉘ will be reduced and the lack of the fuel supply will be result.

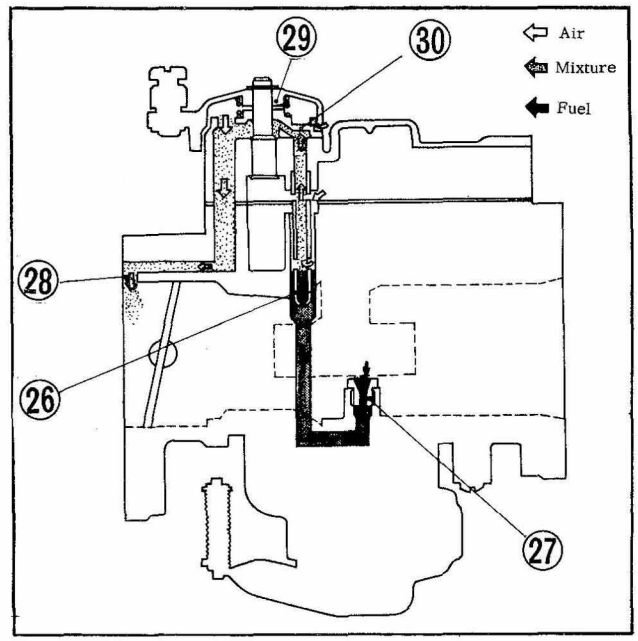


Fig. EF-26

ADJUSTMENT

Idling

Start adjusting after Engine is fully warmed up. Also, be sure to start adjusting after confirming that Throttle valves of all Carburetors are opened in uniform degree. For this, adjust all Throttle valves so that they can fully close under the condition of all Throttle stop screws being loosened. Then, return each Pilot screws for about one round from total close, screw Throttle stop screw in a little and let Engine start. Then, after setting Engine r.p.m. to about the required idling r.p.m. (different for each engines) by Throttle stop screws, set it to the highest r.p.m. by opening and closing each Pilot screws for about 1/4 rounds separately. After obtaining a little higher Engine r.p.m. by doing so, set it to the required Idling (700 r.p.m.) again by Throttle stop screws. Repeat this operation 2-3 times, and the required idling can be obtained.

Medium and High Speed

First, decide Venturies. The size of Venturies depends on the Engine capacity or Engine r.p.m. for maximum power. For racing cars largely requiring high speeds, larger Venturies is required; but, for general motor vehicles, it is recommended to employ Venturies of smaller diameter, instead of larger ones, and increase torque at total-open low-speeds, for easy car running. Therefore, it is necessary to choose two sizes of Venturies, one for normal operation and the other for high output, and to decide, for each of them, the most optimum Main jet, Main air jet, etc. Make rough adjustment by Main jet, and fine adjustments by Main air jet. It is necessary to decide the size of Air funnel, at the same time.

Accelerator Pump

Accelerator pump works for 30% of the Throttle valve opening, by Accelerator pedal pushing, beginning from the position where the pedal is first pushed down. It is important that Pump lever is contacting the Membrane when Throttle valve is opened full. Failing Pump lever to close full and leaving opening there will result in no acceleration at Pedal pushing.

Inspecting and Adjusting Fuel Level

Inspecting

Inspect the fuel level with the carburetor in engine.

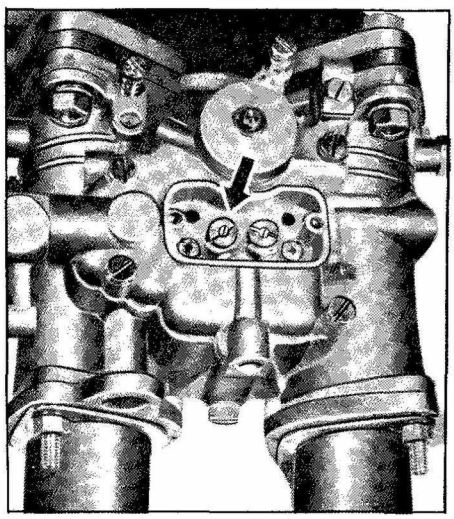


Fig. EF-27

1) Remove Jet Chamber Cover.
2) Remove Jet Block.
3) Insert the fuel level meter into the hole after Jet Block removed.
4) Close the hole on the fuel level meter with a finger and draw up the meter slowly.
5) Read the fuel level on the fuel level meter.

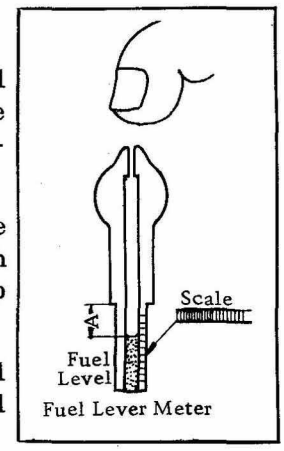


Fig. EF-28

6) If the dimension "A" of the fuel level meter is 18 ± 1 mm (0.7087 ± 0.0394 in.), the fuel level is normal, that is, the fuel level is 20 mm (0.7874 in.) above the center of Main Bore when the fuel pressure is 0.25 kg/cm^2 (3.55 lb/in^2).

Adjusting

If you find the fuel level is wrong, adjust as follows.

1) Adjust by replacing the packing of Needle Valve.
2) The fuel level varies 2 mm (0.0787 in.) with the packing of 0.5 mm (0.0197 in.) thickness.
   That is, if a packing of 0.5 mm is added, the fuel level will be lowered by 2 mm, and if removed, the level will be raised by 2 mm.
3) Standard packing is 1.0 mm (0.0394 in.) thickness and for adjusting, 0.5 mm (0.0197 in.) and 1.5 mm (0.0591 in.) packings are available.

DISASSEMBLING AND ASSEMBLING

Remove Carburetor From Engine

(1) Remove Air cleaner or Air funnel.

(2) Disconnect fuel lines. (Do this carefully, when Exhaust manifold is scorched.)

(3) Remove Throttle wire or Throttle links.

(4) Loosen Starter wire fastening bolts.

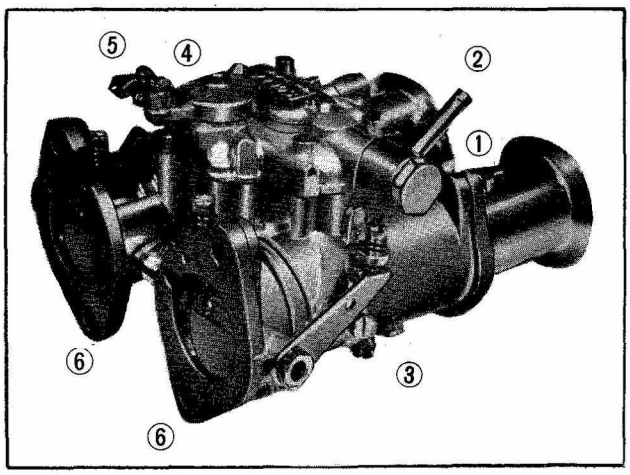


Fig. EF-29

(5) Remove Starter cable.

(6) Remove Carburetor from Intake manifold.

There shall be no scratches on the tight face of Fuel joint and packings.

Clean Filter (wire gauge) by compressed air, and tighten Joint bolts securely so as to keep it free from dust depositing.
(Use 19 mm wrench.)

*Caution

Put Cover on the Intake manifold or Suction ports removed of Carburetor with a piece of cloth to prevent foreign substances from entering them.

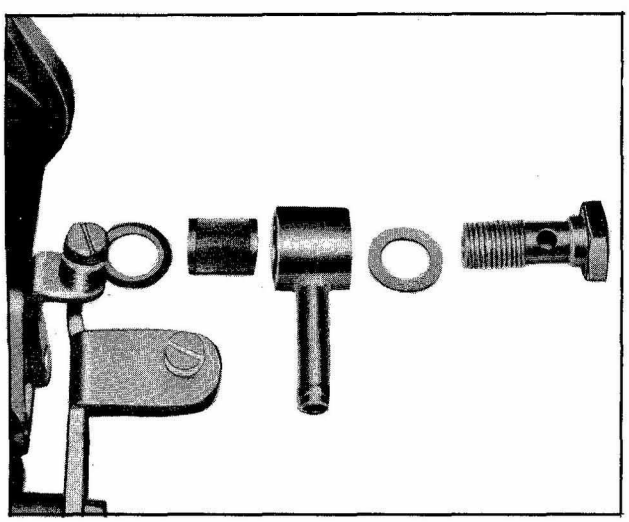


Fig. EF-30

Float Chamber-Remove and Replace

(1) Loosen four screws, and Float chamber cover can be removed.

(2) Remove Float chamber cover carefully not to damage Float chamber packing.

(3) Float can be removed as one unit.

There is no fear of Float to puncture as it is made of foamed material.

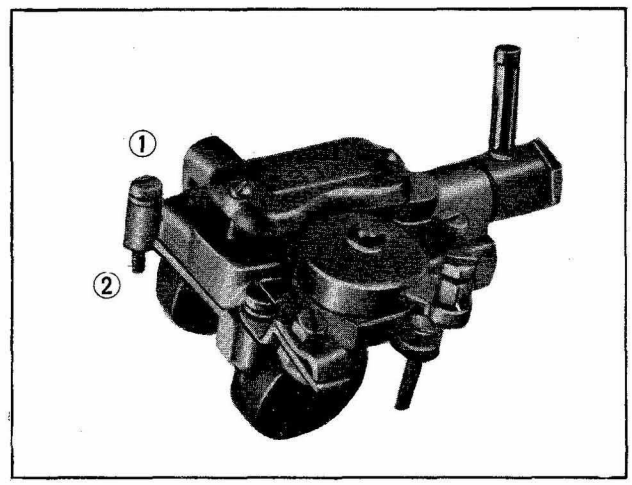


Fig. EF-31

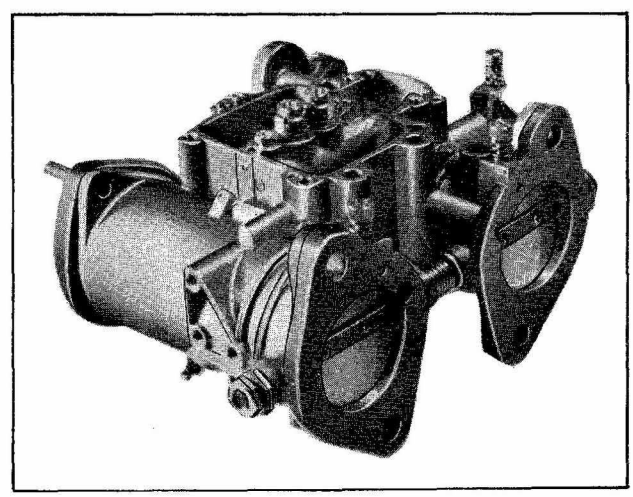


Fig. EF-32

*Caution

It is strictly prohibited to bend (3) Float arm. Especially be careful not to bend it to give change to the fuel level, which is liable to change the carburetor performance.

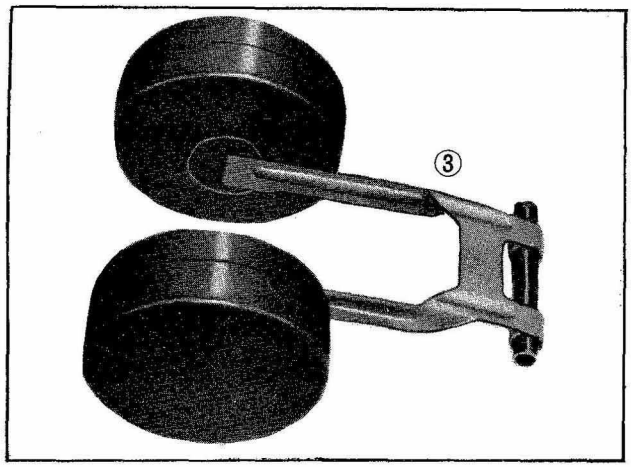


Fig. EF-33

Needle Valve-Remove and Replace

(1) Remove Needle valve(14 mm socket wrench). Engraving (Example: 1.8) shows the diameter of Needle valve in millimeter.

(2) The standard thickness of the packing of Needle valve is 1 mm (0.0394 in.), at which the fuel level is to be standard 20 mm (0.7874 in.) above the center of Main bore when Carburetor being in horizontal condition.
The allowable error is ±1 mm (0.0394 in.).
The fuel level can be changed by adjusting the thickness of the packing as follows:

Make packing thinner ----- fuel level rise.

Make packing thicker --- fuel level lower.

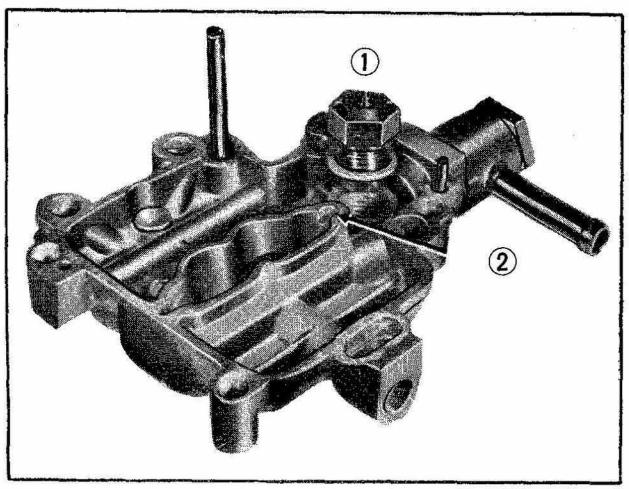


Fig. EF-34

After removing Needle valve, remove Fuel joint and clean it by compressed air.

Check for scratches on the tight surface and fix it, paying attention not to let dust enter.

Jets-Remove and Install

After removing Jet chamber cover.

(1) Remove Main Air jet (MAJ).

(2) Pull Jet block out.

(3) Remove Main jet (MJ) in a manner as illustrated in Fig. EF-36, with screw driver, supporting the head with 10 mm open end wrench.

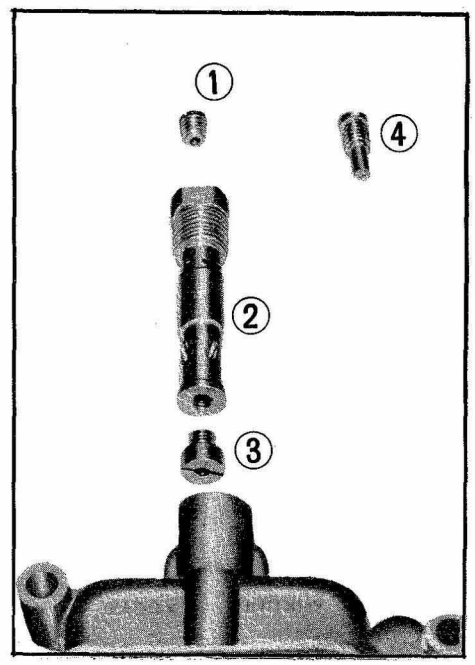


Fig. EF-35

*Caution:

Clean Jets by gasoline and remove foreign substances off by compressed air.

Do not work into the jet holes with wire, etc.

(4) Remove Pilot jet.

(For the working of each jets, refer to Page 74.)

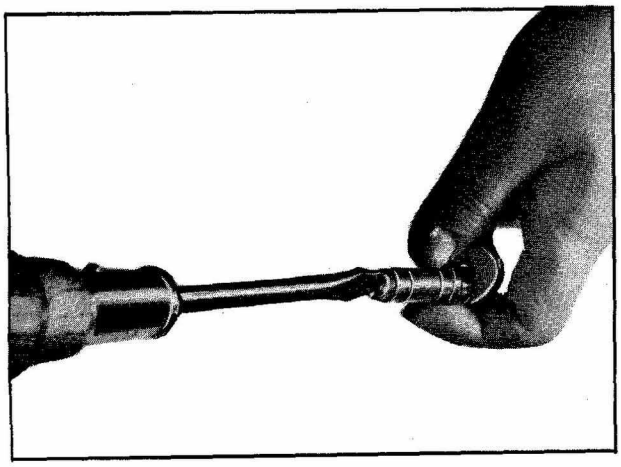


Fig. EF-36

Accelerator Pump-Disassemble and Assemble

(1) Pull Cotter pin out, and remove Washer and Spring.

(2) Remove 6 small screws, and parts (3)-(7) can be removed separately.

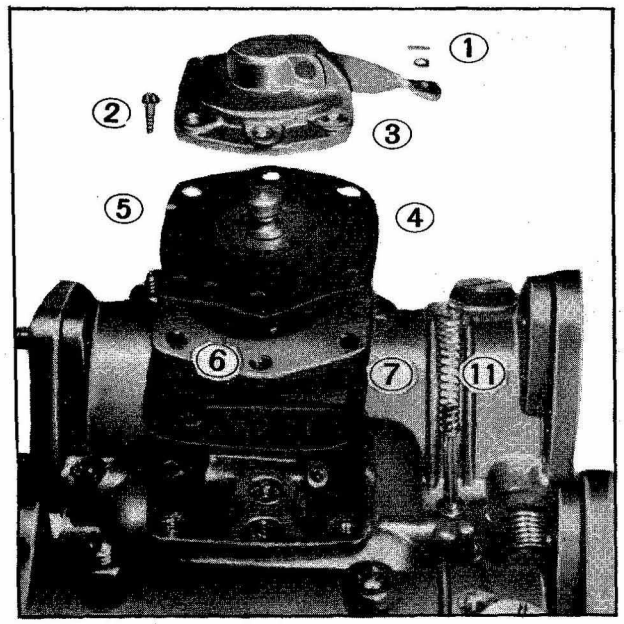


Fig. EF-37

(3) Lever of Pump cover shall be workable smoothly.

(4) Membrane shall be free from scratches or pin holes.

(5) Assemble Membrane return spring and Membrane in the correct directions.

(6) Pump body has Check ball inside; confirm working condition of the Pump body by swinging it and listening to the sound of Check ball.

(7) When assembling, confirm that Tight surface, packing, etc. of each part are free from scratches and securely tighten with 6 small screws.
Excess fuel discharged from the Pump goes through Check valve to effect one-way flow of the Fuel.
Remove Float chamber cover

and,

(8) Remove Plug screw, and

(9) Pump weight will come into view, and under it,

(10) Check ball is provided.

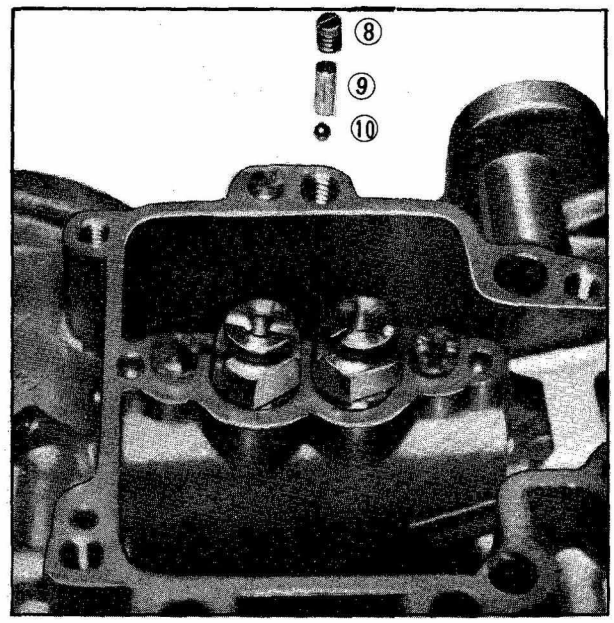


Fig. EF-38

Confirm the surfaces of Ball and Seat part are free from scratches.

Insert Cotter pin into the endmost hole of Pump rod (11) and the discharge of Accelerating pump will decrease (Cotter pin hole at three points.

Starter Pump-Disassemble and Assemble

Remove:

(1) Snap ring,

(2) Starter cover,

(3) Starter disk,

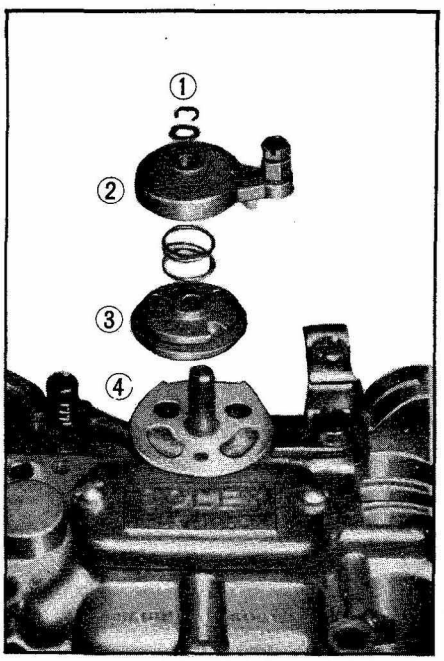


Fig. EF-39

(4) Rubbing surfaces of Starter disk and Carb. body shall be free from scratches.

Scratches or dust will cause leak and unsmooth operation at idling time.

(5) Starter jet (S.J.) is common to Air jet.

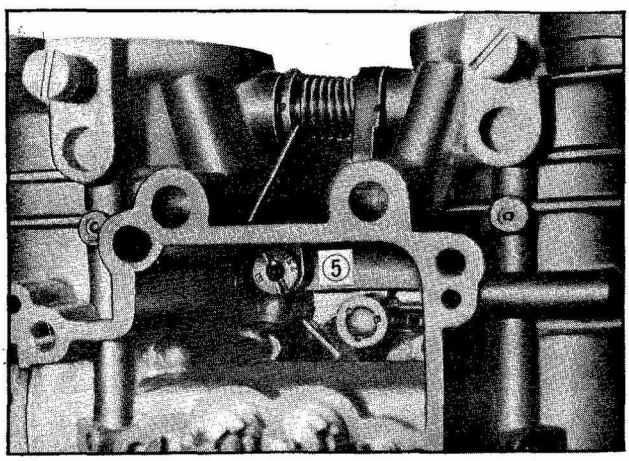


Fig. EF-40

Adjust improper starting and first idling by this Jet.

* This Jet has nothing to do with the output, but is effective only at Stater working time.

Throttle Valve Shaft-Disassemble and Assemble (No.1)

Though Throttle Valve shaft can be disassembled as follows, do not disassemble it without any proper reason.

(1) Remove Nut as illustrated in Fig. EF-41 using 12 mm end wrench and 14 mm wrench paying attention not to cause torsion to the Throttle valve shaft.

The set screw of Throttle valve is caulked at its tip to prevent it from loosening and falling down. So, remove the caulked part using file, etc. as illustrated in the figure and remove the Screw.

When assembling, tighten using a new screw and caulk its tip. Loosened screw will surely cause trouble.

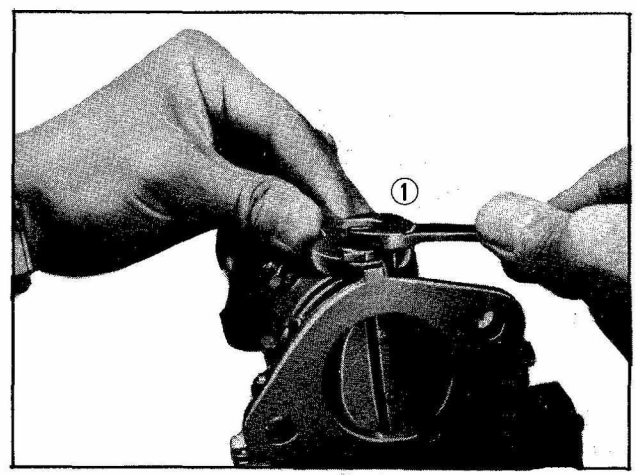


Fig. EF-41

* In repairing, be sure not to give scratches to the inside surface of Throttle valve (the cause of unstable slow-running).

Further, when fixing Throttle valve, assemble it seeing to it that Valves of both Bores will totally close at the same time (the cause of unstable slow-running).

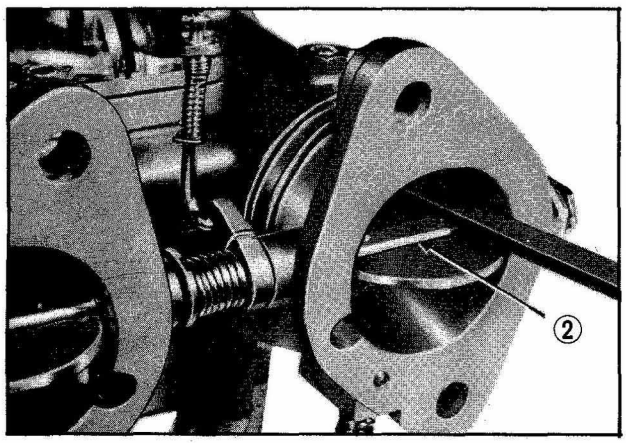


Fig. EF-42

Throttle Valve Shaft-Disassemble and Assemble (No.2)

After removing Throttle valve and Nut:

(1) Remove Snap spring.

(2) Pull Snap pin out.
Then,

(3) Shaft can be pulled out.

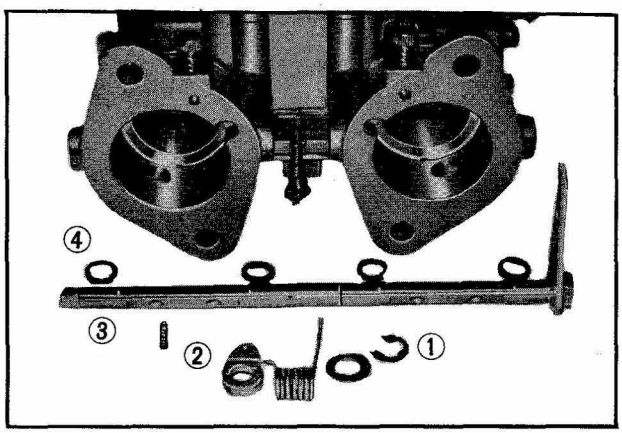


Fig. EF-43

* Caution

1) It is strictly prohibited to bend Shaft.
Especially be careful in pulling out or inserting Shaft as Shaft is liable to bend.
Even a small bend will cause unsmooth working and trouble.

2) Be careful not to lose Dust seal (4) at fixing, as it is easily lost. Lack of Dust seal may accelerate wear and may also cause defective Slow-running.

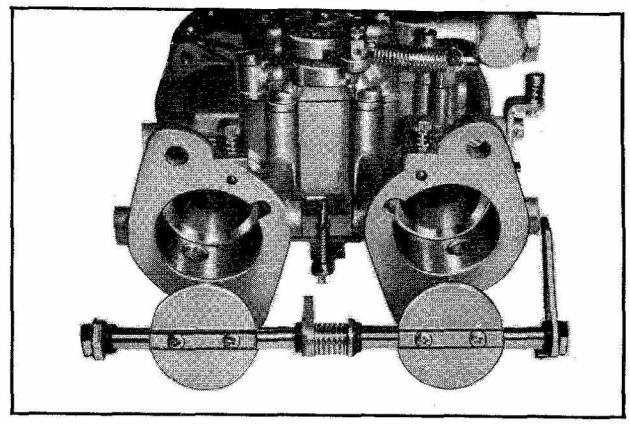


Fig. EF-44

Cleaning and Adjustment of Slow-Running

(1) Pull Pilot jet out in advance.

(2) Remove Pilot screw.
The tip of Pilot screw (P.S.) is in a taper condition and fits to the Pilot outlet hole (P.O.) on the Body side.

(3) There are provided 2 ~ 3 by-pass holes on the passage from P.O. to P.J. which are liable to clog very often.

(4) Clean each holes completely by compressed air.

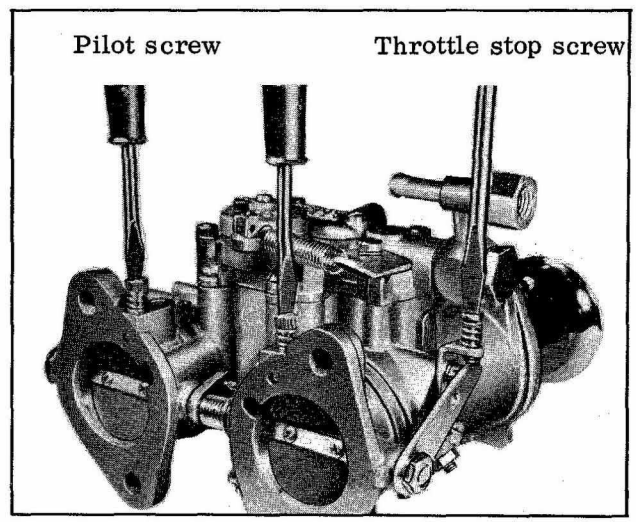


Fig. EF-45

(5) Check the tip of Pilot screw for carbon deposit and remove it.

Exchanging of Outer and Inner Venturi

(1) Loosen 10 mm nut and Remove Air funnel.

(2) Loosen the three nuts.

(3) Remove Inner Venturi.

(4) Remove Outer Venturi.

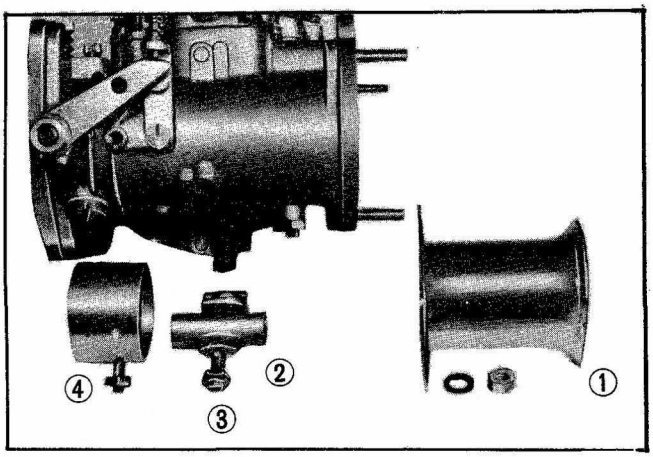


Fig. EF-46

(2) Main Jet
Jet to regulate fuel supply; the larger No., the larger Jet diameter; But the jet No. is decided by the flow instead of by drilled hole diameter. So, the larger this No., the thinner mixture.

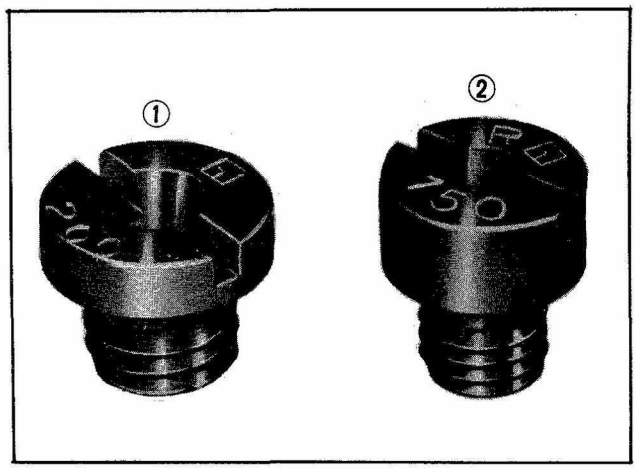


Fig. EF-47

Caution in replacing and assembling:

1. Insert seeing to it that the side of the outer Venturi having inner diameter engraving comes to the cleaner side, and fix Screw seeing to it that the tip of Lock screw fits to the recess of Venturi.
2. Fix Inner Venturi seeing to it that the side having Pump nozzle hole (example: very small hole 0.4 mm DIA (0.0157 in. DIA)) comes to the Suction side and be sure to put packing in and tighten screw tightly.
3. Tighten each nuts fully as they are liable to loosen by Engine vibration.

Each Jets

(1) Main air jet
Jet to regulate air supply only. The larger No., the larger jet diameter.
Example: #185 means 1.85 mm DIA (0.0628 in. DIA); the larger this number, the thinner mixture.

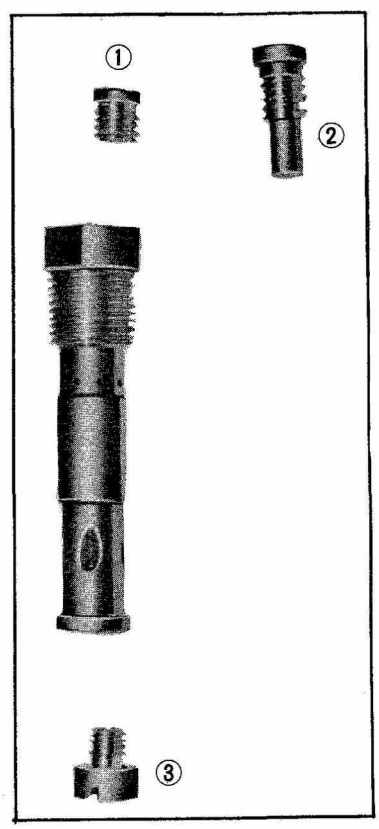


Fig. EF-48

(3) Pilot jet is to regulate the mixture of the Throw system, and the larger its No., the larger jet diameter and thinner mixture.

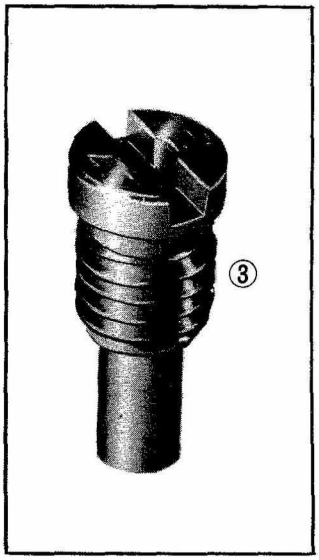


Fig. EF-49

INSTRUCTION FOR BALANCING RIGHT-LEFT (FRONT-REAR) CARBURETORS

(1) Set Pilot screw to the specified number of returnings (1 $\frac{1}{4}$ rounds). (Tighten P.S. to make idling mixture thinner and loosen it to make mixture thicker.)

(2) After Throttle stop screw has struck the Throttle Lever, tighten for another round.

After warming up the Engine:
Balance each cylinder,

(3) Using Flow meter,

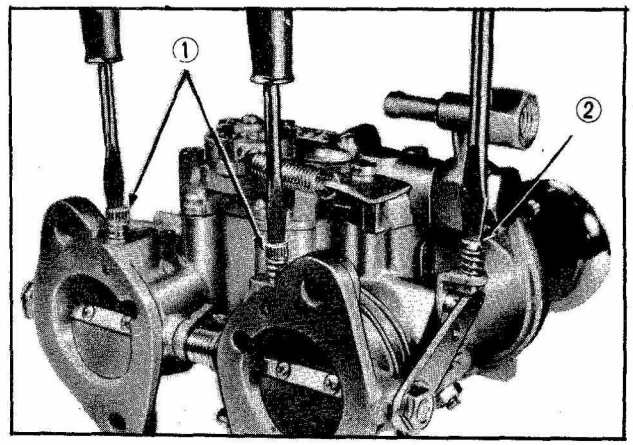


Fig. EF-50

(4) By Joint screw or (2) Stop screw so as to make negative pressure of each cylinders uniform.

After that, adjust, by Pilot screw, so that the Engine attains the highest r.p.m., and, then, make it again to the required idling r.p.m. by Stop screw.

Caution:

(2) Throttle stop screw is for opening Throttle valve.
Tighten it to open Valve and increase r.p.m.

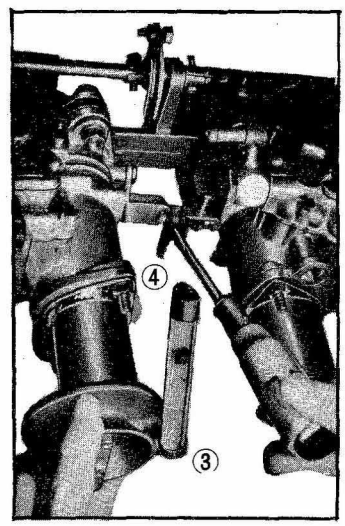
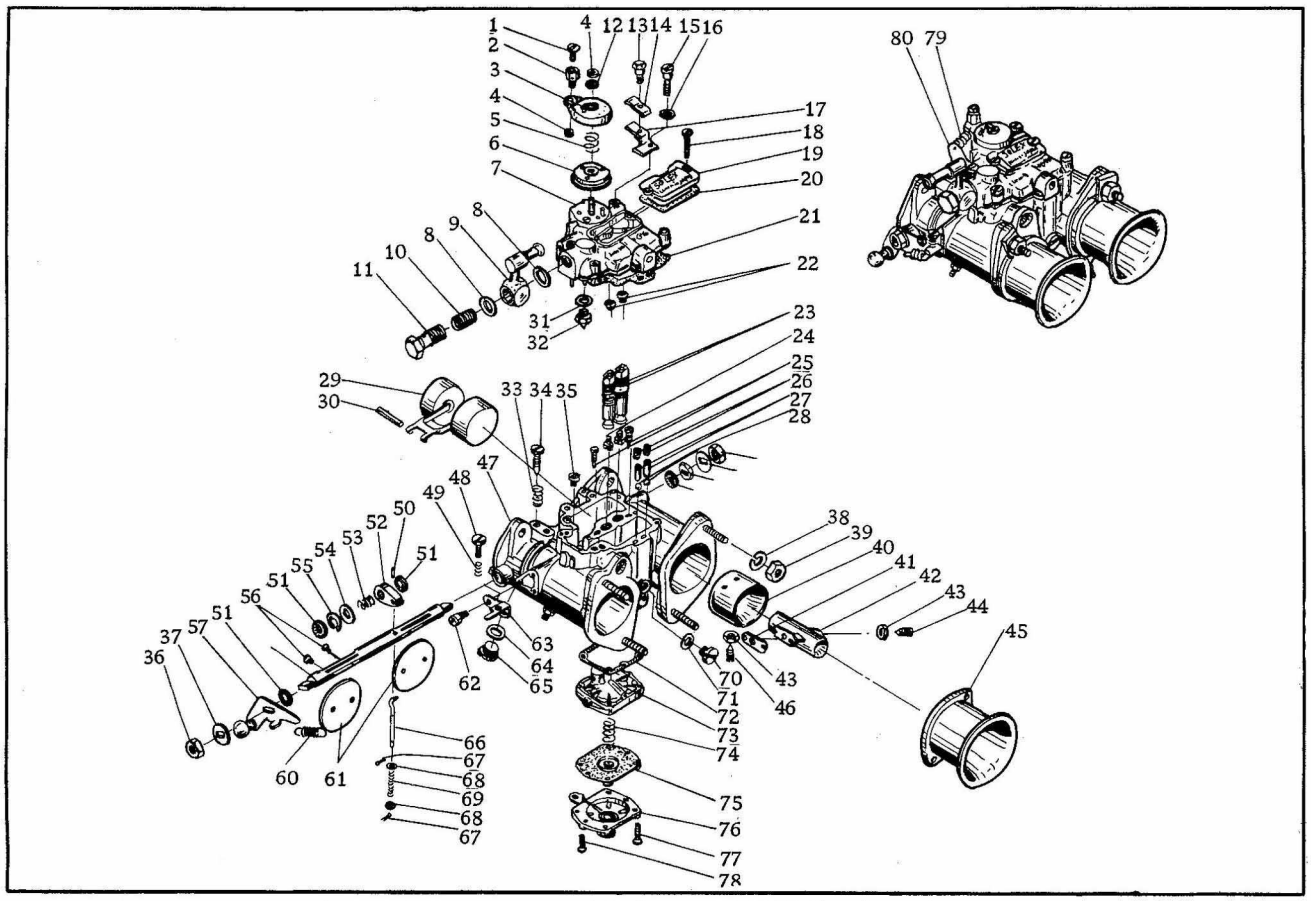


Fig. EF-51



Exploded View of Solex 44 PHH Carburetor

1.	Cable fixing bolt	28.	Ball	55.	Snap ring
2.	Cable fixing collar	29.	Float	56.	Fixing screw; throttle
3.	Starter cover	30.	Spindle; float	57.	Throttle lever comp.
4.	Snap ring	31.	Washer, 12ϕ	58.	Throttle spindle
5.	Starter spring	32.	Needle valve comp.	59.	Nut fixing collar
6.	Starter disk	33.	Volume control screw screw spring	60.	Throttle spring
7.	Float chamber cover	34.	Volume control screw	61.	Throttle butterfly
8.	Washer, 12ϕ	35.	Starter jet	62.	Spring washer screw
9.	Fuel pipe comp.	36.	Nut	63.	Bracket; slow running screw
10.	Filter comp	37.	Washer	64.	Washer
11.	Banjo bolt	38.	Spring washer	65.	Plug screw
12.	Washer, 6ϕ	39.	Nut	66.	Pump control rod
13.	Spring washer bolt	40.	Outer venturi	67.	Split pin
14.	Clip; cable bracket	41.	Gasket-inner venturi	68.	Washer; pump control
15.	Spring washer screw	42.	Inner venturi	69.	Spring; pump control
16.	Washer, 5.3ϕ	43.	Nut	70.	Plug screw
17.	Starter bracket	44.	Fixing screw	71.	Washer
18.	Fixing screw: jet chamber cover	45.	Air funnel	72.	Gasket; pump cover
19.	Jet chamber cover	46.	Fixing screw	73.	Pump cover
20.	Gasket; jet chamber cover	47.	Main body assembly	74.	Pump spring
21.	Gasket; float chamber cove.	48.	Slow running adjustment screw	75.	Diaphragm assembly
22.	Main air jet	49.	Volume control screw spring	76.	Pump cover assembly
23.	Jet block	50.	Stopper pin	77.	Fixing screw
24.	Main jet	51.	Dust proof ring	78.	Fixing screw
25.	Pilot jet	52.	Pump intermediate lever	79.	Starter spring
26.	Plug	53.	Throttle spring	80.	Starter spring bracket
27.	Pump weight	54.	Thrust washer		

COOLING SYSTEM

GENERAL DESCRIPTION

RADIATOR

Type	Corrugated fin and tube type
Pressurised	0.9 kg/cm^2 (0. (12.8 lb/in^2)
Total capacity of cooling water	... 8.5 ltr. (2.245 U.S.gal.)

THERMOSTAT

Type	Wax pellet type
Start to open temperature	82° C (179.6° F)
Fully open temperature	95° C (203.0° F)
Valve lift	at least 8 mm (0.315 in.)

An efficient cooling system is of major importance to ensure the satisfactory running of the engine and it is therefore necessary to pay paticular attention to its maintenance.
Attention is especially drawn to the procedure for winter months, if damage is to be avoided.

The cooling system is maintained by water pump circulation, combined with an efficient fan cooled radiator and thermostat.

The system is pressurised and the relief valve, incorporated in the radiator filler cap, controls the pressure at approximately 0.9 kg per sq. cm. Do not remove the filler cap if the temperature of the coolant is above boiling point or if the engine is running. Topping-up should only be required occasionally to replace water lost through the overflow pipe. Top-up when the engine is cold, and if possible use clean soft water.

The capacity of the system is approximately 8.5 litres (2.245 U.S.gal.).

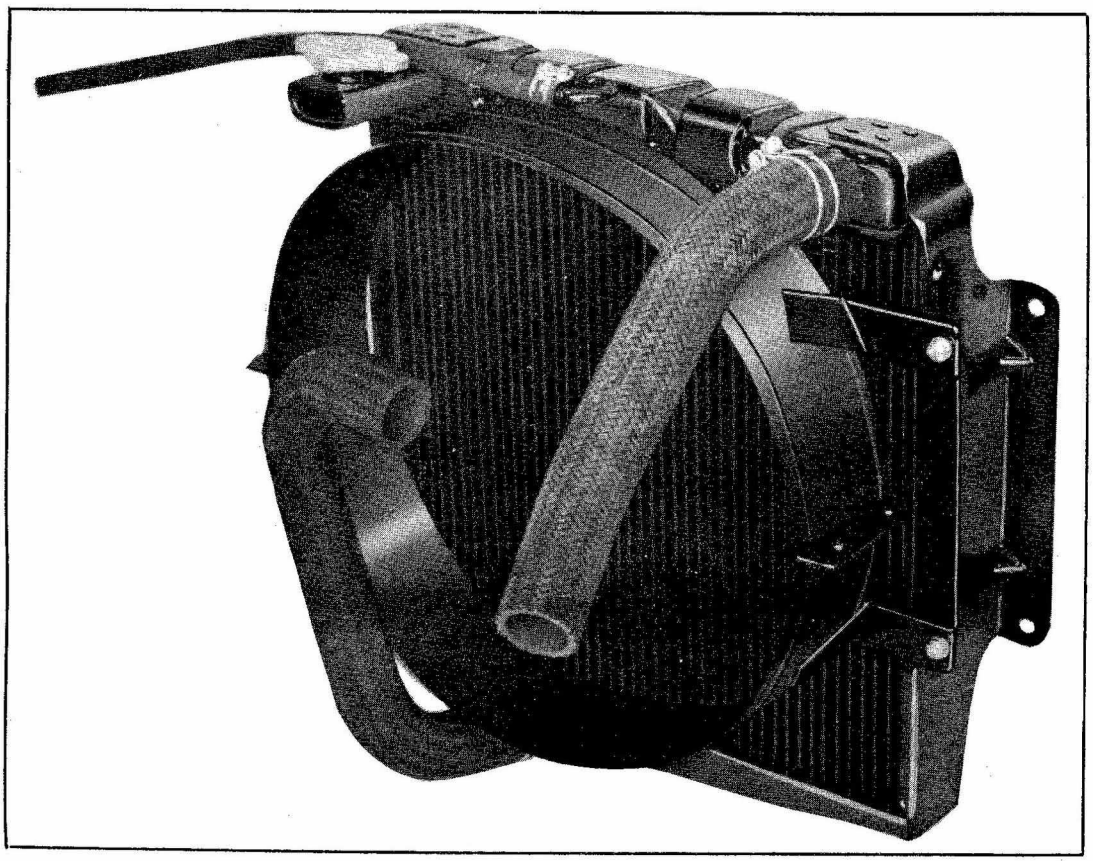


Fig. CO-1 Radiator

Thermostat

In order to ensure maximum efficiency, it is essential to keep the engine operating temperatures within certain limits. To assist this a wax pellet type thermostat is fitted, being located in the water outlet at the front of the cylinder head. The device consists of metallic pellet and rubber sleeve filled with the wax, which controls a valve. When the engine is cold this valve is closed and on starting the engine the flow of water to the radiator is temporarily restricted.

Due to this, the temperature of the water in the cylinder head and cylinder jackets will quickly rise, thus ensuring rapid warming up. The heat so generated will gradually press up the piston by shrinkage of so opening the valve, and ultimatelly permitting a full flow of water to the radiator.

The thermostat itself is detachable; therefore, should the occasion arise, it can be removed from its housing and the hose reconnected to avoid laying up the car. Should the thermostat be tight, there are two tapped holes on the top which may be utilized to ease if from casting. When the system has been completely emptied, it is essential to allow air to escape through the thermostat valve and then finally top-up. The thermostat opening is set by the manufacturer and cannot be altered. It starts to open at a temperature of 82° C. The thermostat can be easily tested by immersing it in water raised to the requisite temperature. The valve should open under these conditions, but if it fails to open a new unit should be fitted.

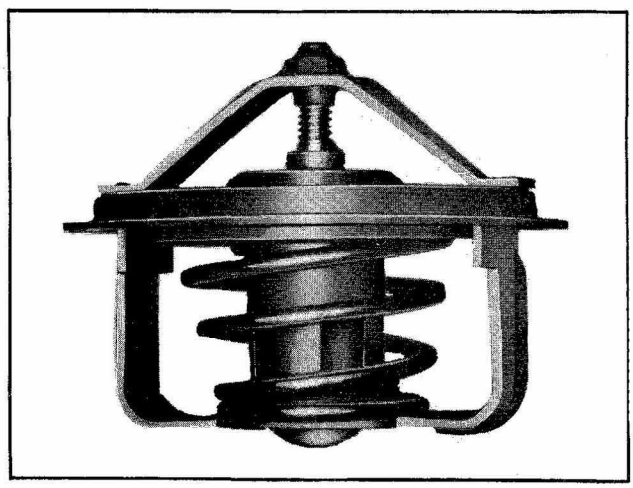


Fig. CO-2

Overheating

Overheating may be caused by a slack fan belt, excessive carbon deposit in the cylinders, running with the ignition too far retarded, incorrect carburetor adjustment, failure of the water to circulate or loss of water.

Fan Belt Adjustment

The fan is driven from the carnkshaft by a "V" belt, this also driving the alternator.

A new belt can be fitted by first loosening the clamp bolts (Fig. CO-3), which hold the alternator in position, and moving the alternator towards the engine. Slide the belt over the fan and onto the fan pulley.

Adjustment is then made by bringing the alternator away from the engine. The belt should be sufficiently tight to prevent slip, yet the belt should have 15 to 20 mm (0.6 ~ 0.8 in.) slack between the alternator and crankshaft pulley when the midspan is pushed firmly.

As the belt fits in the "V" shape groove of the pulleys it is not necessary to have the fan belt excessively tight; to do so may cause excessive wear to the alternator and water pump bearings. After the correct tension has been obtained, securely lock the alternator in position again.

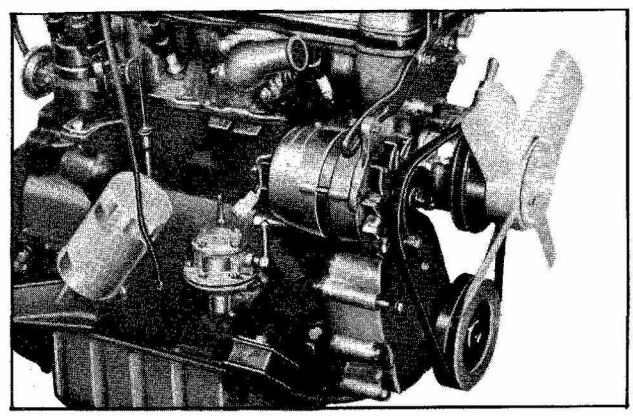


Fig. CO-3 Fan Belt Adjustment

Frost Precautions

Freezing may occur first at the bottom of the radiator or in the lower hose connections.

Ice in the hose will stop water circulation and may cause boiling. A muff can be used to advantage, but care must be taken not to run with the muff fully closed, or boiling will result.

When frost is expected or when the car is to be used in a very low temperature, the anti-freeze liquid should be used to prevent the breakage of the cooling system parts due to freezing.
Anti-freeze liquid must be made up in accordance with instructions applied with the container.

When the warmer season comes and the usage of anti-freeze liquid is no longer required, replace it with ordinary water, otherwise the over heat trouble is sometimes caused.

Protection by Draining

On cars where anti-freeze is not used the following precautions must be taken during frosty water to prevent any damage due to freezing of the cooling system.

When heavy frost is imminent, the cooling system must be completely drained. It is not sufficient merely to cover the radiator and engine with rugs and muffs. There are two drain cocks one on the left hand side of the cylinder block and the other at the base of the radiator block. Both taps must be opened to drain the system and the car must be on level ground while draining.

The drain taps should be tested at frequent intervals by inserting a piece of wire to ensure that they are clear. This should be done immediately the taps are opened, so that any, obstruction freed by the wire may be flushed out by the water. The draining should be carried out when the engine is hot.

When completely drained the engine should be run for a few minutes to ensure that all water has been cleaned from the system.

A suitable notice should be then paid to the radiator, indicating that the water has been drained.

Flushing the Radiator

To ensure efficient circulation of the coolant and to reduce the formation of scale and sediment in the radiator, the system should be periodically flushed with clean running water, preferably before putting in anti-freeze in the winter and again when taking it out in the spring. The water should be allowed to run through until it comes out clear from the drain taps. At intervals a stiff piece of wire should be inserted into the taps during draining to ensure that they are not becoming clogged with sediment.

This method of radiator flushing may serve well, but in cases where the "furring" up is excessive the operator will find it more efficient practice to remove the radiator completely and flush in the reverse way to the flow, turn the radiator upside down and let the water flow in through the bottom hose connection and out of the top connection.

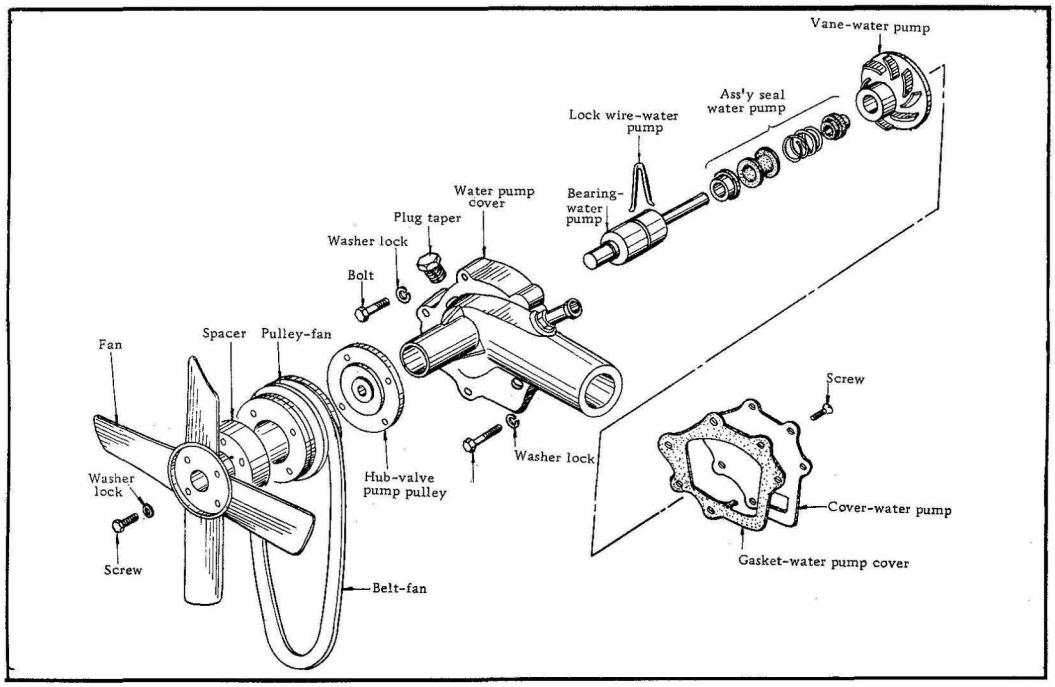
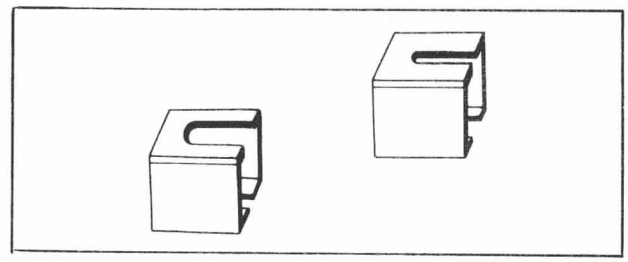


Fig. CO-4 Water Pump

After draining the water from the radiator, remove the pump unit from the cylinder block by taking off the fan belt and removing the set bolts with spring washers.

The shaft and ball bearing assembly can be drawn out from the body.

Thus take out the vane, floating seal and seal which remains in the pump body.



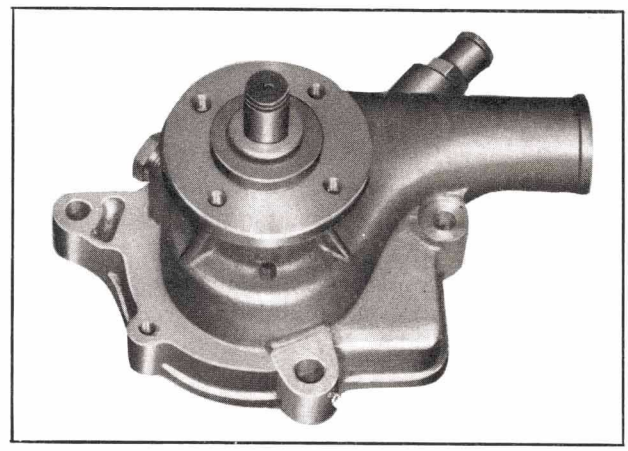


Fig. CO-5

Removing the Pump Shaft Assembly

Disconnect the fan blades, pulley and cover.

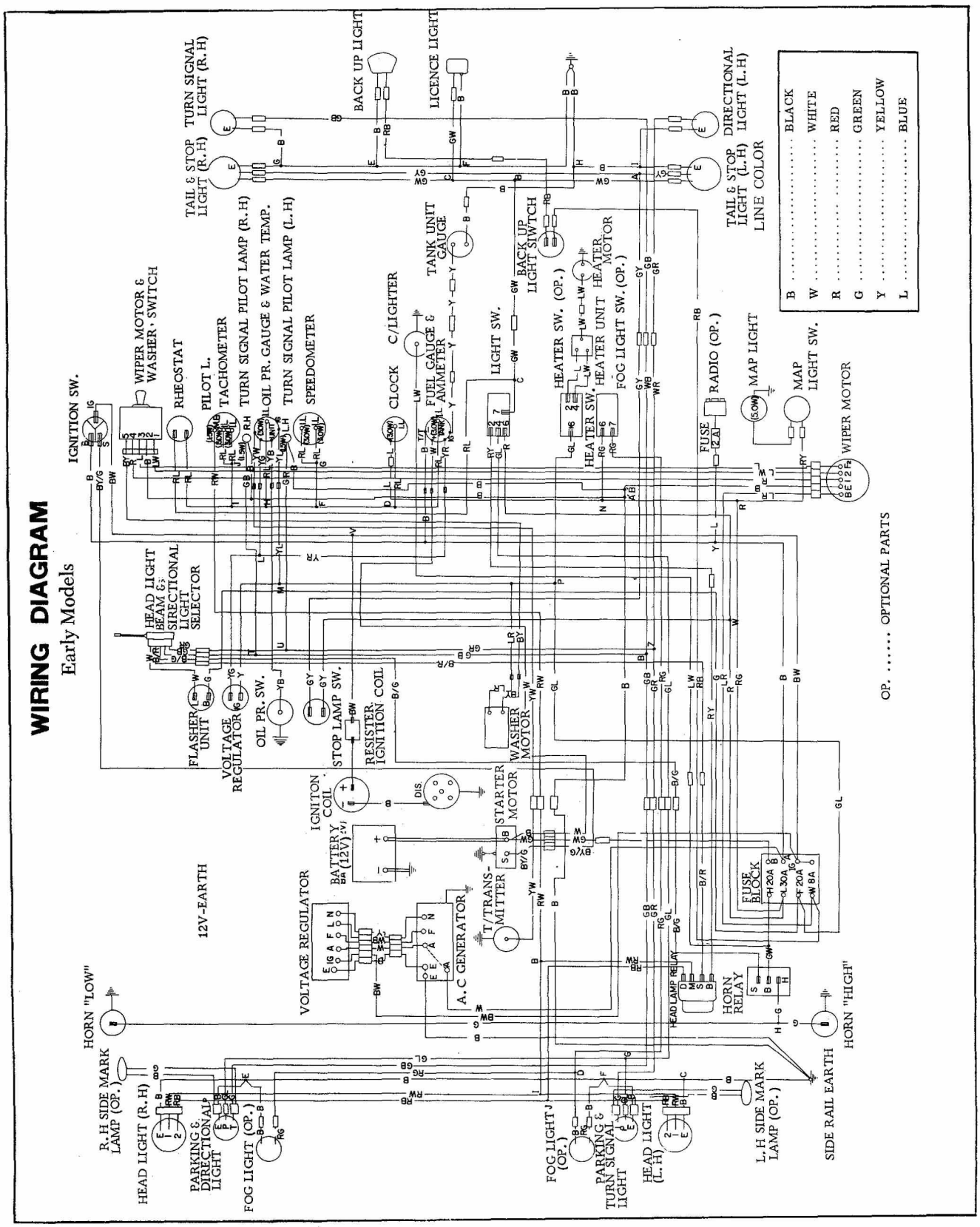
The shaft and ball bearings is combined with one unit.

Put the pulley hub on the bench.

First, press or knock the shaft end with a drift (hard bar) and draw out the pulley hub on the U type bench.

Take out the set pin from the slit which locked the shaft assembly to the pump body.

Next, turn the body upside down and press out the shaft assembly from the vane side on the U type bench.


WIRING DIAGRAM
Early Models
12V-EARTH
IGNITION SW.
WIPER MOTOR & WASHER SWITCH
RHEOSTAT
PILOT L.
TACHOMETER
TURN SIGNAL PILOT LAMP (R.H)
OIL PR. GAUGE & WATER TEMP.
TURN SIGNAL PILOT LAMP (L.H)
SPEEDOMETER
CLOCK
C/LIGHTER
FUEL GAUGE & AMMETER
TANK UNIT
LIGHT SW.
BACK UP LIGHT SWITCH
HEATER SW. (OP.)
HEATER UNIT
HEATER MOTOR
FOG LIGHT SW. (OP.)
FUSE
RADIO (OP.)
MAP LIGHT
MAP LIGHT SW.
WIPER MOTOR
BACK UP LIGHT
LICENCE LIGHT
TURN SIGNAL LIGHT (R.H)
TAIL & STOP LIGHT (R.H)
DIRECTIONAL LIGHT (L.H)
TAIL & STOP LIGHT (L.H)
LINE COLOR
B ..... BLACK
W ..... WHITE
R ..... RED
G ..... GREEN
Y ..... YELLOW
L ..... BLUE
OP. ..... OPTIONAL PARTS
HEAD LIGHT BEAM & DIRECTIONAL LIGHT SELECTOR
FLASHER UNIT
VOLTAGE REGULATOR
OIL PR. SW.
STOP LAMP SW.
RESISTER, IGNITION COIL
WASHER MOTOR
IGNITON COIL
DIS.
STARTER MOTOR
BATTERY (12V)
VOLTAGE REGULATOR
A.C GENERATOR
T/TRANS-MITTER
FUSE BLOCK
HEAD LAMP RELAY
HORN RELAY
HORN "LOW"
HORN "HIGH"
SIDE RAIL EARTH
R.H SIDE MARK LAMP (OP.)
HEAD LIGHT (R.H)
PARKING & DIRECTIONAL LIGHT
FOG LIGHT (OP.)
FOG LIGHT (OP.)
PARKING & TURN SIGNAL LIGHT
HEAD LIGHT (L.H)
L.H SIDE MARK LAMP (OP.)

GENERATOR

SPECIFICATION

Alternator	Mitsubishi Denki
Model	$AS2030A_2$
Nominal output	14V - 30A
Pole	Negative ground
Revolution	1000 ~ 12000 r.p.m.
No load minimum revolution	Less than 1050 c.p.m. (14V, normal temp.)
Output current	23A (14V, 2500 r.p.m., normal temp.)
Pulley ratio	1 : 1.94
Regulator	Mitsubishi Denki
Model	$RL-2220B_5$
Type	Tirrill type (leaf spring)
Element	Constant voltage relay
Constant voltage relay	3 contact point type
No load regulating voltage	13.5 ~ 14.5V/4000 r.p.m.

Note: Use battery charged in full.

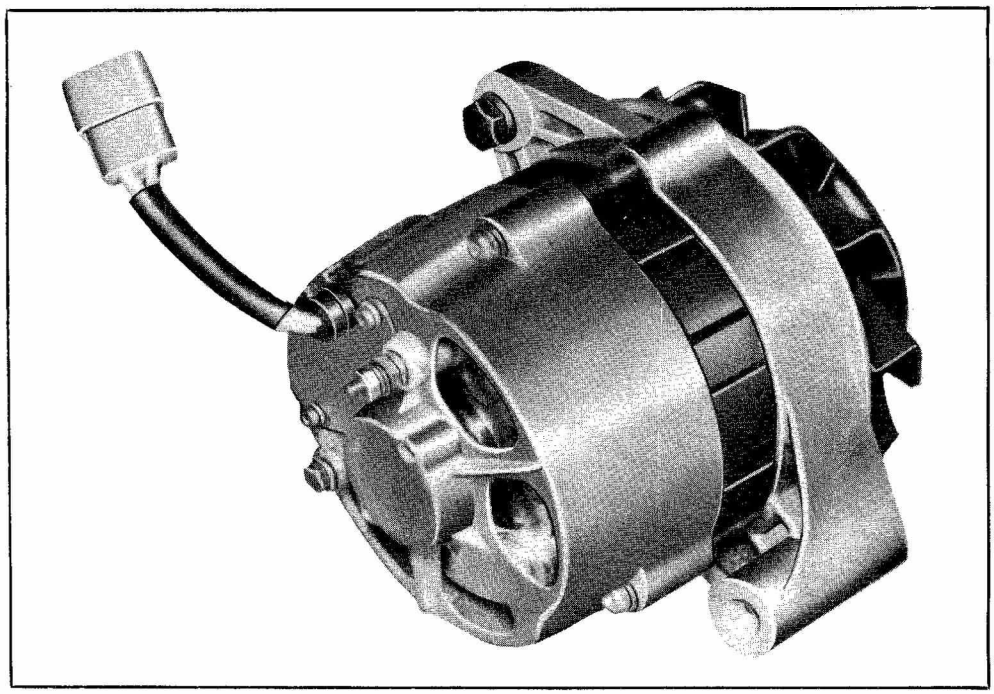


Fig. EE-1

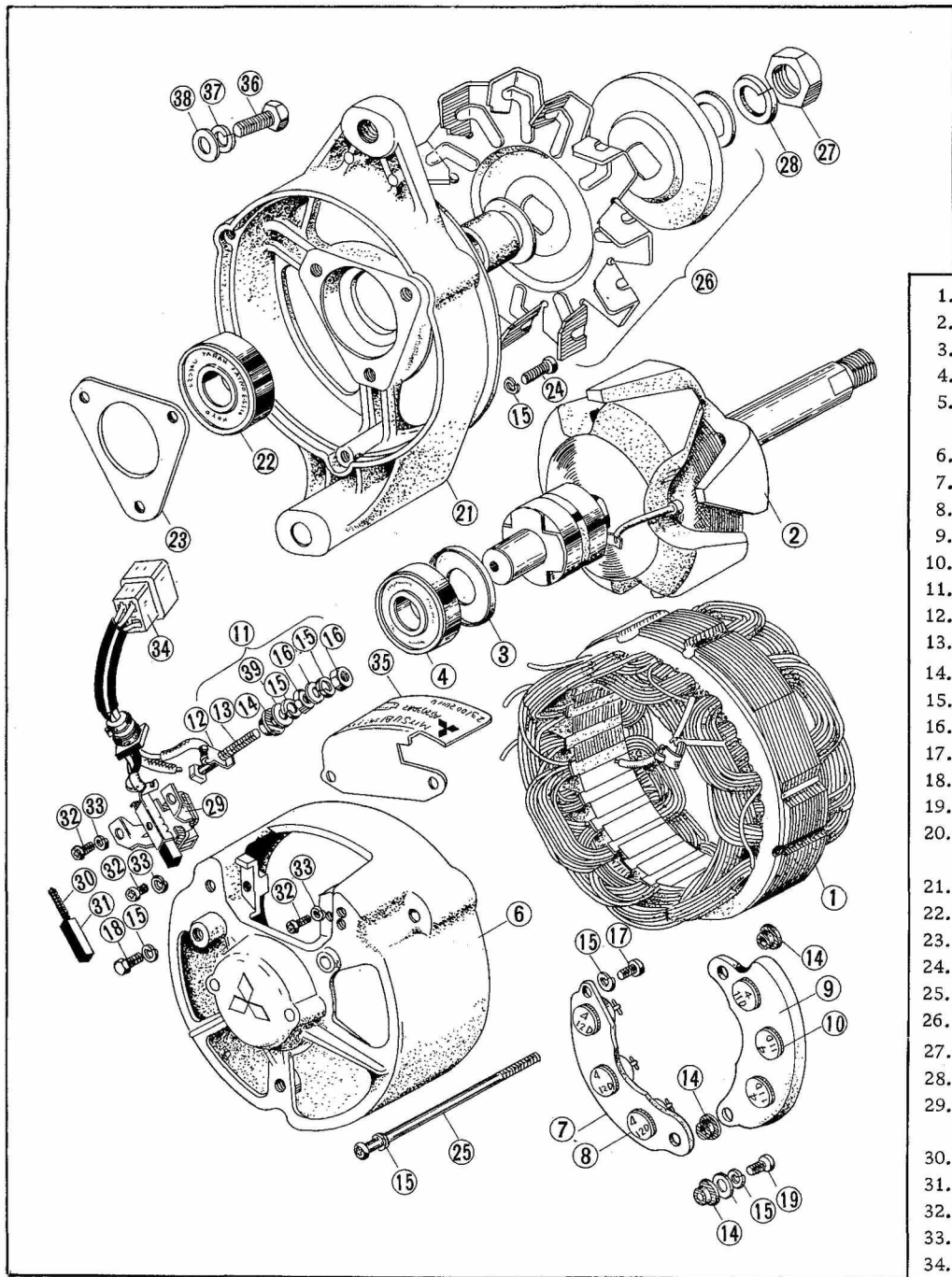


Fig. EE-2

1.	Ass'y-stator
2.	Ass'y-rotor
3.	Seal washer
4.	Ball bearing
5.	Ass'y-rear bracket (Inc. No. 6 ∿ 19 & No. 39)
6.	Rear bracket
7.	Ass'y-diode set
8.	Negative diode
9.	Ass'y-diode set
10.	Positive diode
11.	Ass'y-terminal
12.	Connector
13.	Square bolt
14.	Insulator
15.	Spring washer
16.	Nut
17.	Screw
18.	Terminal bolt
19.	Screw
20.	Ass'y-front bracket (Inc. No. 21 ∿ 24 & No. 15)
21.	Front bracket
22.	Ball bearing
23.	Bearing retainer
24.	Screw
25.	Through bolt
26.	Ass'y-pulley
27.	Nut
28.	Spring washer
29.	Ass'y-brush holder (Inc. No. 30, 31)
30.	Brush spring
31.	Brush
32.	Screw
33.	Spring washer
34.	Ass'y-connector
35.	Brush cover
36.	Bolt
37.	Spring washer
38.	Washer
39.	Washer

CONSTRUCTION AND FEATURE

Different from the DC generator, Alternator turns the magnetic pole and fixes the armature making it generates 3-phase alternate current, and rectifies all waves with the silicon diodes (+) (-) each three, and takes out as direct current.

1	Stater	11	A Terminal Ass'y	20	Terminal bolt	29	Nut
3	Roter	12	Hex bolt	21	Front bracket	30	Spring washer (7)
4	Seal washer	13	Round head	22	Front bracket	31	Grommet
5	Ball bearing	14	Insulator (5)	23	Seal washer	33	Clip
6	Rear bracket Ass'y	15	Insulator (5)	24	Ball bearing	34	Brush holder
7	Rear bracket Ass'y	16	Filter washer	25	Bearing retainer	35	Brush
8	Diode (-)	17	Washer	26	Round head	36	Brush cover
9	Diode Ass'y	18	Spring washer (5)	27	Through bolt	37	Spring washer
10	Diode (+)	19	Stopper nut	28	Pulley Ass'y	38	Round head

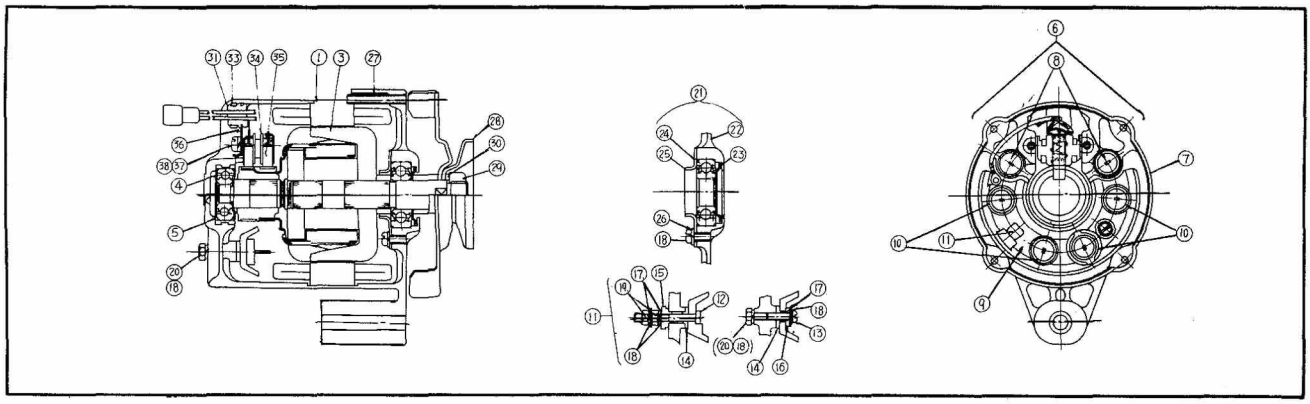


Fig. EE-3

The sealed ball bearings are used to support the rotor. Clearance between the brush and brush holder is also made so as to prevent it from dust. Thus Alternator will increase milage without maintenance. Each 3 diodes are pressed in the rear cover and the diode base respectively.

The clip ring pressed in the shaft is soldered at both ends of the field coil to pass magnetic current.

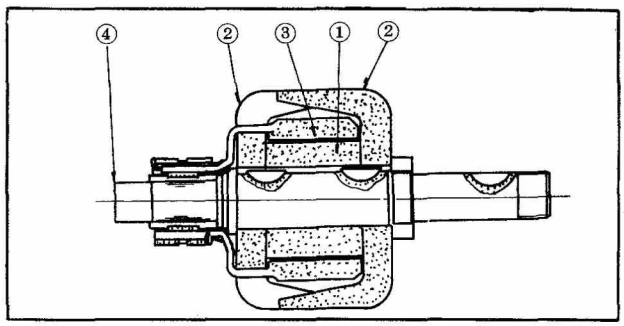


Fig. EE-4 Sectional View of Rotor

① Field core
② Field segment
③ Field coil
④ Shaft

The pole of rotor makes out the magnetic circuit as shown in Fig. EE-5 and all the poles are magnetized by doughnut coil.

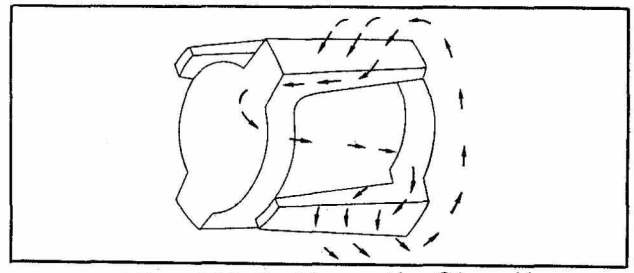


Fig. EE-5 Magnetic Circuit

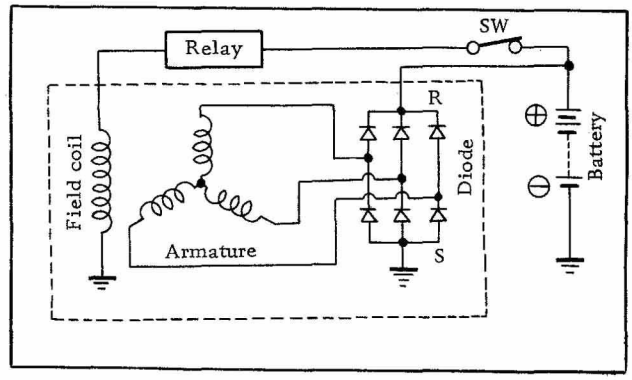


Fig. EE-6 Connection within Alternator

The armature is of a three phase Y connection type and the silicon diode rectifies all waves. It pulls out the neutral point and adds voltage having conducted 3 phase half wave rectification in the circuit of relay.

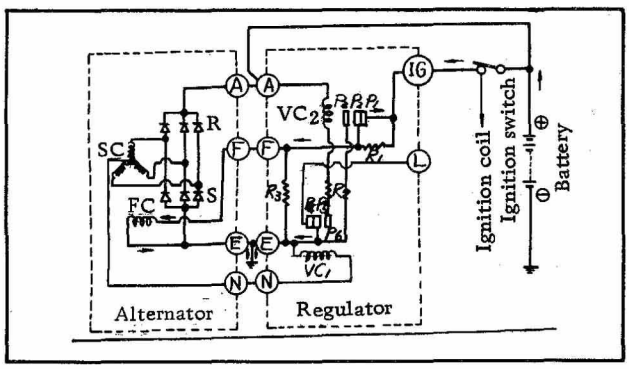


Fig. EE-7 Charging System

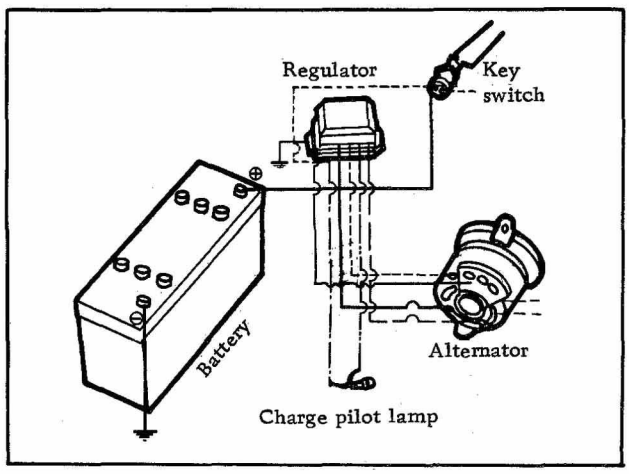


Fig. EE-8 Outside Connection

When the ignition switch is put on, the battery current flows in the arrow marked direction passing through Alternator E terminal, brush slip ring, field coil, slip ring, brush, Alternator F terminal, relay F terminal and IG terminal and completes the field circuit. It is difficult for Alternator to stand up only be residual magnetism of the field core, so that magnetization is necessary until voltage rises to suit charging after the engine has started.

This is because the diode is used and when the voltage is so low, large proportional resistance comes up and current does not flow through the field coil unless Alternator makes very high revolution.

DISASSEMBLY AND ASSEMBLY

Disassembly

Alternator is disassembled in the following order.

1) Remove Complete assembly from Engine.

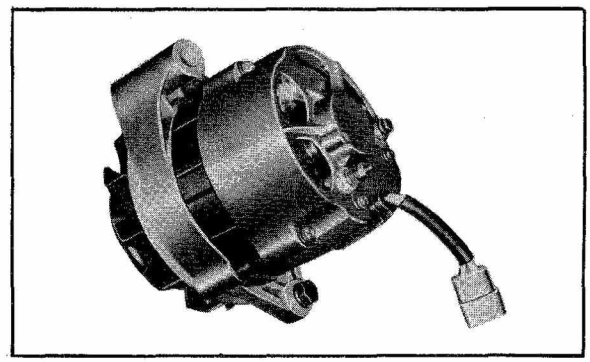


Fig. EE-9

2) Remove Brush cover by unscrewing each setscrew.

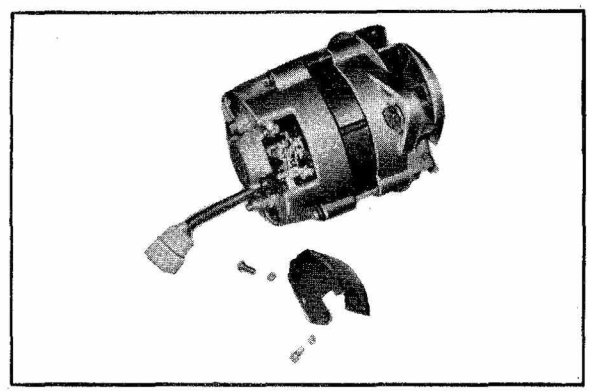


Fig. EE-10

3) Unscrew three through bolts and separate Rotor from Stator by hitting Front Bracket lightly with a mallet.

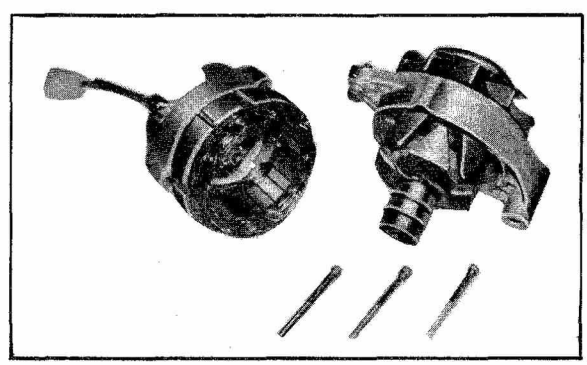


Fig. EE-11

4) Vise Rotor carefully not to injure the fan. Remove Pulley nut, Pulley rim, Fan and Spacer.

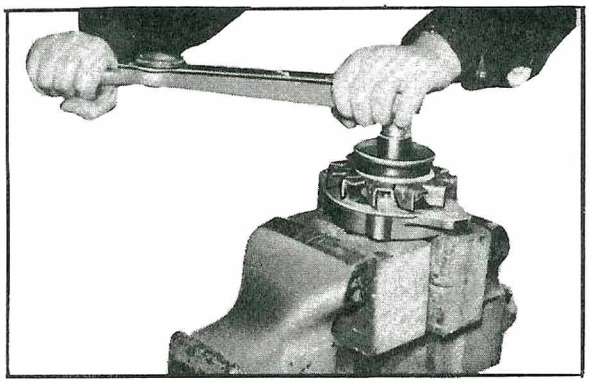


Fig. EE-12

5) Remove Rotor from Front Bracket.

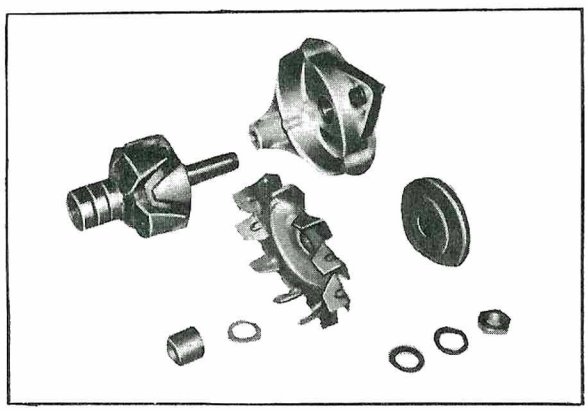


Fig. EE-13

6) Remove Bearing retainer by unscrewing three set screws and push out Bearing, using a arbor press.

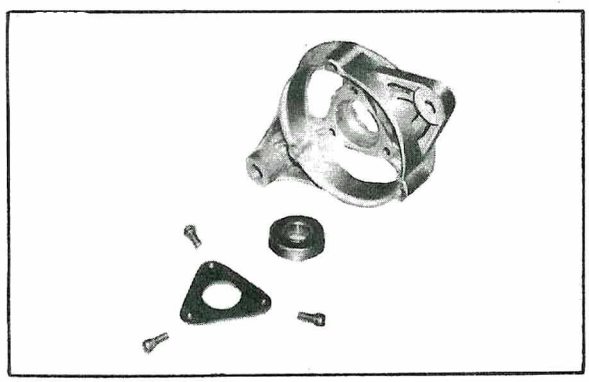


Fig. EE-14

7) Separate Rear Bracket from Stator. Disconnect Negative diode (3 each) from the stator coil lead wire (3 each) and each lead wire between diodes by melting solder with an soldering iron.

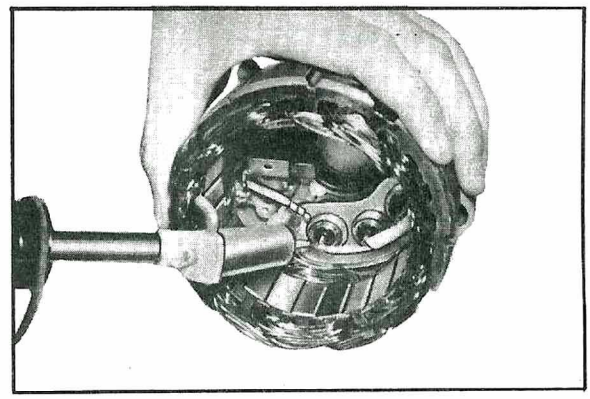


Fig. EE-15

8) Disconnect N terminal lead wire by melting solder, then Rear Bracket and Stator can be separated.

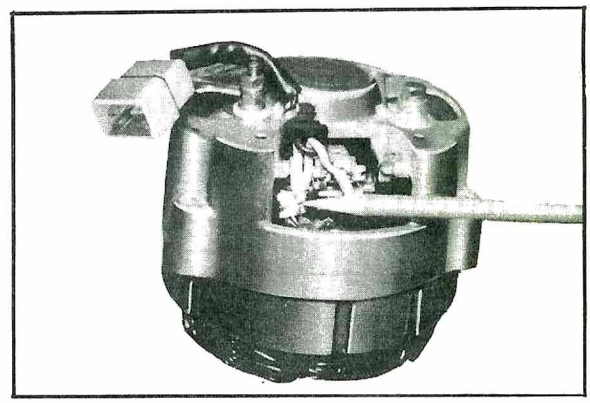


Fig. EE-16

NOTE: When temperature within diode goes up over 150°C the diode will lose its function, so use the electric iron, 100 ~ 200W, for around 2 seconds at the soldered portions.

9) Remove Diode set and Brush holder from Rear Bracket by disconnecting Lead wire between Positive diode set and Connector. Be careful not to lose small parts such as screws, washers and bushings.

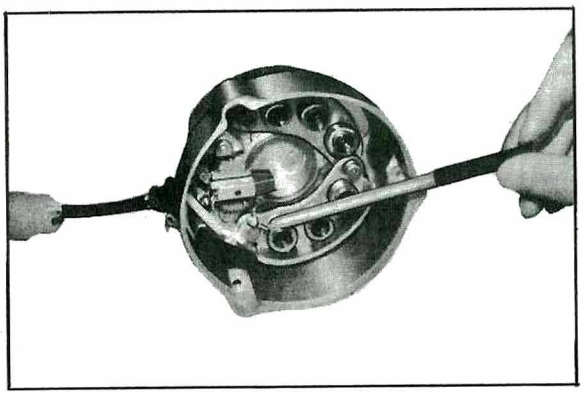


Fig. EE-17

10) Disassemble Brush Holder
Dissolder lead wire F (black/white color), lead wire E (black color) and Brush holder wires (negative & positive), using a soldering iron.

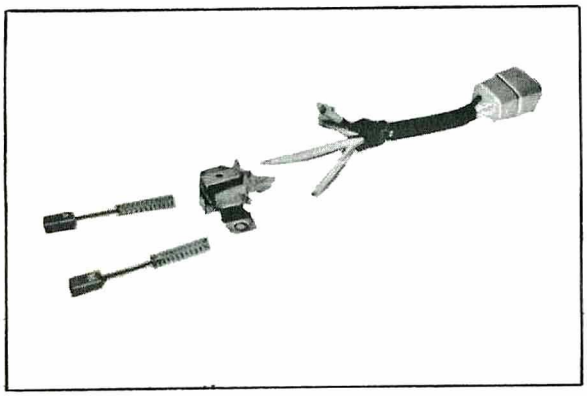


Fig. EE-18

11) All disassembled parts are shown in Fig. EE-19.

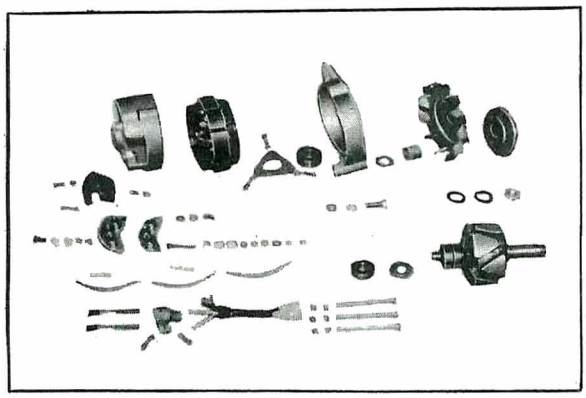
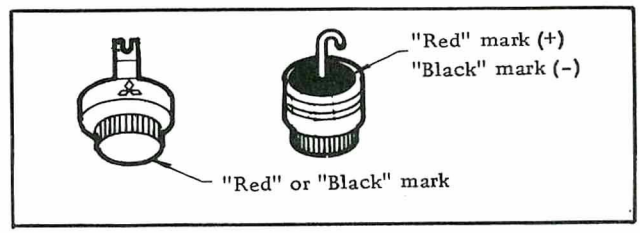


Fig. EE-19

Assembly

Assembly is a reversal of disassembly procedure.

Always make sure the polarity of alternator or regulator before replacing the diode either positive or negative. The polarity of Alternator or Regulator is usually marked on the name plate or label which is attached to each mdoel.



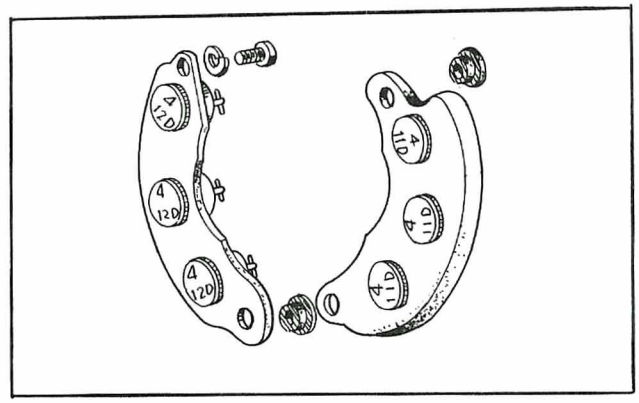


Fig. EE-20 Diode Set Exploded View

Diode Removal

To remove a diode, use a suitable tool to support the end of the frame, or heat sink, and push the diode out by using an arbor press as shown the below.

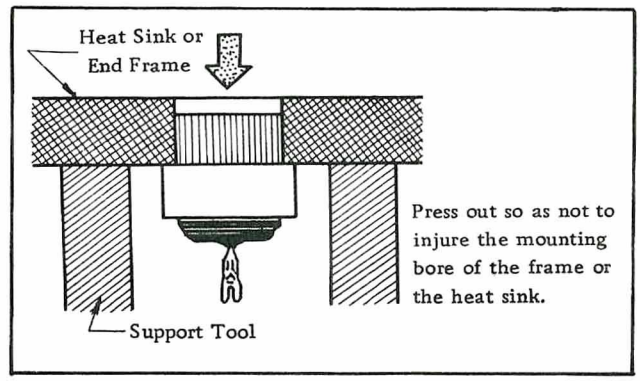


Fig. EE-21

Diode Installation

Support the heat sink or end frame with a suitable tool and then press the diode in the heat sinks by using the tool shaped Ⓐ which fits over the outer diode edge A portion.

Press down perfectly the diode in the mounting bore of C portion to the lower edge of B portion of the diode. Replaced diode should not be taken out with a force smaller than 15 kg (33 lb.).

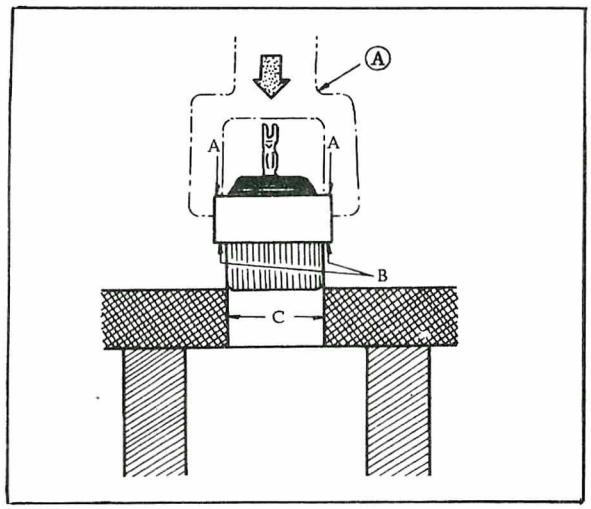


Fig. EE-22

INSPECTION AND REPAIR

Inspection of Output

For output inspection, remove Alternator from the vehicle and connect wiring as shown in Fig. EE-23 and drive it with motor.

Through the wiring shown in Fig. EE-23, magnetic current flows from the battery to the field coil of Alternator. In this state, raise revolution of Alternator slowly up to the speed where there is no reverse flow (2 A approx.) to the field coil and read the revolution. Correct revolution is approx. 1000 r.p.m. without load.

Next, increase load resistance to the maximum and almost stop flowing of load current, and put off the switch. Then, raising the load current slowly, increase revolution of Alternator. Observe thus increasing output current as revolution of Alternator increases. If there is no large difference from the specification, it is correct.

No matter how the battery is over-charged or discharged, if the charging current is small, first make sure either Alternator or the relay is in disorder. Inspect the charging current by inserting the ammeter between A terminal of relay and the battery.

Disconnect wire passing from Alternator F terminal to the relay F terminal at the relay F terminal and make the removed lead wire short circuits at the relay A terminal, when if the charging current highly increases, the relay is in disorder.

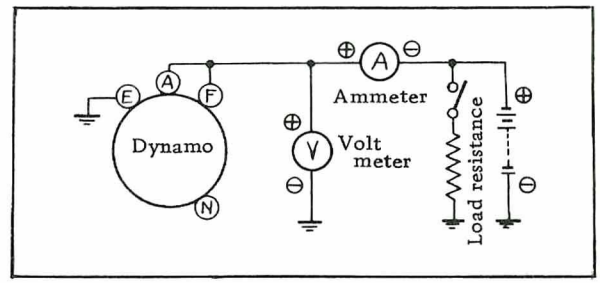


Fig. EE-23

NOTE: Use the battery charged in full up to the normal capacity.

Rotor Inspection

1) Conduction Test of Field Coil
As shown in Fig. EE-24, put the tester between the slip rings of Rotor and if there is no conduction, the disconnection of Field Coil will be thought. When the resistance is approximately 4.47 Ω at normal room temperature, the condition is all right.

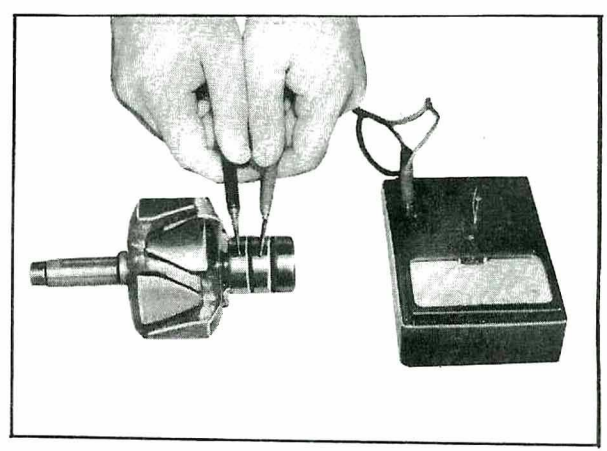


Fig. EE-24

2) Ground Test of Field Coil
Check the conduction between Slip ring and Rotor shaft. If the conduction exist, replace Rotor assembly because in this case, Field Coil or Slip ring must be grounded.

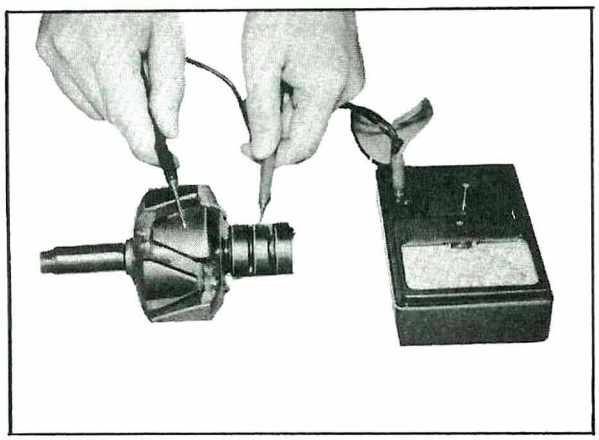


Fig. EE-25

3) Inspection of Rotor Eccentricity
Check the eccentricity of Rotor as shown in Fig. EE-26, using a dial gauge.
Repair or replace if the eccentricity is over 0.10 mm (0.0039 in.).

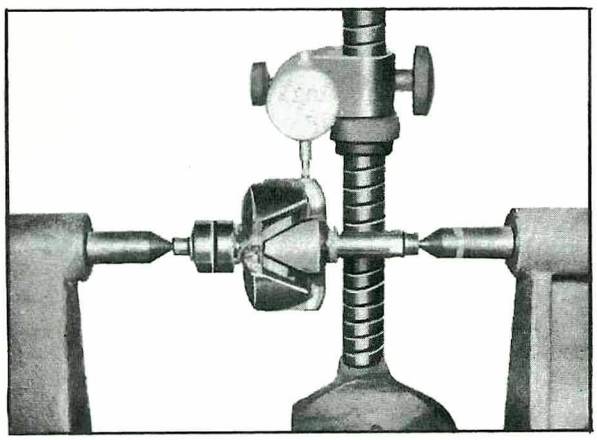


Fig. EE-26

Inspection of Stator(Armature)

1) Conduction Test
If the neutral wire of Stator which is to be connected to N terminal (yellow) is conductive with each lead wire of Armature Coil, the condition is all right.

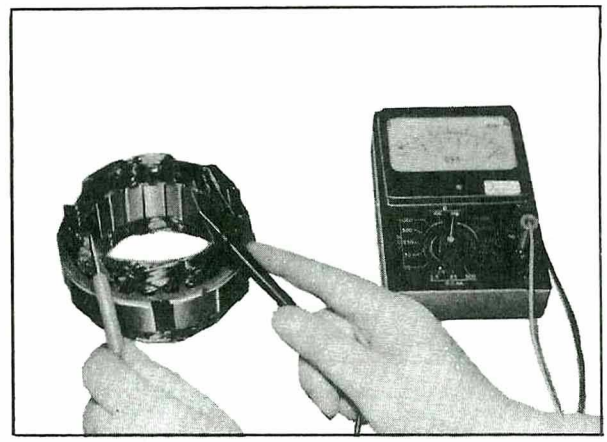


Fig. EE-27

2) Ground Test
If each lead wire of Armature Coil (including neutral wire) is not conductive with Stator Core, the condition is all right.

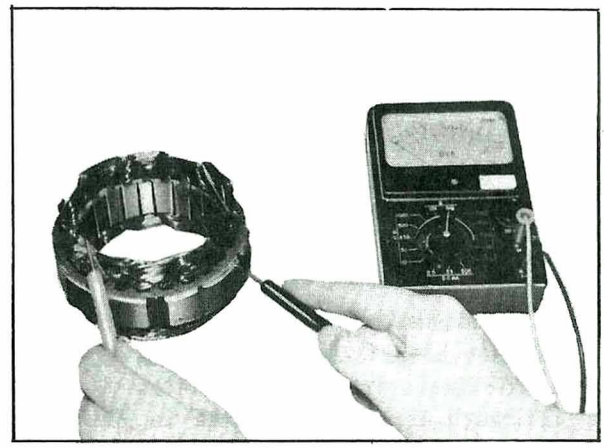


Fig. EE-28

Inspection of Diode (Using Lamp and Battery)

1) Positive Side Diode
Connect Battery negative terminal with Connector A terminal (white color) and Battery positive terminal with Connector N terminal (yellow color) as shown in Fig. EE-29.
Lamp in the circuit will light.

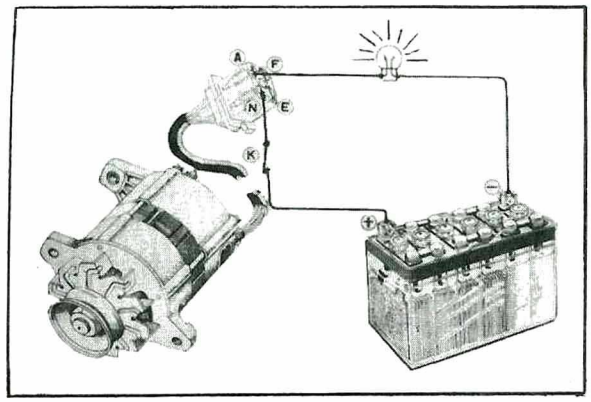


Fig. EE-29

Nextly, if Lamp does not light when the connection is made reversely as shown in Fig. EE-30, the positive side diode is in good working condition.

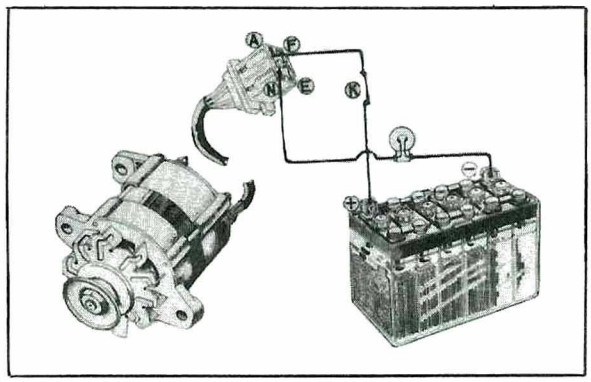


Fig. EE-30

2) Negative Side Diode
Connect Battery negative terminal with Connector N terminal (yellow) and Battery positive terminal with Connector E terminal (black) as shown in Fig. EE-31.
Lamp in the circuit will light.

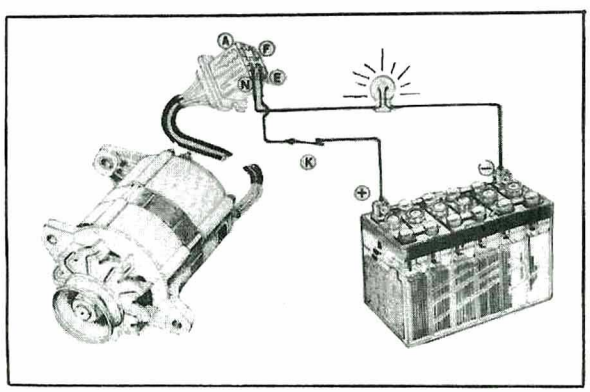


Fig. EE-31

Nextly, if Lamp does not light when the connection is made reversely as shown in Fig. EE-32, the negative side diode is in good working condition.

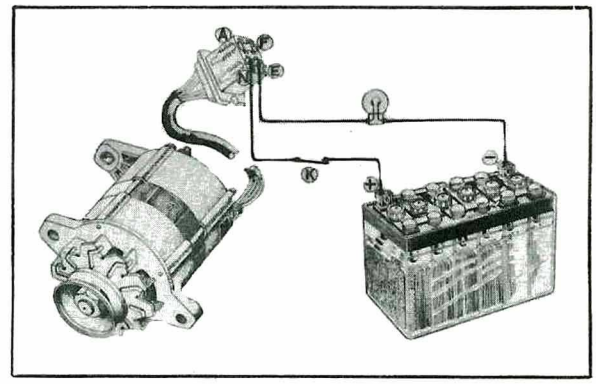


Fig. EE-32

Inspection of Diode with Tester

There are two kinds of diodes as shown in Fig. EE-33. Each diode can be descriminated its polarity by the color of the printed mark or letter on each diode.

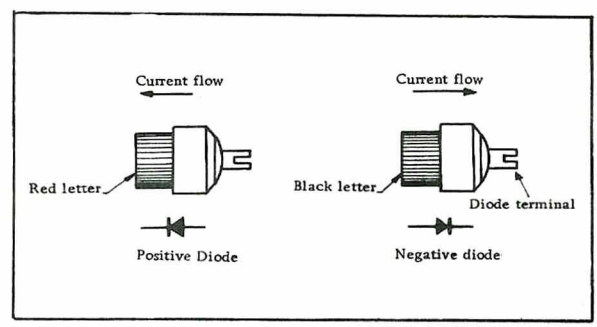


Fig. EE-33

Check Diode resistance, using a tester, in a current flow direction and a reverse direction.

When one side shows low resistance and the other shows high resistance, the diode condition is all right.

If both sides are low, there will be a short circuit and if both sides are high, there will be a open circuit. In both cases, replace diode.

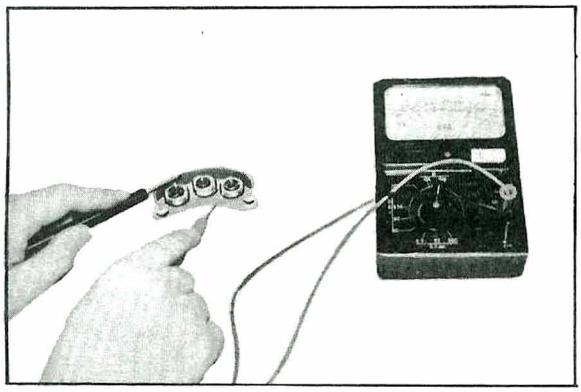


Fig. EE-34 Positive Diode

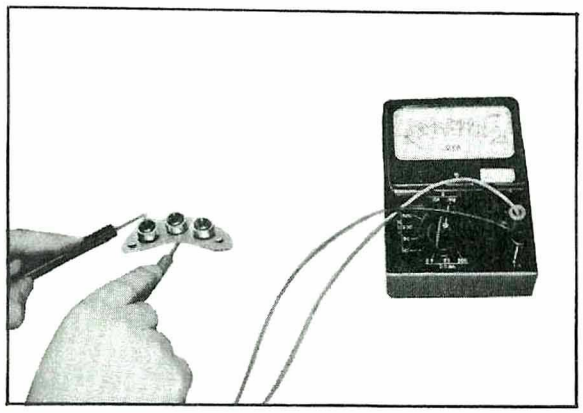


Fig. EE-35 Negative Diode

Inspection of Brush

Check the movement of Brush and if the movement is unsmooth, check Brush holder and clean it.

The standard length of Brush is 13 mm (0.512 in.). If Brush wore off smaller than 6 mm (0.236 in.), replace the brush to new one.

Spring Pressure Test

Place a suitable block on a platform scale and press down Brush holder with Brush and Spring on the block until Brush sinks in the holder to 2 mm (0.0787 in.) height from the holder. The reading subtracted the block weight shows the spring pressure. The spring pressure should be 0.35 kg (0.77 lb.). If the pressure is smaller than 0.2 kg (0.44 lb.), replace it.

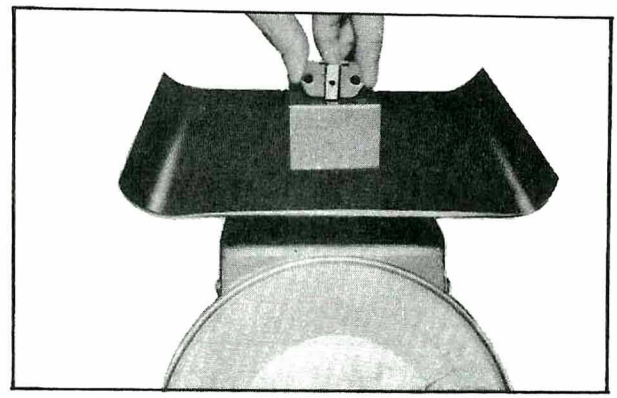


Fig. EE-36

TROUBLE AND REMEDIES

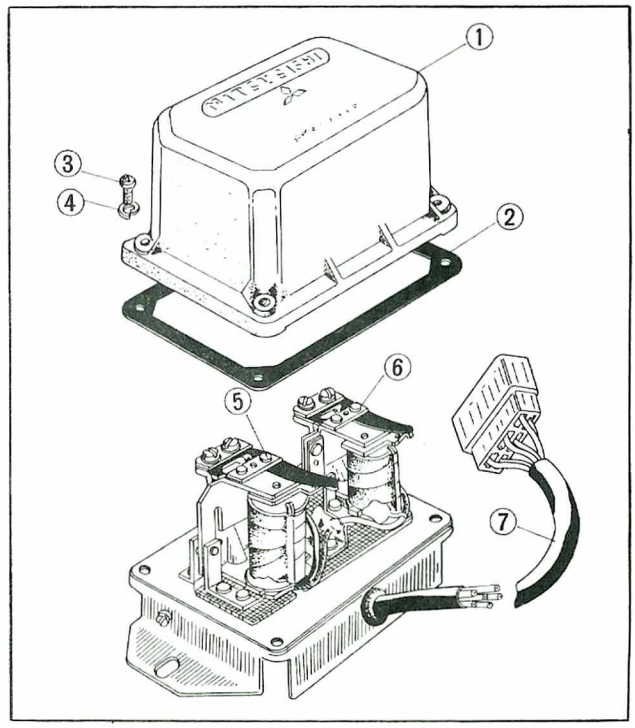
Trouble & Cause	Remedy
Over-discharge of battery	
1. Slackness of fan belt.	Adjust
2. Ground or breakage of stator coil.	Repair or replace
3. Breakage of rotor coil.	Replace
4. Malcontact of brush and slip ring.	Replace brush, clean holder
5. Malfunction of diode.	Replace as a set
6. Adjust voltage of constant voltage relay is low.	Readjust
7. Shortage or unfitness of electrolyte.	Add distilled water, check S.G.

8. Malfunction of battery pole. (short circuit)	Replace or repair
9. Malcontact of battery terminal.	Clean, retighten terminal
10. Malcontact or breakage between ignition switch and relay IG terminal.	Repair
11. Malcontact or breakage between regulator F terminal and dynamo F terminal.	Repair
12. Excessive electric load.	Check power consumed
Over-charge of battery	
1. Constant voltage relay adjust voltage is too high.	Readjust
2. Constant voltage relay coil breakage or rare short.	Replace
3. Constant voltage relay coil straight resistance breakage.	Replace
4. Breakage or rare short of pilot lamp relay.	Replace
5. Malcontact of pilot lamp relay contact point.	Polish contact point
6. Malfunction of regulator earth.	Adjust
7. Malcontact or breakage between regulator N terminal and dynamo N terminal.	Repair
Noises of Alternator	
1. Malfunction of bearing.	Replace
2. Malfunction of diode.	Replace diode as a set
3. Earth or rare short of stator coil.	Replace

REGULETOR

CONSTRUCTION AND OPERATION

(1) Construction



1.	Cover
2.	Packing
3.	Screw
4.	Spring washer
5.	Constant voltage relay
6.	Pilot lamp relay
7.	Connector

Fig. EE-37

(2) Operation of Constant Voltage Relay

When the ignition switch is on, current from the battery passes through Alternator F terminal, field coil, contact points P_2, P_1 and Alternator is magnetized.

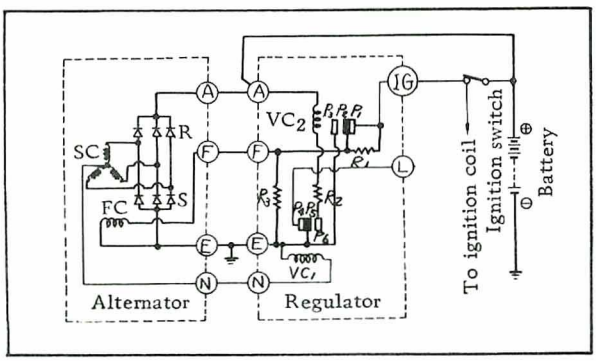


Fig. EE-38

When the engine starts and Alternator is driven, three phase alternate current generates on the stator coil, passing through the three phase all wave rectifier (diode) and changes to direct current between the terminal A-E for charging.

At the N terminal, voltage, half of that between A-E, generates and passes through the circuit, N terminal, VC_1, coil, E terminal and with action of the VC coil, the movable contact

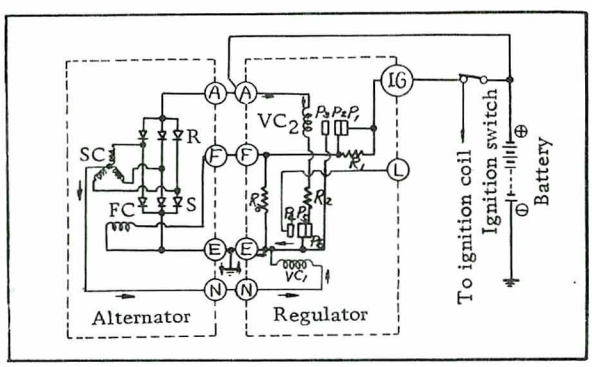


Fig. EE-39

point P_5 leaves from P_4 and makes contact with P_6, so that the lamp is off and it passes through the circuit, E terminal, contact points P_5, P_6, resistance R_2, VC_2 coil and A terminal, then the VC_2 coil animated and prepares to vibrate the movable contact point P_2 of the constant voltage relay.

When Alternator revolution gets higher, the contact point P_2 separates from P_1 with electric magnetism of the VC_2 coil and the field current from the circuit of Alternator E terminal, field coil, F terminal and resistance R_1 and when the contact point P_2 contacts with P_1, the current flows through the circuit of Alternator E terminal, field coil, E terminal, contact points P_2, P_1. This is repeated according to vibration of the contact point P_2 and Alternator terminal voltage is kept evenly and continues charging.

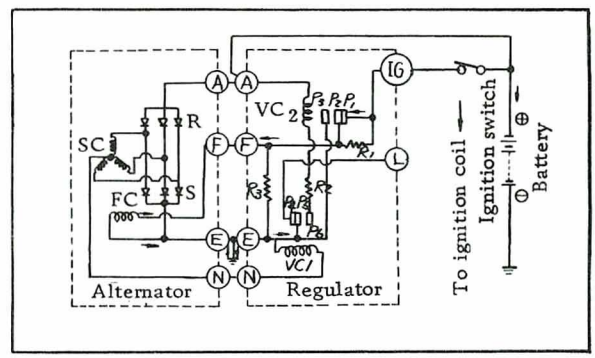


Fig. EE-40

When Alternator revolution gets still higher, the movable piece is drawn and the movable contact point P_2 sticks to P_3, so that current almost does not flow the field and the generated voltage of Alternator goes down. As the result, the contact point P_2 separates from P_3 and the current from through Alternator E terminal, field coil, F terminal, resistance R_1 and voltage goes up again. At such a high speed, with open and close of the contact points, P_2 and P_3, Alternator terminal voltage is always kept evenly.

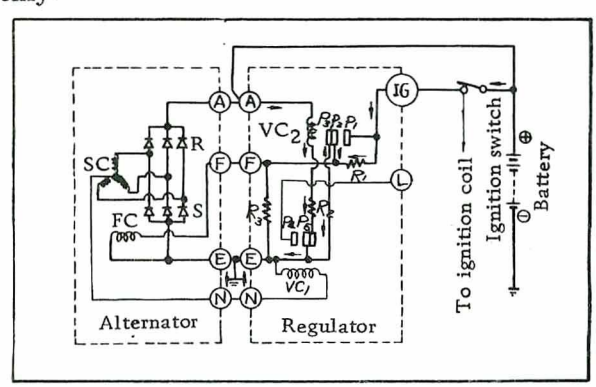


Fig. EE-41

The operation of this time is called a high speed operation and the adjust voltage is called a secondary voltage.

When Alternator revolution goes down and charging capacity reduces, the voltage between the terminals, N-E, also lowers.

As the result, the electric magnetism of VC_1 coil weakens and the contact point P_5 fixed with the movable piece can not continue contact with P_6 and changes to P_4 side and lights the lamp indicating non-generation.

When the ignition switch is turned off to stop the engine, the lamp goes out and the current to the field coil is suspended.

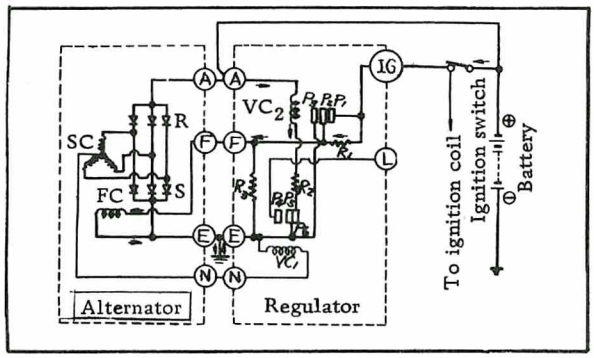


Fig. EE-42

ADJUSTMENT

(1) Check Adjusted Voltage of Constant Voltage Relay

Connect the battery almost charged in full as shown, and raise Alternator revolution to 400 r.p.m.

When the voltage of this time is 13.5～14.5 V, it is all right.

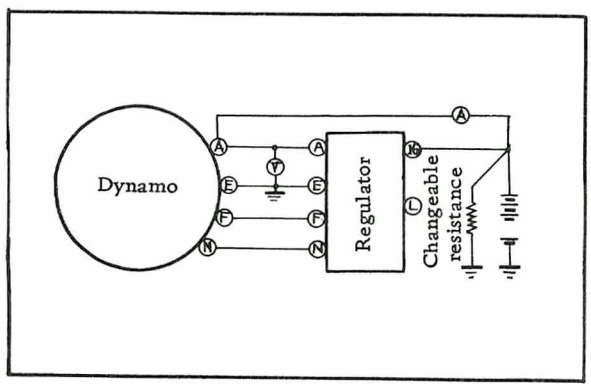


Fig. EE-43

(2) Adjustment of Gap (Constant Voltage, Pilot Lamp Relay)

The voltage adjust values of the constant voltage relay and the pilot lamp relay must be as shown in Fig. EE-44.

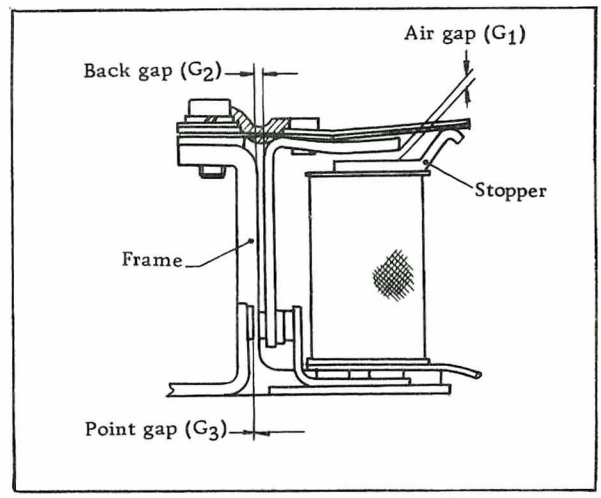


Fig. EE-44

	G_1	G_2	G_3
Constant Voltage Relay	0.8～1.2	0.8 ～ 1.1	0.3 ～ 0.4
Pilot Lamp Relay	0.9～1.2	0.75～1.1	0.75～1.1

Back Gap

Measure the gap with Pin gauge or thick-

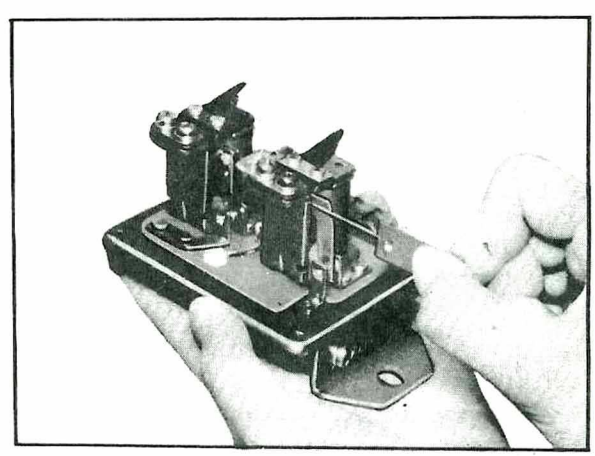


Fig. EE-45

ness gauge. Adjust the gap by releasing the fixing screw of Auxiliary spring if the gap is out of specification.

Air Gap

Check the gap with Pin gauge and adjust as shown in Fig. EE-46 and Fig. EE-47, if required.

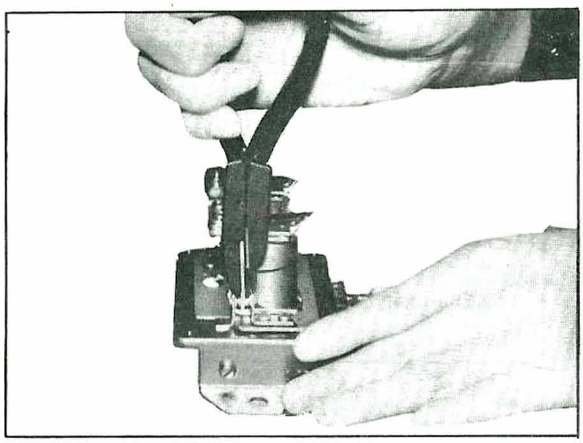


Fig. EE-46

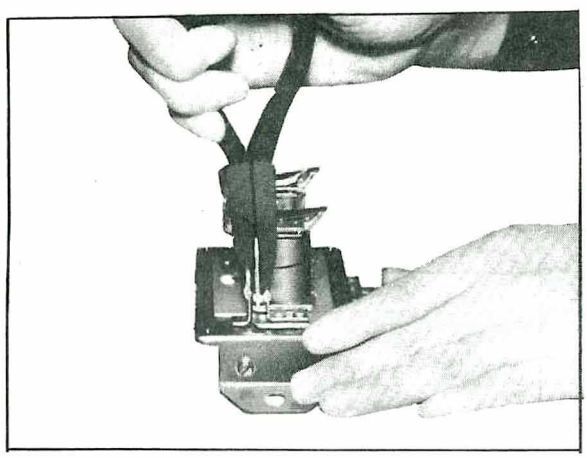


Fig. EE-47

Point Gap

Check the gap and adjust the gap by bending the constant base in the right or left direction.

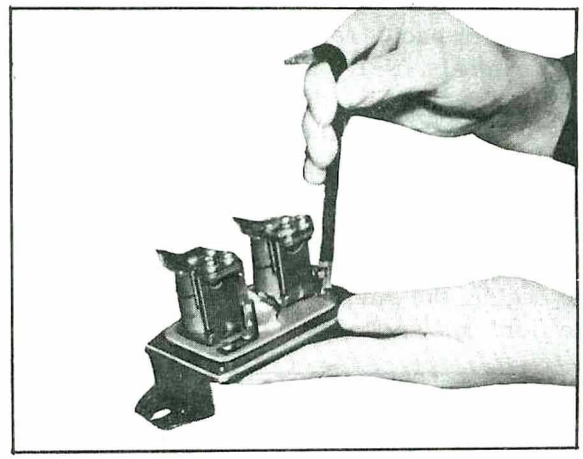


Fig. EE-48

(3) Adjustment of Voltage

Adjust the voltage by bending the stopper up and down. Bend upward to heighten adjust value and downward to lower adjust value.

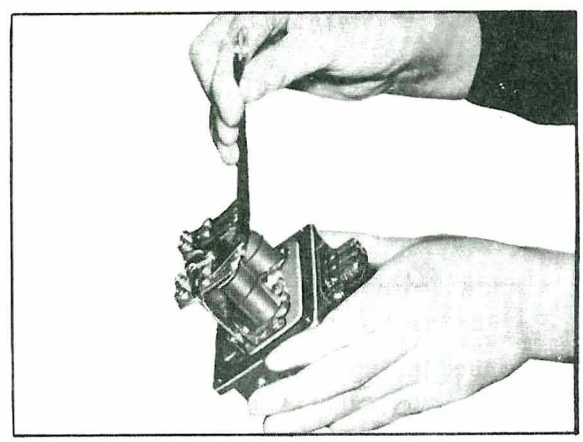


Fig. EE-49

STARTING MOTOR

SPECIFICATION

Type	MITSUBISHI ME-Y_2R
Voltage	12 volts
Output	1.0 kw
Starting Current (Voltage)	Less than 500 Amps. (6 volts)
Lock torque	Over 1.0 kg-m (7.23 ft-lb)
No Load Current (Voltage)	Less than 60 Amps. (11 volts)
No Load Starter Revolution	Less than 6,000 r.p.m.

Shift type of Pinion Gear ..... Magnetic Shift
Number of tooth on pinion gear 9
Number of tooth on ring gear 120
Weight ..... 5.5 kg (12.13 lb.)

DESCRIPTION

The starting system permits the engine to be cranked by turning the ignition switch to "start" position. While the ignition switch is turned to "start" position, the starting motor continues operation until the engine starts running on its own power, then the starting motor current is opened and the motor is disengaged by turning the ignition switch on to "Ign" position. This starting motor utilizes an enclosed over-running clutch type and the compound motor as described following. The magnetic switch is mounted at the upper side of the yoke.

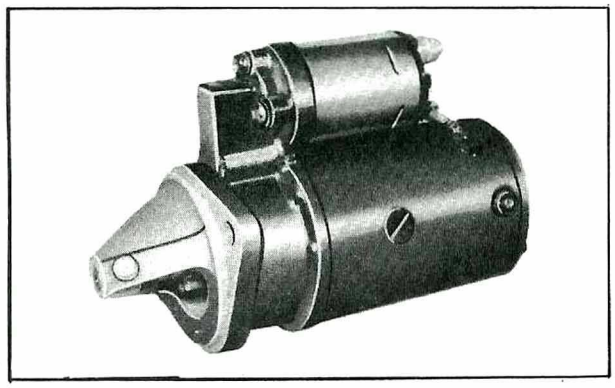


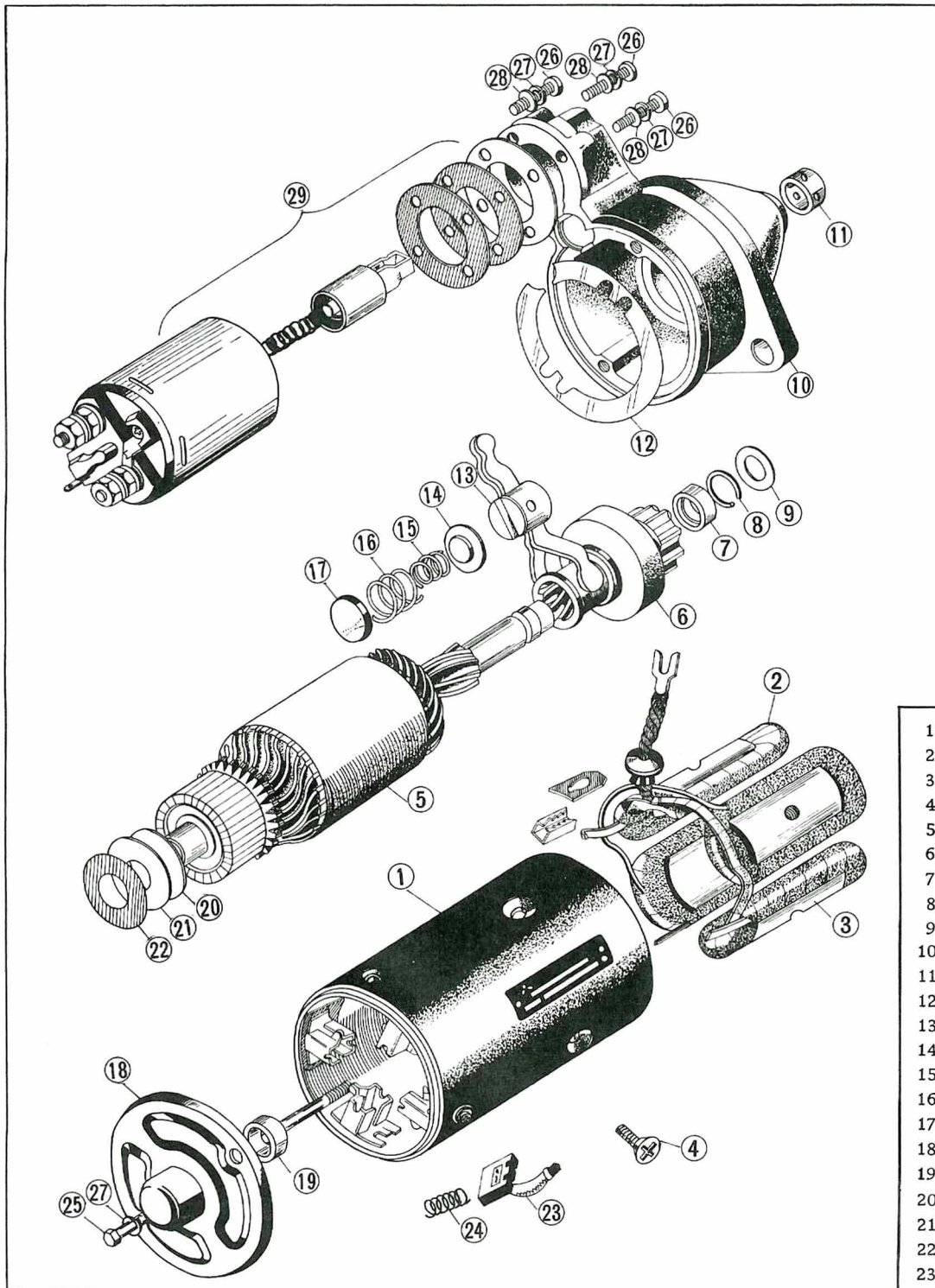
Fig. EE-50

OPERATION

When the ignition switch is turned on to "start" position, (cf. Fig. EE-52) current flows through the "current" and "potential" coils of the solenoid and magnetize the solenoid. The plunger is pulled into the solenoid so that it operates the shift lever to move the drive pinion into engagement with flywheel ring gear and then closes the solenoid switch B and M.

Closing of the contact B and M causes the motor to crank the engine and also cuts out the "current" coil of the solenoid, the magnetic pull of the "potential" coil being sufficient to hold the pinion in mesh after the shifting has been performed.

After the cranking, and when the ignition switch is turned to "Ign" position, the "current" coil demagnetizes against the "potential" coil, then a return spring actuates the plunger to return to the original position, consequently stops the motor. More positive meshing and demeshing of the pinion and ring gear teeth are secured by means of the over-running clutch. The over-running clutch employs a shift lever to slide the pinion along the armature shaft and into, or out of, mesh with the ring gear teeth. The over-running clutch is designed to transmit driving torque from the motor armature to the ring gear, but permits the pinion to over-run the armature after the engine has started.



1.	Yoke Ass'y
2.	Field coil
3.	Pole core
4.	Screw
5.	Armature
6.	Over running clutch
7.	Stopper ring
8.	Ring
9.	Washer
10.	Front bracket
11.	Pinion case metal
12.	Shim
13.	Shift lever Ass'y
14.	Lever spring cap
15.	Lever spring (A)
16.	Lever spring (B)
17.	Lever spring seat
18.	Rear cover
19.	Rear cover metal
20.	Washer
21.	Washer
22.	Insulating washer
23.	Brush
24.	Brush spring
25.	Through bolt
26.	Screw
27.	Spring washer
28.	Washer
29.	Switch Ass'y

Fig. EE-51

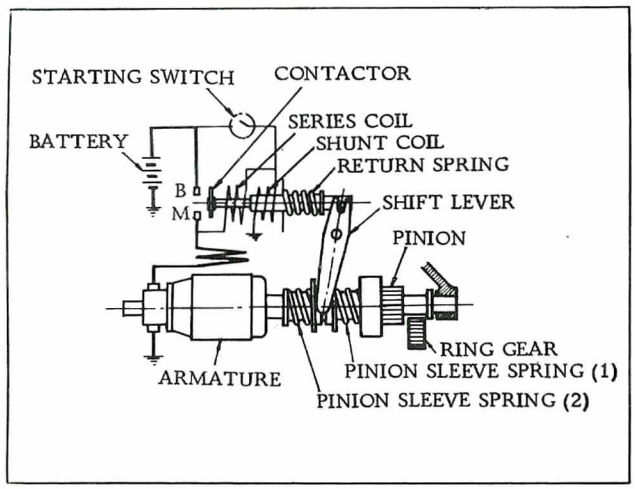


Fig. EE-52 Starting Motor Circuit

CONSTRUCTION

Field Coil;

The field coil is mounted on yoke by the pole core and pole core screws and located inside the yoke.

Armature; (include over-running clutch)

The armature is retained into yoke assembly by the rear cover and gear case bush so that it permits the armature to high speed revolution. The armature shaft includes drive mechanism such as over-running clutch assembly.

Magnetic Switch Assembly;

The magnetic switch is mounted on the gear case by four screws. The plunger and the over-running clutch is mechanically connected by the shift lever and operate simultaneously.

Over-running Clutch Assembly;

The main parts of drive mechanism are over-running clutch assembly and this starting motor uses over-running clutch as mentioned above.

The over-running clutch consists of the pinion, the roller and the thrust spline.

Brush and Brush Holder;

The brushes and brush springs are installed in the brush holders inside the yoke.

REMOVAL

1. Disconnect the battery ground cable. Disconnect the black with yellow tracer wire from the magnetic switch terminal, and black battery cable from the magnetic "battery" terminal.
2. Remove two bolts securing the starting motor to engine end plate. Pull starter assembly forward and remove starting motor.

DISASSEMBLY

1. Remove the nut securing the connecting plate to the magnetic switch "M" terminal. Remove three bolts securing Mangetic switch and remove Magnetic switch assembly.

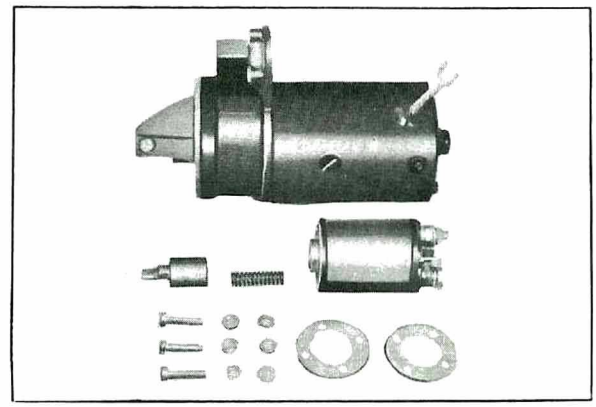


Fig. EE-53 Removing Magnetic Switch Ass'y

2. Remove two through bolts and Brush cover assembly.
3. Remove Yoke assembly by hitting lightly with a wooden mallet.

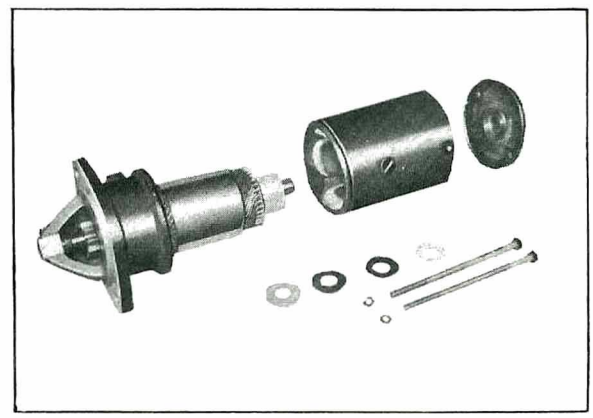


Fig. EE-54 Separating Yoke Ass'y and Armature Ass'y

4. Withdraw Armature assembly and Shift lever.

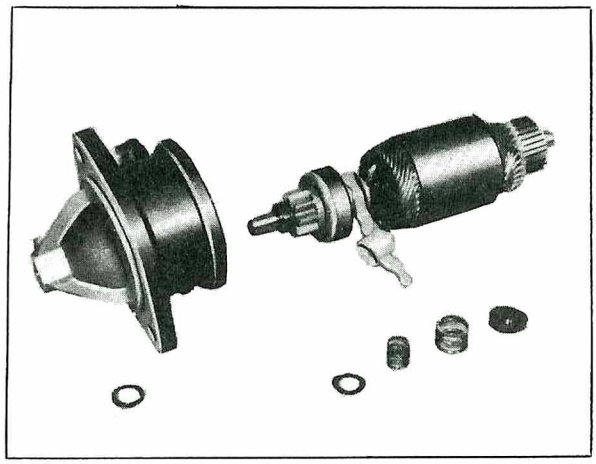


Fig. EE-55 Removing Armature Ass'y and Shift Lever

5. Remove Pinion stop ring located at the end of the armature shaft. To remove Stop ring, firstly push Stop ring to the Clutch side and then, after removing Snap ring, remove Stop ring with Over-running clutch. Withdraw Over-running clutch assembly from the armature shaft.

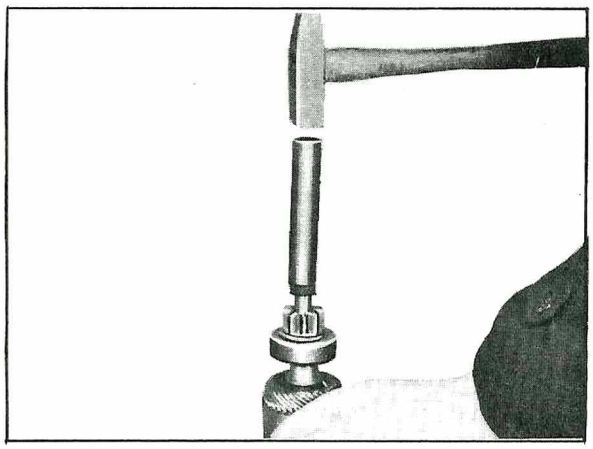


Fig. EE-56 Removal of Over-running Clutch Ass'y

6. Dissolder the brushes, using a soldering iron and remove each brush.

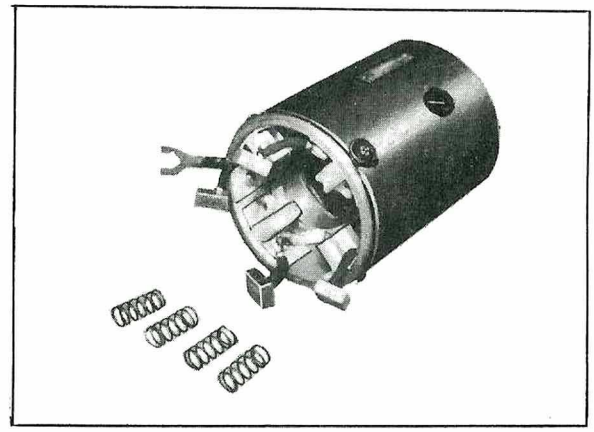


Fig. EE-57

CLEANING AND INSPECTION

Clean all disassembled parts, but do not use grease dissolving solvents for cleaning the over-running clutch, armature assembly, magnetic switch assembly and field coils since such a solvent would dissolve the grease packed in the clutch mechanism and would damage the coils or other insulators.

Check to see if these are damaged or worn excessively, they should be replaced as necessary.

1. Terminal

Check for damage and wear, and replace if necessary.

2. Field Coil

Check the field coil insulation. If the insulation of the coil is damaged or worn it should be replaced.

Field Coil Test for Continuity

Connect the test probe of a circuit tester or an ohmmeter to Field coil positive terminal and Negative brush holder.

If no conductance is read, the field circuit or coil is open.

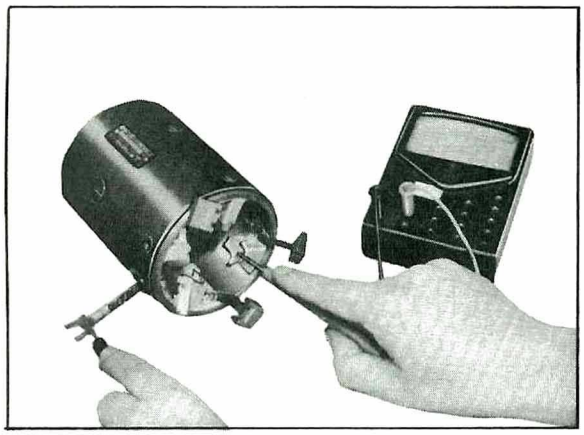


Fig. EE-58 Field Coil Test for Continuity

Field Coil Test for Ground

Place one probe of the circuit tester onto the yoke and the other on to the field coil lead (positive terminal).

If very little resistance is read, the field coils are grounded.

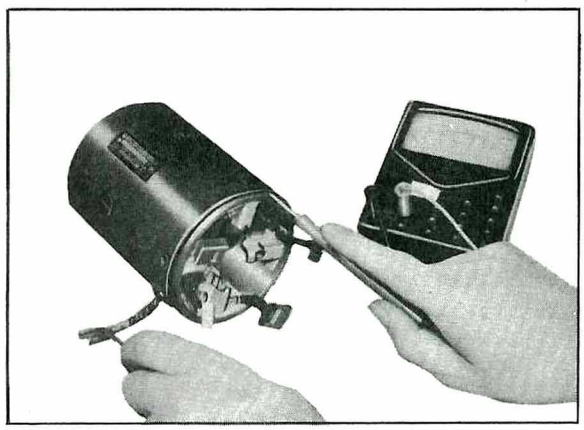


Fig. EE-59 Field Coil Tester Ground

Field Coil Test for Short

Dissolder the connecting section of each coil and proceed to the same mentioned above.

If a defective coil is found, it should be replaced.

3. Brushes and Brush Lead Wire

Check the condition of the brush contact surface and wear of the brush. If a loose contact may be found it should be replaced.

If the brush wear until its height is less than 7.5 mm (0.2953 in.), replace it.

Check the connection of the lead clip and lead wire.

Check brush holders and spring clip to see that they are not deformed or bent, but will properly hold brushes against the commutator.

If the brushes, or brush holders are dirty they may be cleaned.

4. Brush Spring Tension

Check the brush spring tension by a contact pressure gauge. Take the gauge reading when the new or replaced brush separate from the commutator. The reading should be 0.95 kg (20.94 lbs.). Replace the spring if the tension is lower than 0.5 kg (11.02 lbs.).
Gauge reading should be done when the brush height from holder is 1.5 mm (0.059 in.)

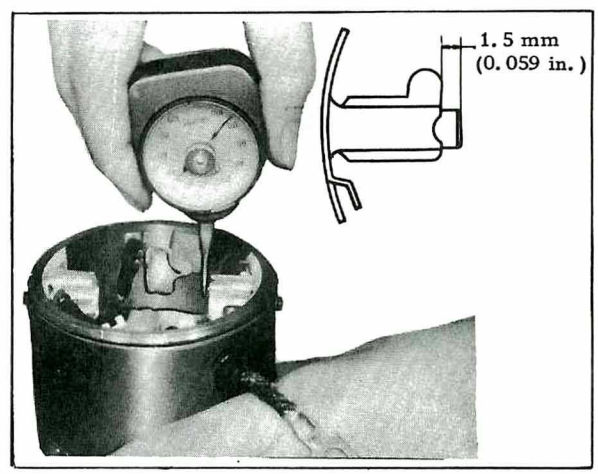


Fig. EE-60 Inspection of Brush Spring Tension

5. Armature Assembly

Check external appearance of the armature and the commutator.

a. Measure the armature shaft for bend by a dial gauge. Replace the armature shaft if the bend exceeds 0.1 mm (0.004 in.).

b. Inspect the commutator. If the surface of the commutator is rough, it must be sanded lightly with a No. 500 emery paper.
The commutator may be checked also for out-of-round.

If the out-of-round is more than 0.2 mm (0.0078 in.), or the depth of the insulating mica is less than 0.2 mm (0.0078 in.) from the commutator surface, the commutator (armature) should be turned in a lathe, so that the out-of-round is less than 0.05 mm (0.0019 in.). Insulating mica should be also under cut so that the depth of it is from 0.5 mm to 0.8 mm (0.0196 to 0.0315 in.).
The wear limit of the commutator diameter in 2 mm (0.0787 in.). If the commutator is beyond repair, replace it.

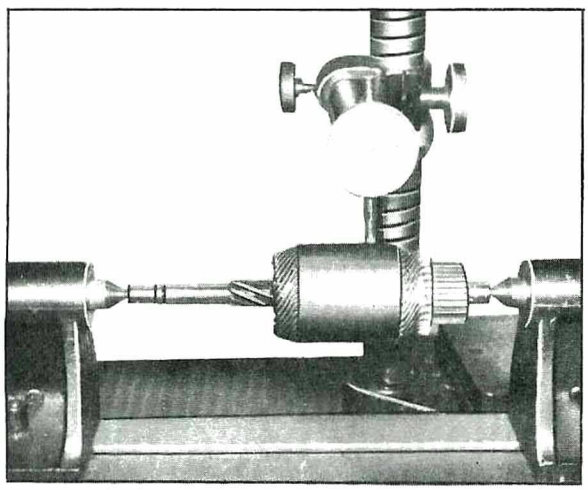


Fig. EE-61 Inspection of Armature Shaft for Bend

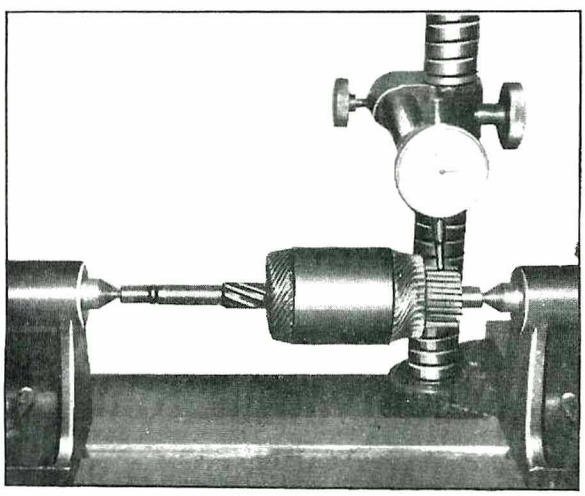


Fig. EE-62 Inspection of Commutator

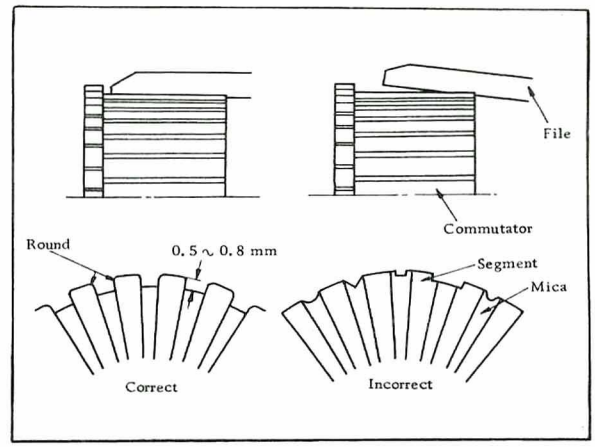


Fig. EE-63 Undercutting Insulating Mica

c. Inspect the soldered connection of armature lead and commutator. If the loose connection is found, solder it using rosin flux.

d. Armature Test for Ground.
Using a circuit tester, place one test probe on to armature shaft and other on to each commutator bar.
If the tester shows conductive, armature is grounded and must be replaced.

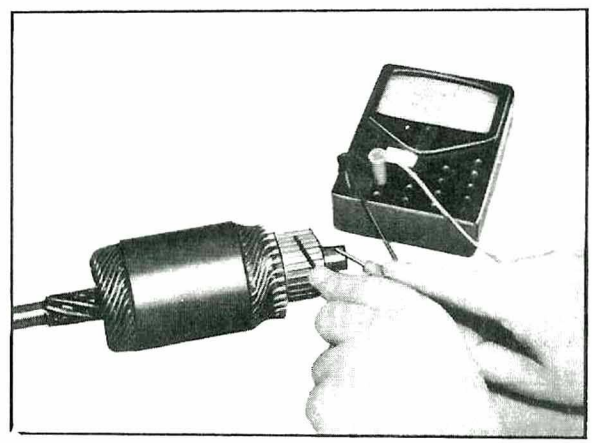


Fig. EE-64

e. Check armature for shorts by placing on growler and with back saw blade over armature core, rotate armature.
If saw blade vibrates, armature is rare shorted.

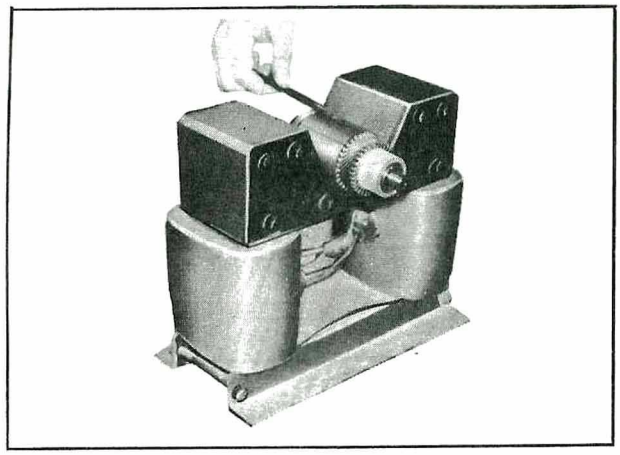


Fig. EE-65 Armature Test for Short

f. Check armature for continuity by placing the probes of tester on two segments side by side. If the tester shows no conduction, the circuit is open.

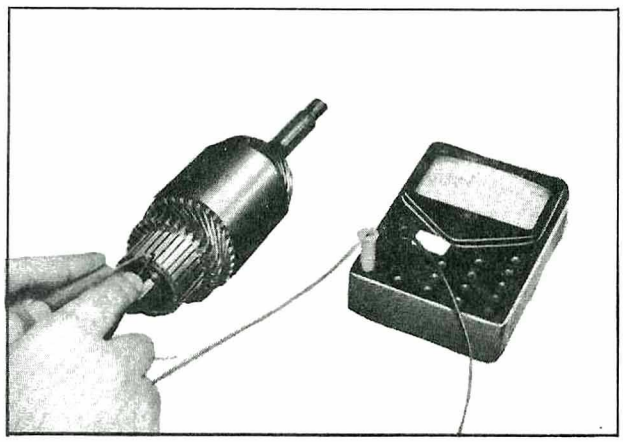


Fig. EE-66 Armature Test for Continuity

6. Over-Running Clutch Assembly

Inspect the pinion assembly and screw sleeve. Screw sleeve must be freely slide along the armature shaft splined. If scratchs are found or resistance would be felt when sliding, it must be repaired. Inspect the pinion teeth. If excessive rubbing would be found on the teeth, it should be replaced. The flywheel ring gear also must be inspected.

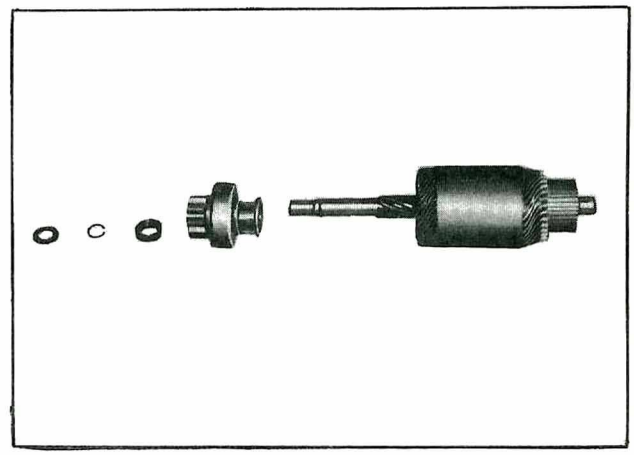


Fig. EE-67 Over-running Clutch Ass'y

7. Brush Holder Test for Ground

Using a circuit tester, place one test probe on to rear cover and another on to positive side brush holder. If the tester shows conductive the brush holder is shorted to ground. Replace an insulator or brush holder.

8. Pinion Case Bearing Metal

Inspect the bearing metal for wear or side play. If the clearance between the bearing metal and the armature shaft is more than 0.2 mm (0.0078 in.), replace the metal. Press in a new bearing and adjust the clearance to 0.050 ~ 0.104 mm (0.0020 ~ 0.0041 in.). The bearing metal should be so pressed in that the end of the bearing metal would be equal to gear case end plane.

9. Magnetic Switch Assembly

Inspect the magnetic switch contacts. If a rough welding be found on the contact is should be repaired.

ASSEMBLY

Assembling is a reversal of the disassembly procedure.

When assembling, pack the grease in the rear case and apply light coat of oil to the rear cover bearing metal, pinion and center bearing.

STARTING MOTOR TEST

The starter motor should be subjected to a "no-load" and a "lock-torque" test whenever it has been overhauled to ensure that its performance will be satisfactory when installed to the engine. The starter motor should also be subjected to these tests when the cause of abnormal operation is to be determined. A brief outline of the two tests is given below.

1. No-Load Test

Connect the starting motor in series with the specified (12 volts) battery and an ammeter capable of indicating 1, 000 amperes.

Specified current draw and revolution in these test are shown in "specification".

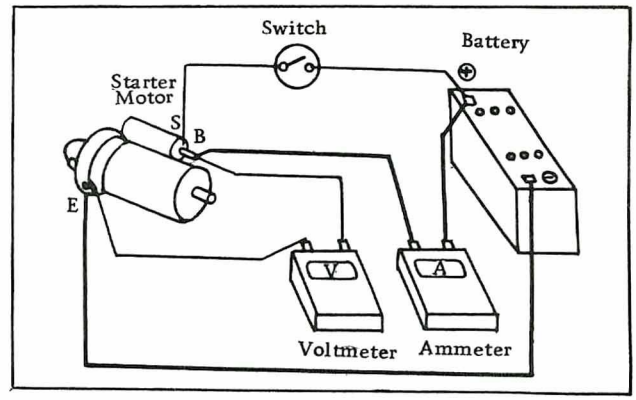


Fig. EE-68 No-load Test

2. Torque Test

Torque testing equipment should be used to the motor will develop rated torque. A high current carrying variable resistance should be connected into the circuit so that the specified voltage at the starting motor may be obtained, since a small variation in the voltage will produce a marked difference in the torque development.

Specified Power, Voltage across the starting motor (+) and (-) and Torque are shown in Fig. EE-69.

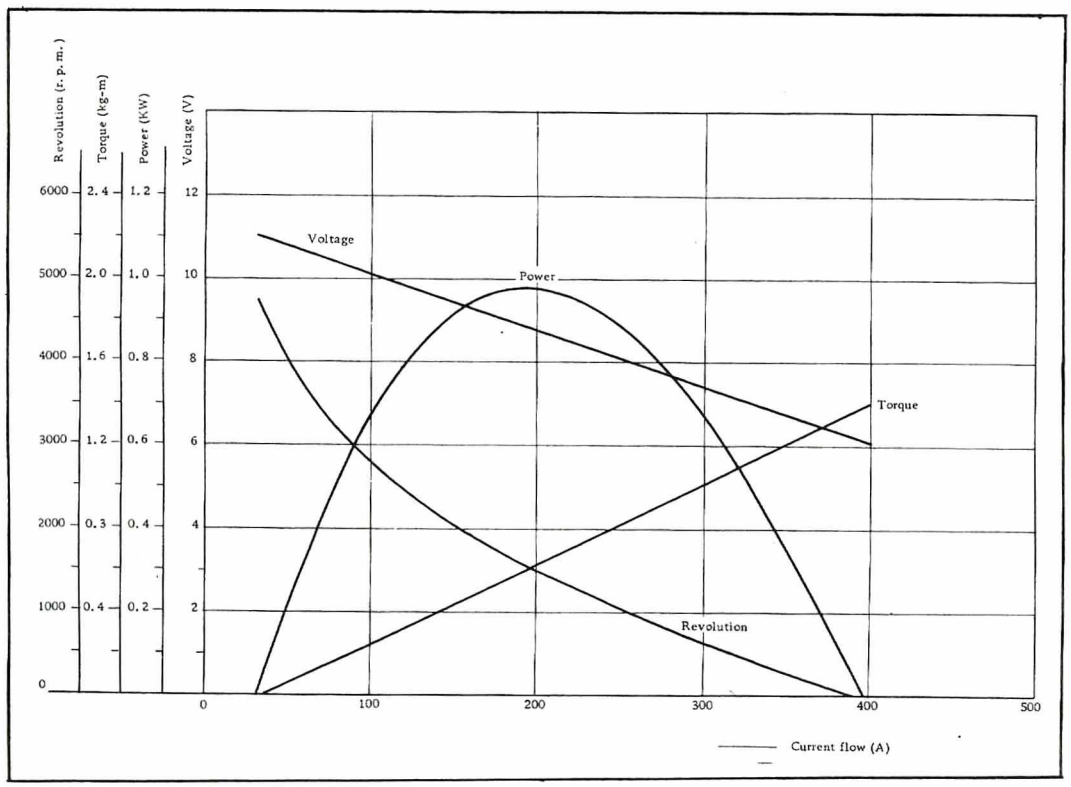


Fig. EE-69 Performance Curves

3. Diagnosis of Test

A. Low speed with no-load and high current draw may result from followings.

a. Tight, dirty or worn bearings.
Bent armature shaft or loosen field probe.

b. Shorted armature
Check armature further.

c. A ground armature of field
Remove copper connector. Remove negative side brush and insulate it from the commutator before inspection.
Using a circuit tester, place one probe on insulated terminal and another on rear cover. If the tester indicates conductive, remove other two brushes and check fields and armature separately to determine whether it is the fields or armature that is grounded.

B. Failure to operate with high current draw may result from followings.

a. A grounded or open field coil
Inspect the connection and trace the circuit by a circuit tester.

b. The armature coil do not operate
Inspect the commutator for excessive burned out. In this case, arc may occur on defective commutator, when the motor is operated with no-load.

c. Burned out commutator bar
Weak brush spring tension, broken brush spring, rubber brush, thrust out of mica in the commutator or a loose contact brush and commutator would cause to burn the commutator bar.

C. Low torque, low current draw and low no-load speed would cause high internal resistance due to loose connections, defective leads, dirty commutator and causes listed on item B-c.

D. High no-load speed with low developed torque would cause grounded field coil. Replace the field coil and check for improvement in performance.

4. Magnetic Switch Assembly Test

If the starting motor check is "OK". Check the magnetic switch assembly. Connect jumper cables between the "positive" battery terminal and the starting motor "B" terminal, the "negative" battery terminal and the ground side of

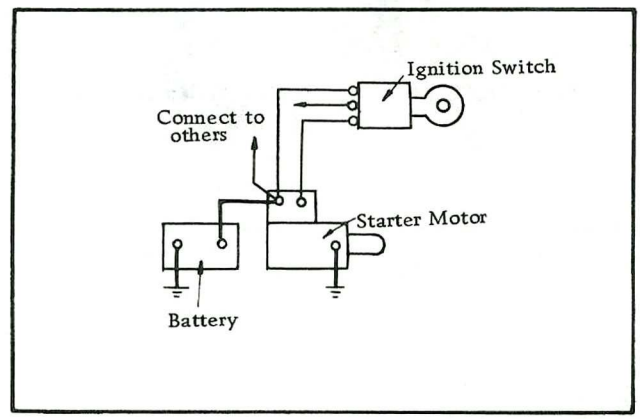


Fig. EE-70

starting motor, and the "positive" battery terminal and the starting motor "S" terminal (Connect ignition switch in series).

Measure the gap "ℓ" between Pinion front edge and Pinion Stopper.

If the gap is off the standard, adjust the gap by adjusting the dimension "L" of Magnetic Switch to the standard dimension.

Cap-Pinion Face to Pinion Stopper ..... 0.5 ~ 2.0 mm (0.0197 ~ 0.0787 in.)

"L" dimension ..... 27.5 ~ 28 mm (1.0837 ~ 1.1024 in.)

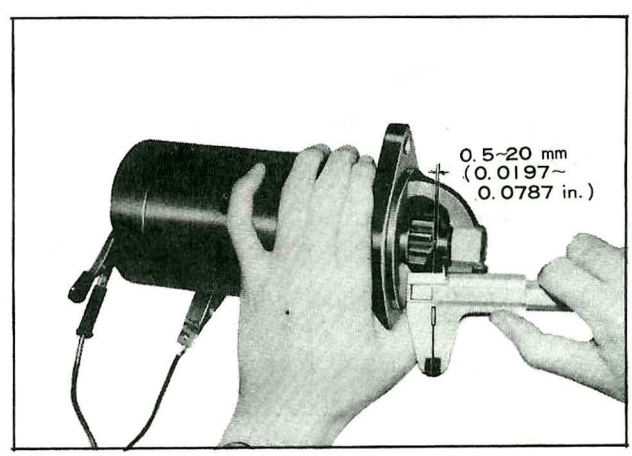


Fig. EE-71

Fig. EE-72

5. Diagnosis of Test

A. With the ignition switch on to "start" position, the motor does not operate.
Poor contact of the magnetic switch would be the cause of trouble.

B. With the ignition switch on to "start" position, the plunger moves to push and pull the pinion. Open potential coil would be the cause of trouble.

C. With the ignition switch on to "start" position, the plunger does not move to pull the pinion but the motor operates by manual pulling the pinion. Open current coil would be the cause of trouble.

D. With the ignition switch turned off, the motor does not stop. Defective terminals would be the cause of trouble.

E. Low no-load speed with low torque loose connection of the terminals would be cause of trouble.

SERVICE DATA

Armature Shaft Diameter (Pinion side)	$11\frac{-0.050}{-0.077}$ mm	(0.4331 $\frac{-0.0020}{-0.0030}$ in. Dia.)
Armature Shaft Diameter (Rear end)	$14.2\frac{-0.050}{-0.077}$ mm	(0.5591 $\frac{-0.0020}{-0.0030}$ in. Dia.)
Amendment Limit of Shaft Dia.	0.1 mm	(0.0039 in.)
Amendment Limit of Shaft Bent	0.1 mm	(0.0039 in.)
Clearance between Shaft and Bush	0.050 ~ 0.104 mm	(0.0020 ~ 0.0041 in.)
Amendment Limit of Dittoed Clearance	0.2 mm	(0.0079 in.)
Outer Diameter of Commutator	39 mm	(1.5354 in.)
Wear Limit of Commutator Dia.	2 mm	(0.0787 in.)
Brush Length	14 mm	(0.5512 in.)
Wear Limit of Dittoed Length	6.5 mm	(0.2559 in.)
(Remaining Brush should be move than 7.5 mm)		(0.2953 in.)
Brush Spring Tension	0.95 kg	(2.094 lb.)
Front Bracket Metal Inner Diameter	$11\frac{+0.027}{0}$ mm	(0.4331 $\frac{+0.0011}{0}$ in.)
Rear Cover Metal Inner Diameter	$14\frac{+0.027}{0}$ mm	(0.5591 $\frac{+0.0011}{0}$ in.)

TROUBLE DIAGNOSIS AND CORRECTIONS

Troubles	Causes	Remedies
Starting motor will not operate.	Discharged battery.	Charge or replace the battery.
	Defective solenoid switch.	Repair or replace the solenoid switch.
	Loosen connections of the terminal.	Clean and tighten the terminal.
	Defective brushes	Replace the brush.
	Defective starting motor.	Remove the starting motor and make test.
Nosiy starting motor.	Loose securing bolt.	Tighten the bolt.
	Worn pinion gear.	Replace the pinion gear.
	Poor lubrication.	Fill in oil.
	Worn commutator.	Disassemble the motor.
	Worn brushes	Replace the brush.
Starting motor cranks slowly.	Discharged battery.	Charge or replace the battery.
	Loose connection of the terminal.	Clean and tighten the terminal.
	Worn brushes.	Replace the brush.
	Locked brushes.	Inspect the brush spring tension or repair the brush holder.
	Dirty or worn commutator.	Clean and repair.
	The armature rubs the field coil.	Disassemble the motor.
	Defective solenoid switch	Repair or replace the switch.
Starting motor operate but does not crank the engine.	Worn pinion.	Replace the pinion.
	Locked pinion guide.	Repair the pinion guide.
	Worn ring gear.	Replace the ring gear.
Starting motor will not disengage even the ignition switch it turned off.	Defective solenoid switch.	Repair or replace the solenoid switch.
	Defective gear teeth.	Replace the defective gear.

DISTRIBUTOR

SPECIFICATION

TYPE & MAKE	D407-52 HITACHI
Ignition Timing ..... (B.T.D.C.)	Solex 20°/700 r.p.m. SU 16°/700 r.p.m.
Rotaling Direction	Counter-Clockwise
Advance Starting ..... R.P.M.	800 ~ 1100 r.p.m. (Engine revolution)
Dwell Angle	49° ~ 55°
Condenser Capacity	0.20 ~ 0.24 μF

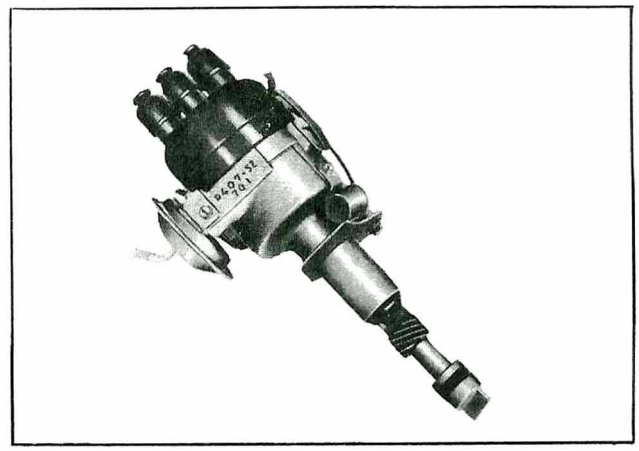


Fig. EE-73

CONSTRUCTION AND OPERATION

Fig. EE-74 shows ignition diagram of gasoline engine. Functionally, the distributor consists of high tension voltage part, switch off part, centrifugal advancing angle part, vacuum advance mechanical part and driving part. Fig. EE-75 shows structure of its typical product.

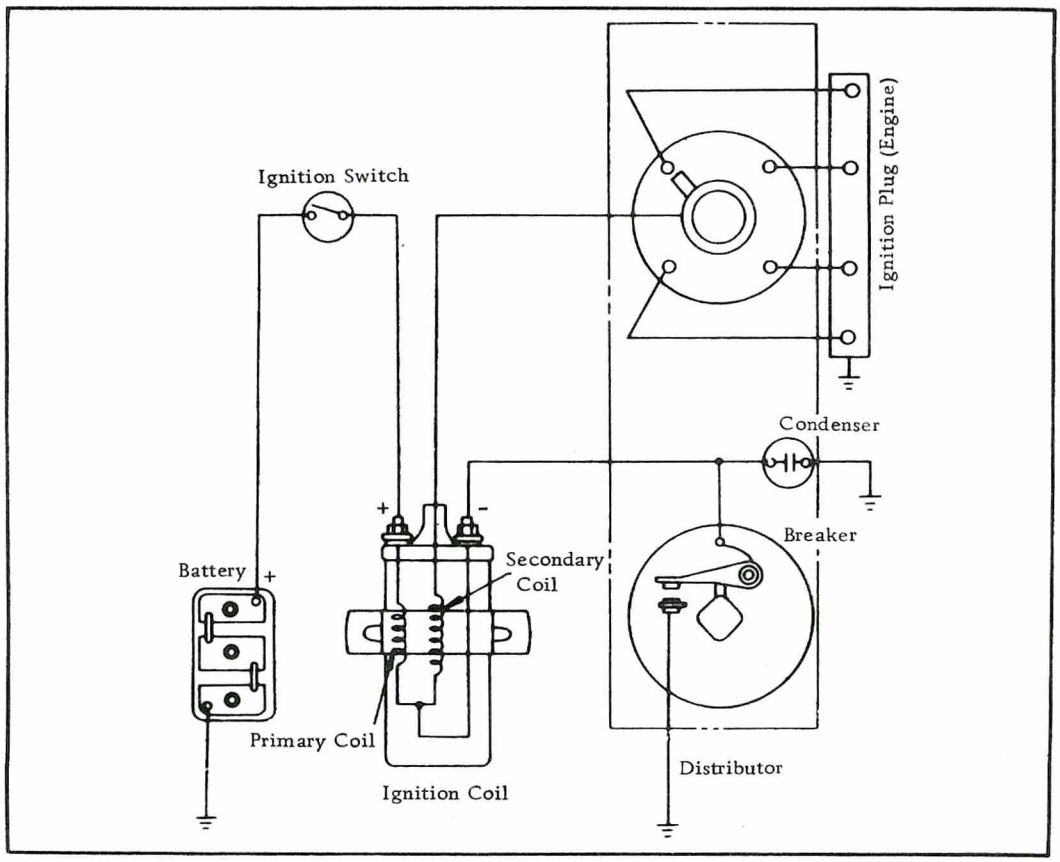


Fig. EE-74

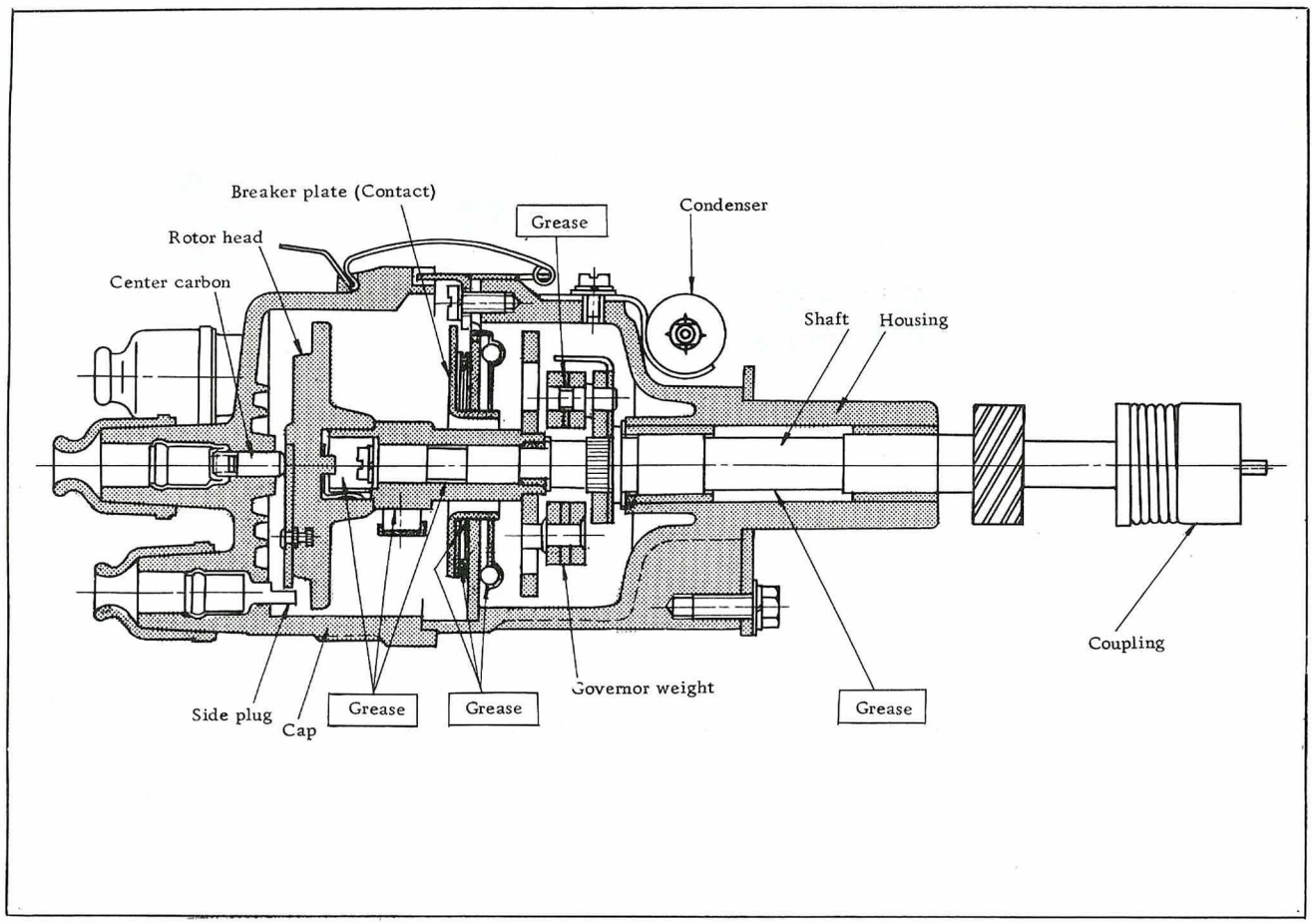


Fig. EE-75

High Tension Voltage Part

Cap and rotor head are main parts of high tension voltage distributor. Cap is made of synthetic resine durable to high tension voltage. There is a center carbon in the center of the cap, through which high tension voltage generated at the secondary part of the ignition coil runs to rotor head.

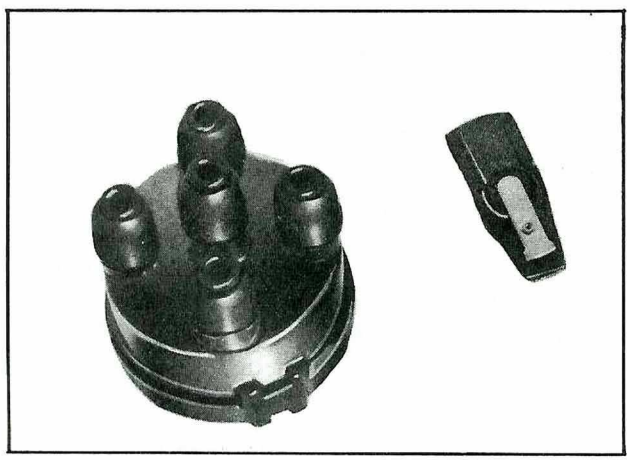


Fig. EE-76

Rotor head is set in cam head to lead high tension voltage sent from center carbon to side plug. Material is same as that used for cap.

Switch On-Off Part

Switch on-off part consists of cam, contact arm, contact point and condenser. Cam is shaped square and has same number of angles as that of engine cylinder, point is opened when the top draws near. Fig. EE-78 shows cam assembly which possesses timing lever to adjust advance automatically by putting weight pin in the rectangular hole of the lever.

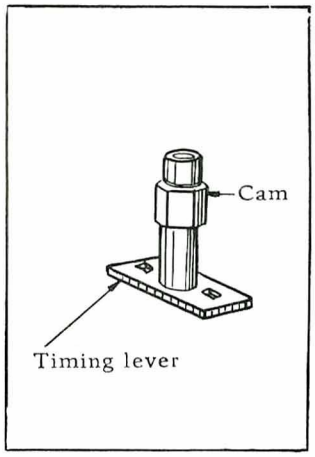


Fig. EE-77

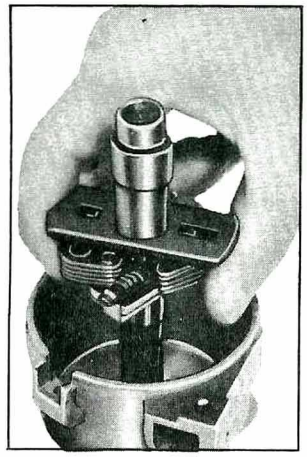


Fig. EE-78

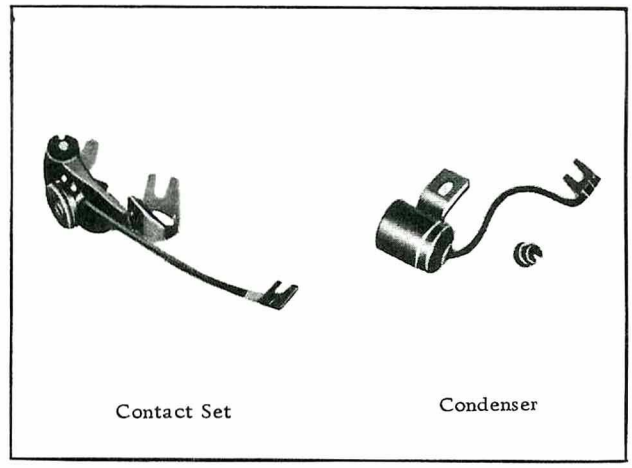


Fig. EE-81 *Fig. EE-82*

Contact set is a combination of contact arm and contact point. As shown by Fig. EE-79, contact arm has an arm and consists of point, heel (lever slide) pivot receiver and spring. Standard pressure at point is 0.50-0.65 kg (1.102 ~ 1.433 lb.) and when the pressure is too high, heel wears rapidly and when too low, ignition timing becomes bad, thus causing engine trouble in either case.

As shown by Fig. EE-80, contact point possesses point setting pad which is connected with arm pivot and has oblong hole for adjustment. As shown by Fig. EE-74, condenser is connected to point in parallel and not only prevent point from damage by absorbing Arc between points but also increase secondary voltage by switching off quickly primary electric current.

This condenser contains small and light MP condenser capable of self-recovery at the time of puncture. Fig. EE-82 shows the picture of MP condenser.

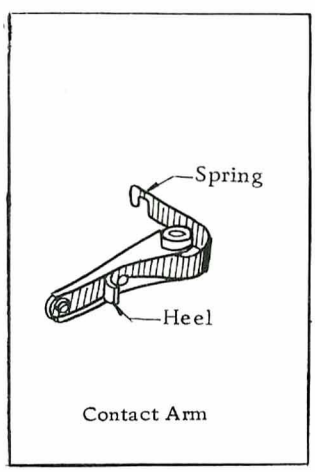


Fig. EE-79

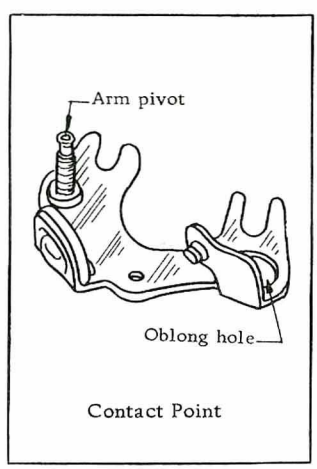


Fig. EE-80

Centrifugal Advance Mechanical Part

When sparking is made to mixed gas in the cylinder of engine, usually it takes time to make explosion instantly and make complete burning by getting required pressure inside cylinder. Becuase of time required for burning, ignition must be made to the mixed gas by sparking shortly before the piston comes to the upper dead point. This timing, however differs by rotation frequency. Centrifugal advancing device is to hasten ignition timing according to rotation velocity, as explained in the following. Refer to Fig. EE-83. When the shaft rotates unclockwise, weight opens automatically by centrifugal power with weight pivot as its center. However due to existence of spring, it keeps balance at the place where spring tension and centrifugal power equals. Pin B is knocked in weight and kept inside of the oblong hole of timing lever so that timing lever, (i.e., cam) advances as the weight moves.

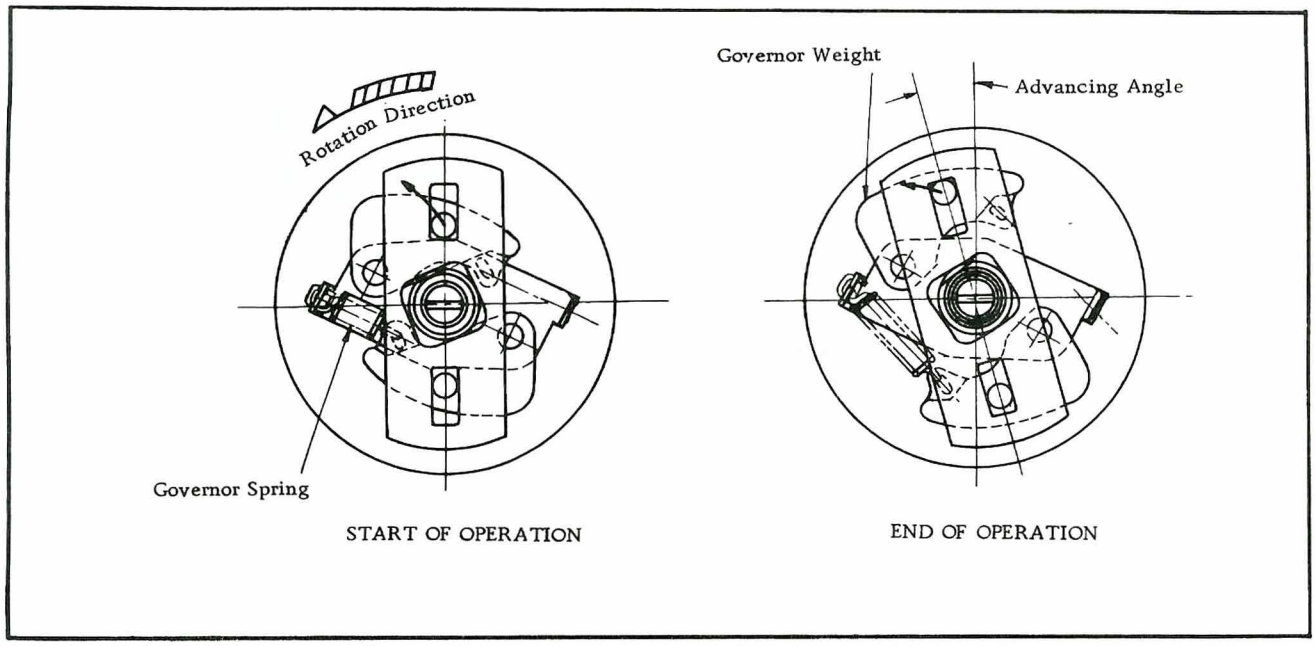


Fig. EE-83 Centrifugal Advance Mechanism

Vacuum Advance Mechanical Part

When mixing ratio is fixed, only centrifugal advance will do. However, in actuality, it varies by the load, so that adjustment is required in ignition timing. In case load is small, manifold load is considerably large and burning time is long. Quickening of ignition timing is required. In case load is large, on the other hand, manifold load is small and burning time is small. Decrease in advance is required.

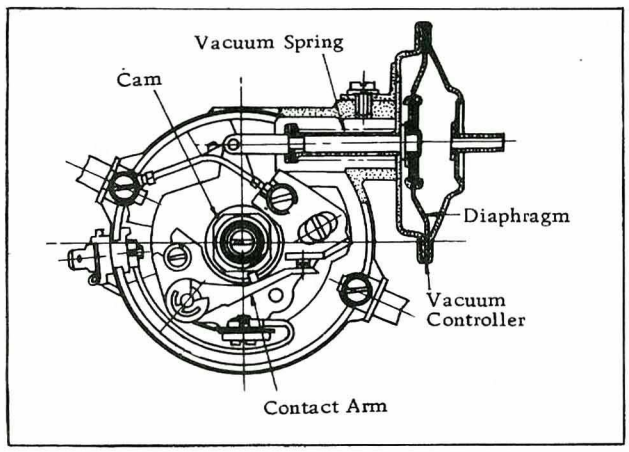


Fig. EE-84 Vacuum Advance Mechanism

Fig. EE-84 shows vacuum advance mechanism. Vacuum room and atomospheric room are divided by oil-proof diaphragm. The former is led by pipe to the vicinity of completely closed area of throttle valve. When vacuum increases, diaphragm moves toward right and rod turns whole breaker, thus advancing the distributor to that extent.

Note: In case Solex type carburetor is used, vacuum controler terminal is to be covered by vinyle cover since vacuum advance becomes unnecessary.

CHECKING AND ADJUSTMENT

Cap & Rotor Head

Cap & rotor head must always be kept clean to maintain good insulation durability since high tension voltage from ignition coil is imposed on them. Sometimes, inside of cap & rotor head is covered by only fine carbon powder and dust, cleaning is required by gasoline once in a month. Whenever crack or trace of leakage is found on the cap, it must be replaced with a new one.

Point

Standard size of point gap is 0.45 - 0.55 mm. In case size is off the standard, adjustment is required by loosening point screws (1) & (2) (Fig. EE-85). Gap gauge is required for adjustment. However, without gap gauge it can be adjusted by holding down the contact arm of which the stopper is 0.5 mm thick.

As for those with tungsten point, point gap must be checked at every 4,000 km run. Adjust it to size required in case it is off the standard. When surface of the point is not smooth, fine sand paper No. 500 or 600 or oily whetstone must be applied for smoothing. At this time, grease must be supplied to heel. In case wearing of point is remarkable, it must be replaced with a new one. In this case, contact arm and contact point are also to be replaced with. Details for replacement is as undermentioned. First loosen by 1 - 1.5 time of screw at contact arm and primary lead wire connection part to pull out primary lead terminal. In this case, however, notice not to loosen the screw excessively. Refer to Fig. EE-85.

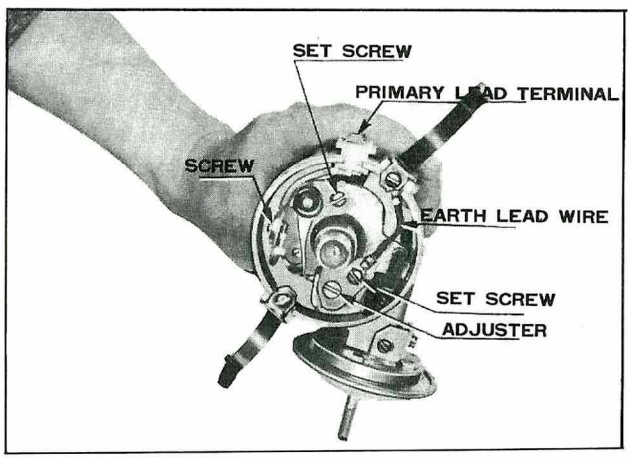


Fig. EE-85 Breaker

As shown by Fig. EE-86, hold the contact point by fingers and pull out toward you elevating it a little. Then both contact point and contact arm can be disconnected together.

Further, when stopper is disconnected, contact arm can easily be taken off from stem bar. When new contact set is connected, do simply just in opposite order. Apply slightly Grease on both arm pivot receiver and surface of cam.

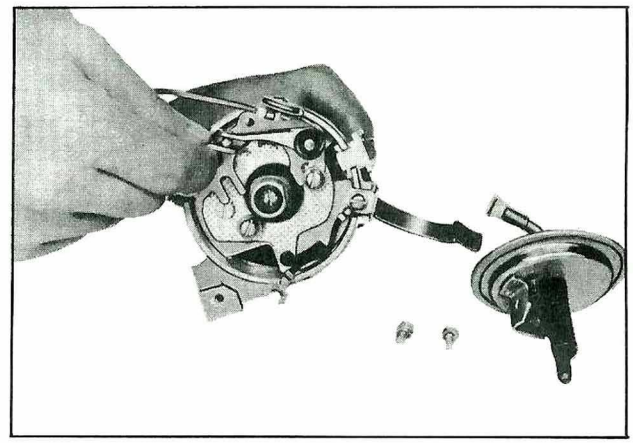


Fig. EE-86

Condenser

Performance of condenser depends on the setting and insulating condition. Thus, frequent checking is required to clean the outlet of lead wire and to prevent set screw from loosening.

Checking of condenser is made by capacity meter. Without capacity meter, it can be checked by tester by adjusting its range to measure large resistance value. When condenser is normal, tester arm swings largely instantly and gradually moves back to the infinite. In case the arm never stays or it points Zero in resistance, the transformer is out of order and must be replaced with.

Vacuum Advance Mechanical Part and Switch On-Off Part

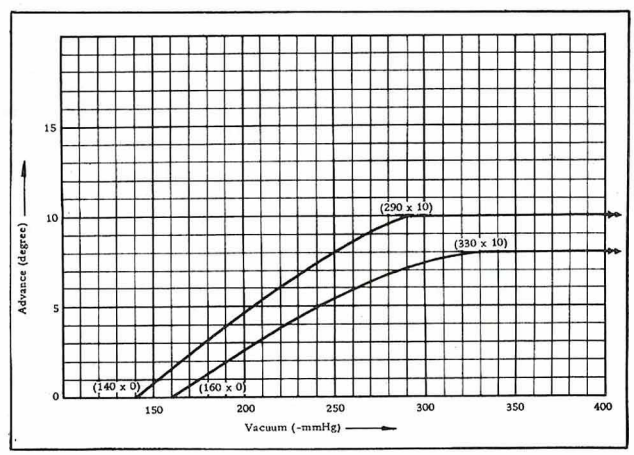


Fig. EE-87 Vacuum Advance Characteristic

Check whether or not vacuum advance mechanism operate by operation indicator attached to vacuum advance mechanism.
Followings are the causes considered for non-operation.

(1) Leakage of air due to incomplete fasening of vacuum inlet.

(2) Leakage due to defective diaphragm.

(3) Fixed side and moving side of breaker plate is fixed.

Solution for (1) is to make complete fastening and (2) is to replace it with a new one.

Solution for (3) is as follows:

(a) As shown by Fig. EE-88, moving side of breaker plate is supported by three steel balls for each up and down side. Do these balls work smoothly?

(b) Moving side of breaker plate is to rotate with pivot receiver of fixed side as a center. Does this pivot receiver move?

In case of assembly, be sure to put in 3 steel balls for each up and down side and to apply grease.

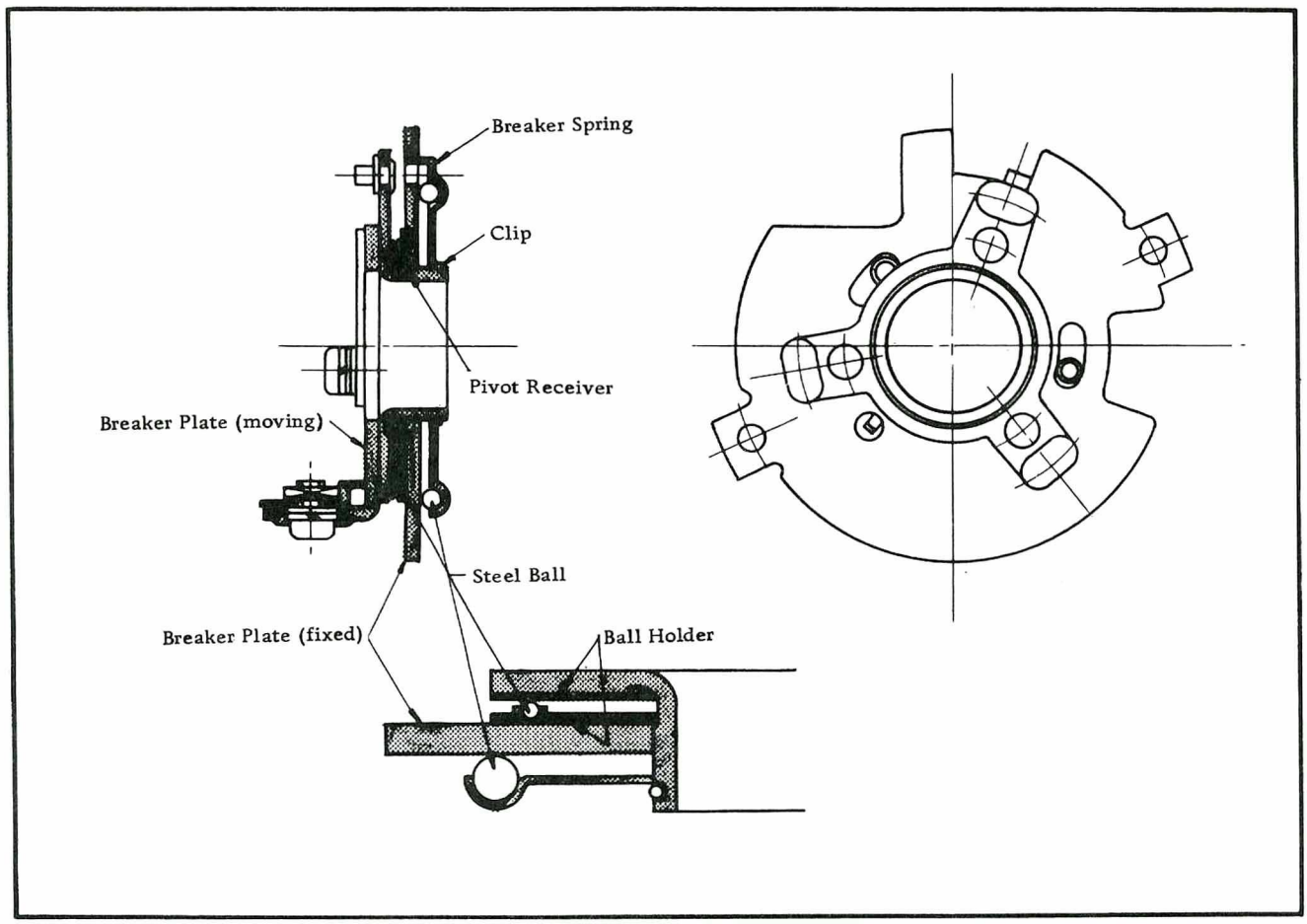


Fig. EE-88 Breaker Plate Collecting Part Mechanism

Centrifugal Advance Mechanism Part

When cause of engine trouble is traced to centrifugal advance mechanical part, use distributor tester to check its characteristic:
When nothing is wrong with its characteristic, causes conceivable are defectiveness or unusual wearing-out of driving part or others. So don't disassemble it. In case of improper characteristic, take off switch on-off part and check closely cam assembly, governor weight, shaft and governor spring, etc.

In case centrifugal advance mechanical part is reassembled, be sure to check advance characteristic by distributor tester.

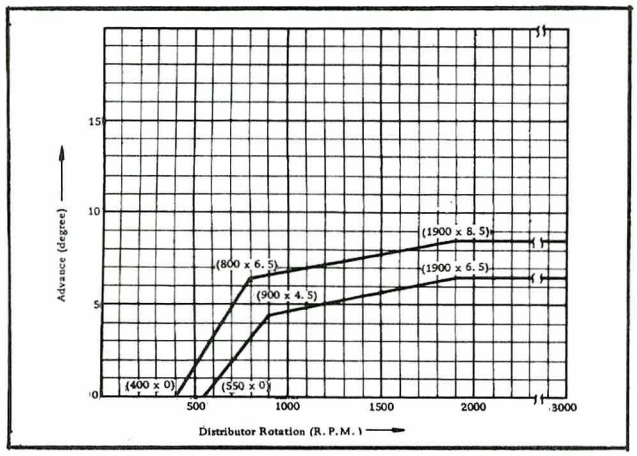


Fig. EE-89 Centrifugal Advance Characteristic

DISASSEMBLY AND ASSEMBLY

Disassembly

When distributor is disconnected from engine, position of distributor and rotor head for housing must be well remembered or marked. If distributor is set to wrong place, no operation become possible. Disassembly is to be made in the following order.

(1) Take off cap and disconnect rotor head.

(2) Take off vacuum controller (Fig. EE-90).

(3) Take off contact breaker (Fig. EE-90).
Reffer to page 111 when contact set is to be disconnected.

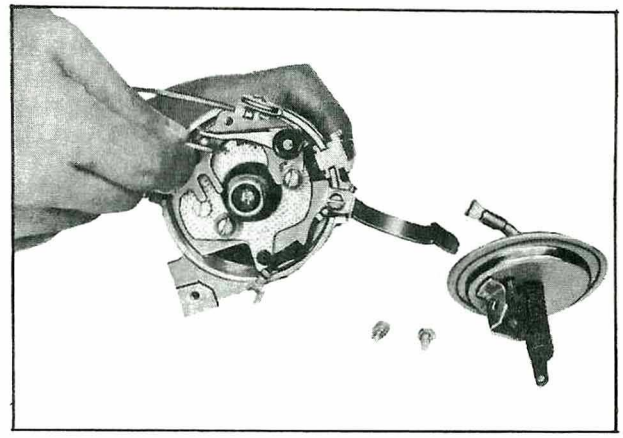


Fig. EE-90 Disassembly of Vacuum Controller

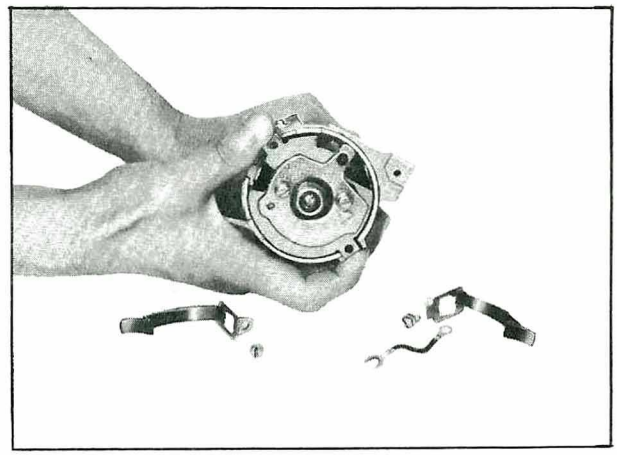


Fig. EE-91 Disassembly of Contact Breaker Plate

(4) When contact breaker is disassembled, take off clip in Fig. EE-88 to disconnect breaker plate (fixed) putting down breaker plate moving.
Be careful not to lose steel balls between breaker spring and breaker plate as well as those between breaker plates.

(5) Pull roll pin and disconnect coupling to pull out whole rotation part. However before pulling out, put counter mark on coupling and shaft or remember well relation between coupling direction and setting groove of cam rotor head. (Fig. EE-92).

(6) When cam is disconnected, take off set screw first since shaft head is fastened by screw to hold cam down. In this case also, put counter mark on cam and shaft or remember well the relation with ignition timing.

(7) When governor weight and spring are disconnected, be careful not to stretch or deform the governor spring. When disassembly is completed, apply grease to weight pivot.

(8) Fig. EE-93 shows complete disassembly.

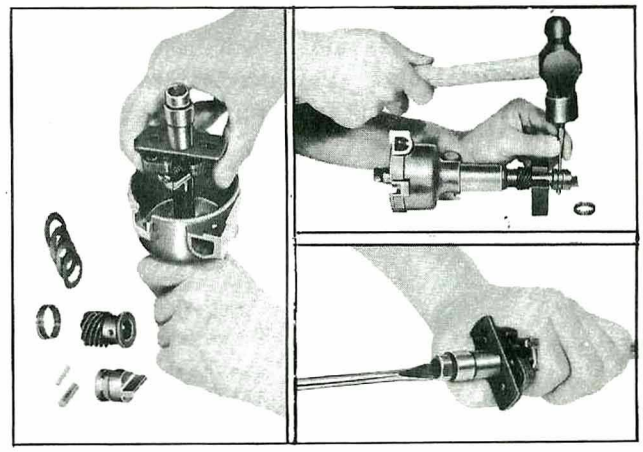


Fig. EE-92 Disassembly of Coupling Shaft and Cam

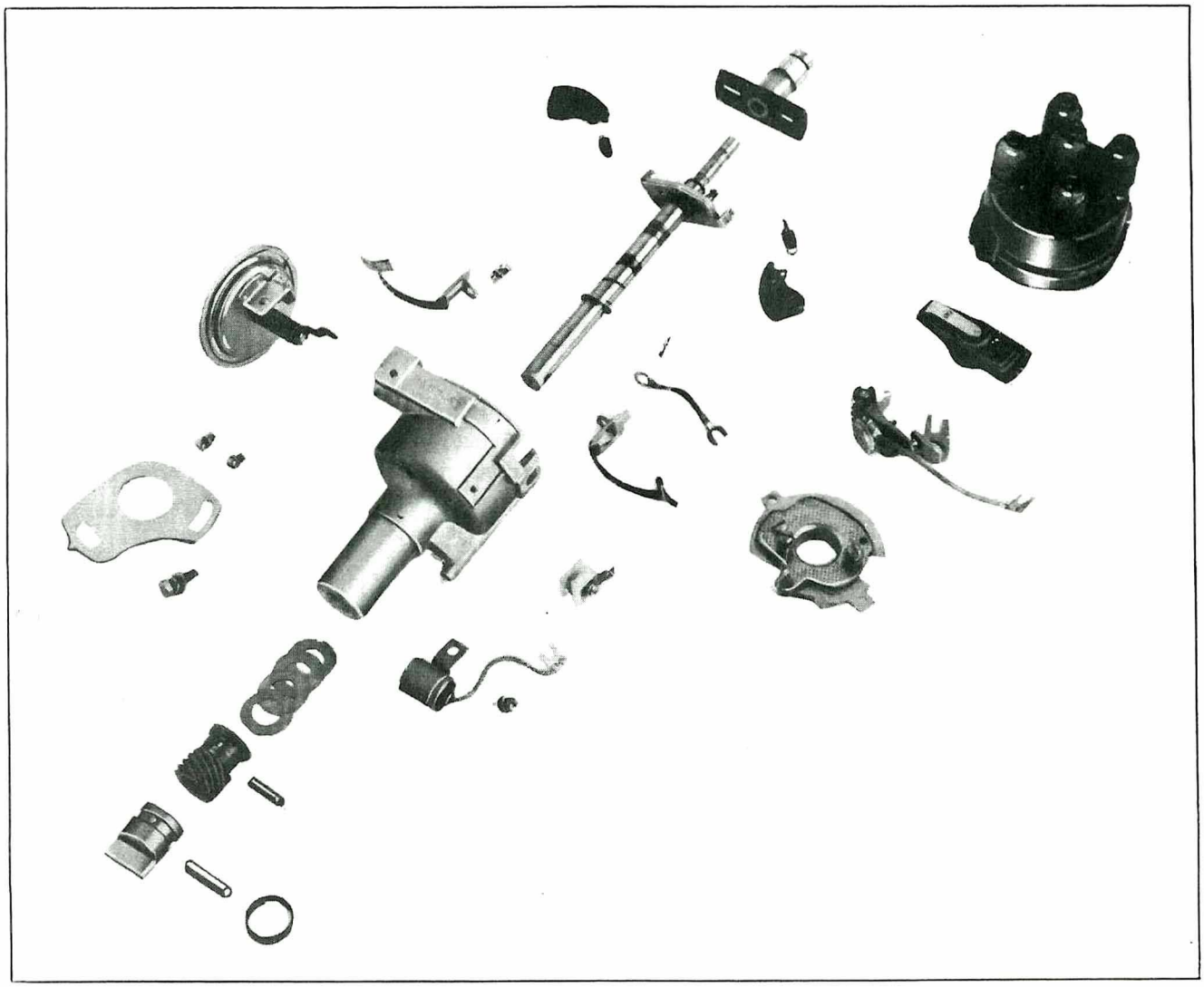


Fig. EE-93 Exploded View of Distributor

Assembly

In case of reassembly do it in just reverse way of disassembly. Pay attention to fastening and setting of coupling to cup particularly.

Refer to Fig. EE-94 at the time of replacement and reassembly of governor spring and cam.

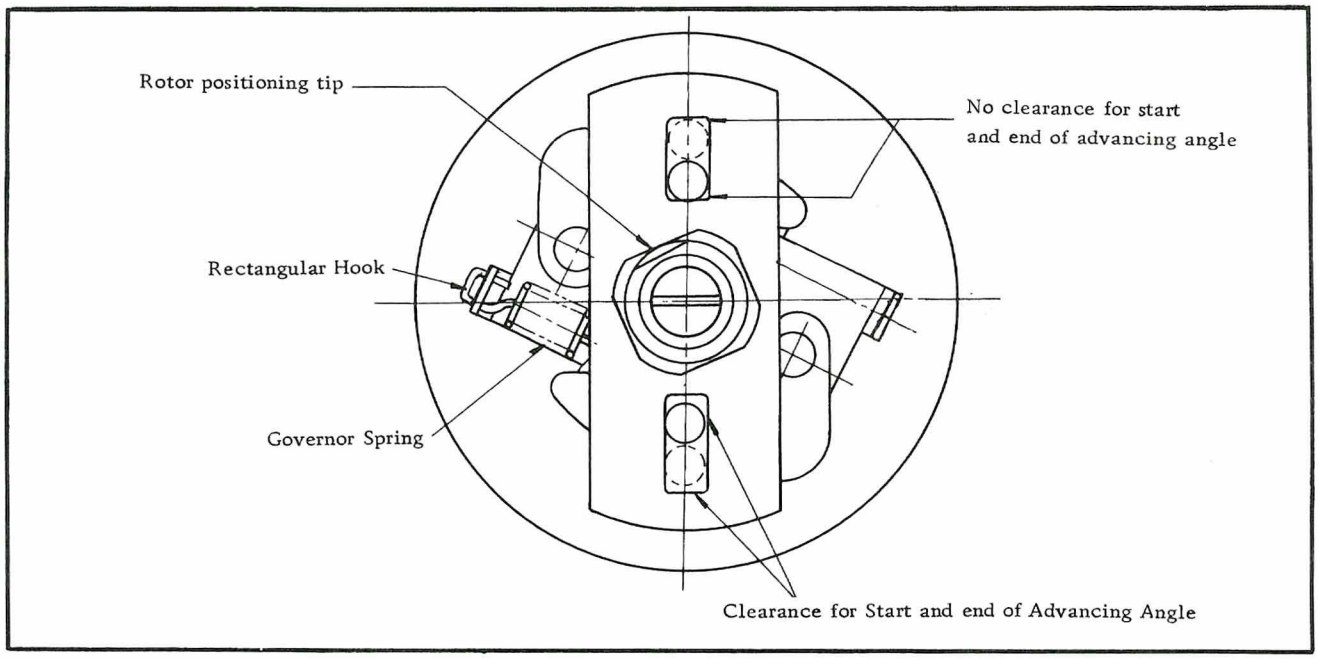


Fig. EE-94 Setting of Governor Spring and Cam

At the time of assembly, rotor head positioning tip at cam is to be set to governor spring side (rectangular hook). Then weight pin for governor spring (3) comes in long rectangular hole. It leaves clearance at the start and end of advancing.
Meanwhile, weight pin on opposite side comes in short rectangular hole. It does not leave clearance either at the start and end of advancing.

When assembly is completed, set it to engine after checking advance characteristic and confirming performance. Be sure to make adjustment of ignition timing after this. Adjustment must be made to let off the distributor point at degree position of upper dead point of first cylinder compression of engine.

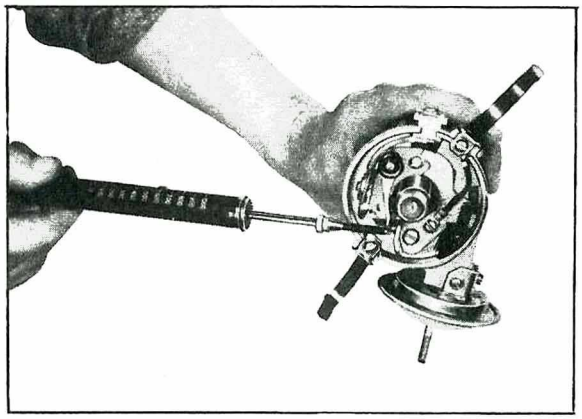


Fig. EE-95 Point Pressure Test

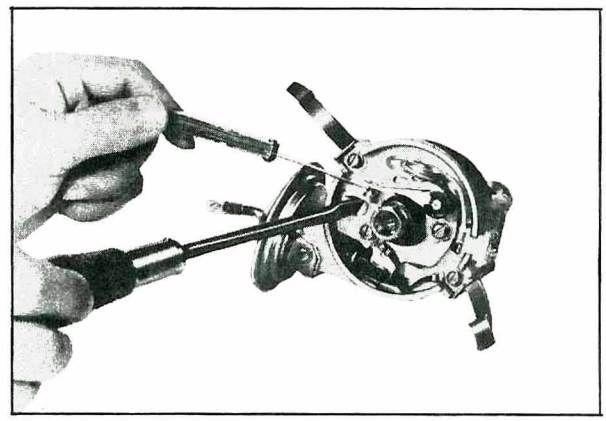


Fig. EE-96 Point Gap Measure

SERVICE DATA

Point Gap	0.45 ~ 0.55 mm	(0.0157 ~ 0.0196 in.)
Point Pressure	0.50 ~ 0.65 kg	(1.10 ~ 1.43 lb.)
Shaft Diameter (lower part)	$12.45\ ^{-0.010}_{-0.020}$ mm	($0.4902\ ^{-0.0004}_{-0.0008}$ in.)
Housing Inner Diameter	$12.45\ ^{+0.018}_{0}$ mm	($0.4902\ ^{+0.0007}_{0}$ in.)
Clearance between Shaft and Housing	0.010 ~ 0.038 mm	(0.0004 ~ 0.0015 in.)
Ammendment Limit of Clearance	0.08 mm	(0.0031 in.)
Shaft Diameter (upper part)	$8\ ^{-0.005}_{-0.014}$ mm	($0.3150\ ^{-0.0002}_{-0.0006}$ in.)
Cam Inner Diameter	$8\ ^{+0.015}_{0}$ mm	($0.3150\ ^{+0.0006}_{0}$ in.)
Clearance between Shaft and Cam	0.005 ~ 0.029 mm	(0.0002 ~ 0.0036 in.)
Weight Pivot Diameter	$5\ ^{-0.010}_{-0.028}$ mm	($0.1575\ ^{-0.0004}_{-0.0010}$ in.)
Weight Hole Diameter	$5\ ^{+0.018}_{0}$ mm	($0.1575\ ^{+0.0007}_{0}$ in.)
Clearance between Pivot and Hole	0.01 ~ 0.046 mm	(0.0004 ~ 0.0025 in.)

NISSAN

TRANSMISSION

SERVICE MANUAL

NISSAN MOTOR CO., LTD.

TRANSMISSION

TRANSMISSION

MODEL FS5C71A TRANSMISSION

GENERAL DESCRIPTION

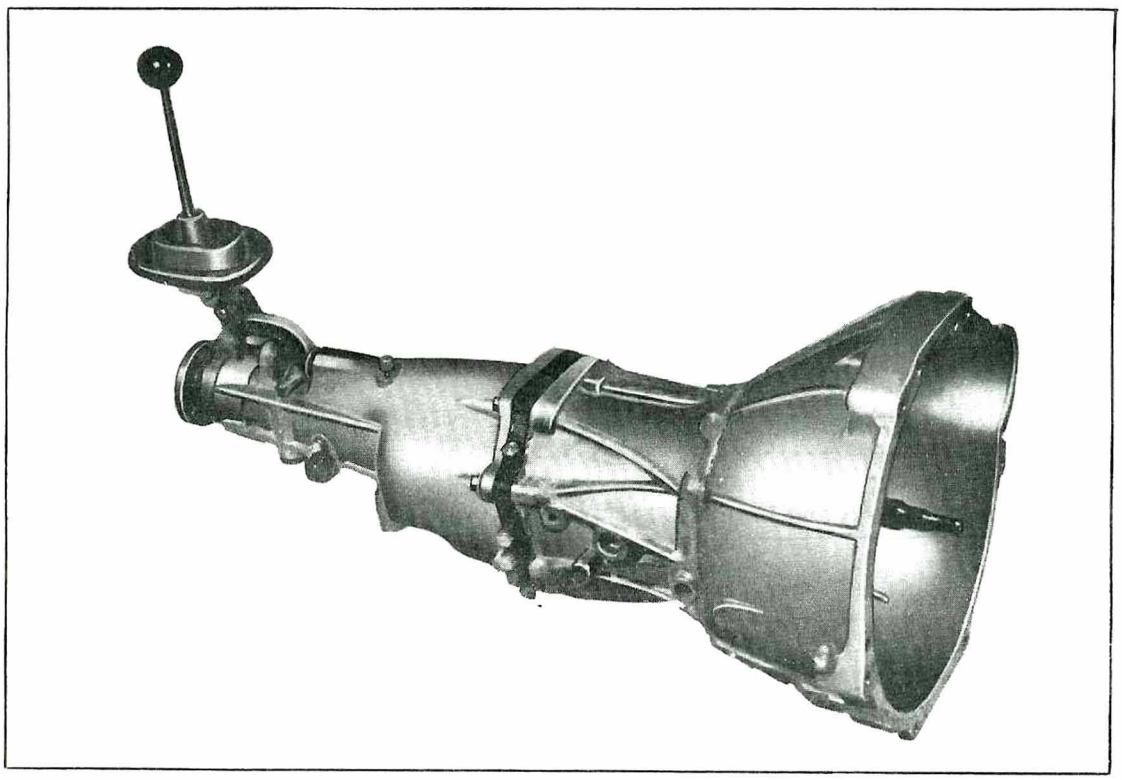


Fig. TM-1

TYPE FS5C71A transmission has 5 stage with over drive gear and divided type.

The clutch housing, gear case and rear extention can be easily divided, moreover, as the gear assembly is fixed to the gear case with the adaptor, the gear assembly can be easily taken out from the gear case.

The front cover of the transmission is constructed in a body to the clutch housing and the synchronizing method is servo type.

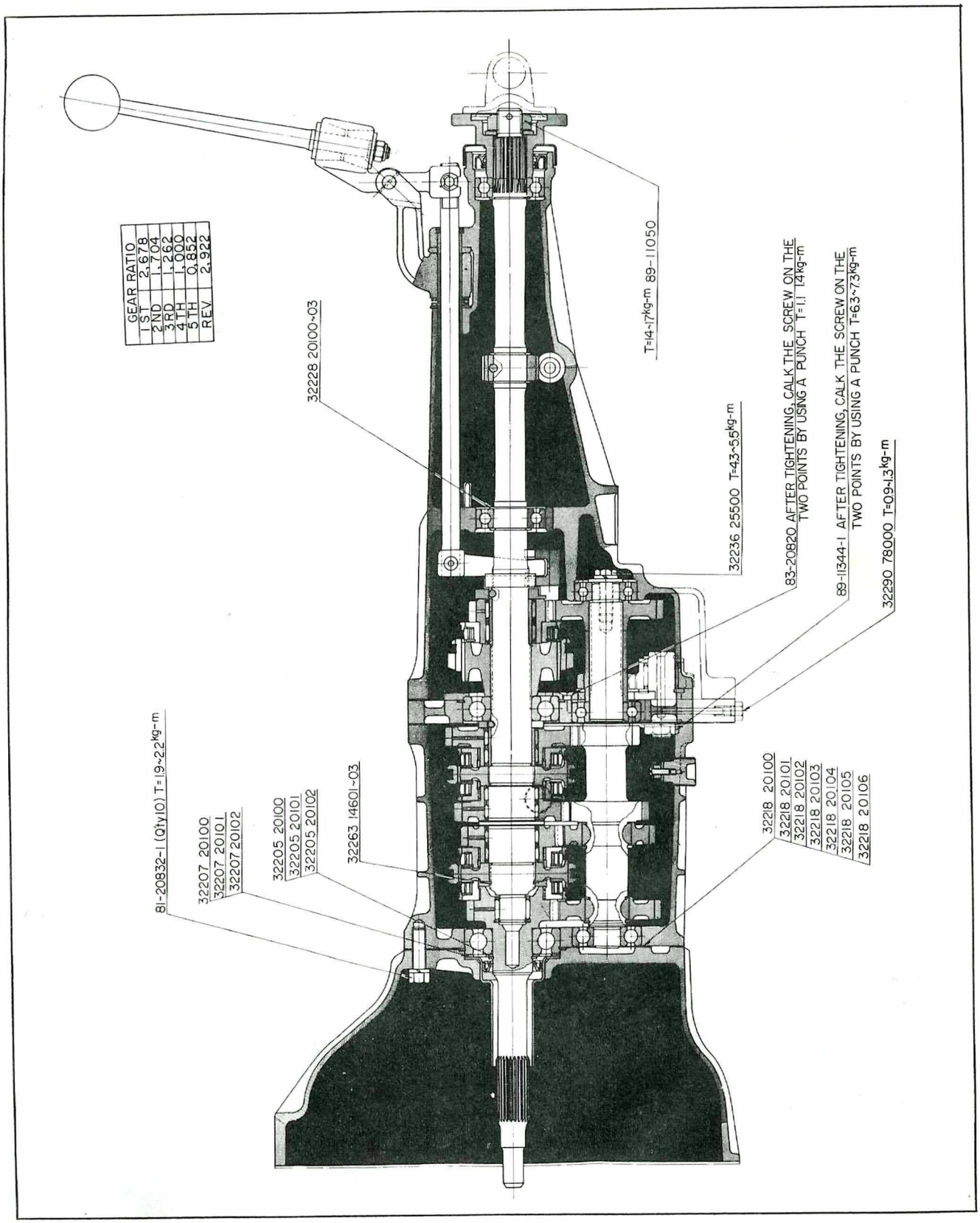

GEAR RATIO
1ST 2.678
2ND 1.704
3RD 1.262
4TH 1.000
5TH 0.852
REV 2.922
32228 20100-03
T=14~17kg-m 89-11050
32236 25500 T=43~55kg-m
83-20820 AFTER TIGHTENING, CALK THE SCREW ON THE TWO POINTS BY USING A PUNCH T=1.1 14kg-m
89-11344-1 AFTER TIGHTENING, CALK THE SCREW ON THE TWO POINTS BY USING A PUNCH T=6.3~7.3kg-m
32290 78000 T=0.9~1.3kg-m
81-20832-1 (Qty 10) T=1.9~2.2kg-m
32207 20100
32207 20101
32207 20102
32205 20100
32205 20101
32205 20102
32263 14601-03
32218 20100
32218 20101
32218 20102
32218 20103
32218 20104
32218 20105
32218 20106

Fig. TM-2

SERVICE OPERATION

DISMOUNT AND DISASSEMBLE

Inspect Transmission Oil

1) Check the transmission oil level before disassembly with the vehicle at normal flat condition.
   The oil level and the oil condition can be used as a factor for judging the cause of the trouble.
2) As the drain plug has magnet, the condition of its gathering the iron particles will be a reference factor for analyzing the trouble.
3) Check the impurities or dirts obtained at screening the drained oil before disassembly.
4) Record the place of leakage if any found before disassembly on the followings.
   a) Oil leakage at oil seal.
   b) Oil leakage at packings.

Dismount Ass'y Transmission

Transmission can not be dismount with Engine in the car.

So to dismount and mount transmission assembly, remove Engine and Transmission as a unit from the car.

Refer to Engine-Remove and Replace procedure.

Detach Rear Extension, Clutch Housing and Gear Case

1) Drain Gear Oil.
2) Disconnect Striking Rod from Control Lever.
3) Pull up Split Pin and release nut and remove Companion Flange from Rear Extension.
4) Release fixing bolts and detach Rear Extension, disengaging Striking Rod from Fork Rods.

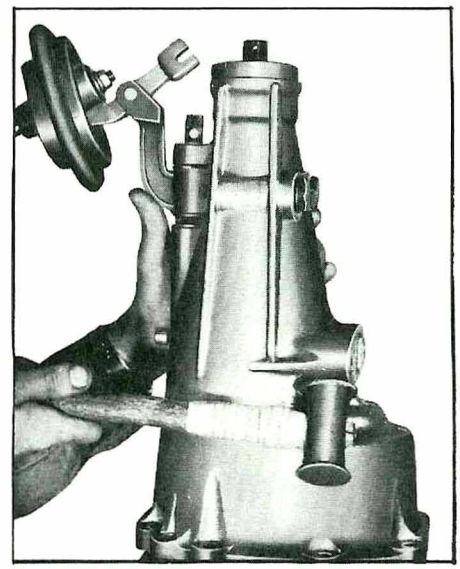


Fig. TM-4

5) Remove Oil Seal and Bearing, if required.
6) Remove Select Spring Plug and take out Select Spring & Select Pin, if required.
7) Pull out Striking Rod and remove "O" ring Cap and Bush-Striking, then remove Control Arm, if required.
8) Release fixing bolts and detach Clutch Housing from Gear Case.

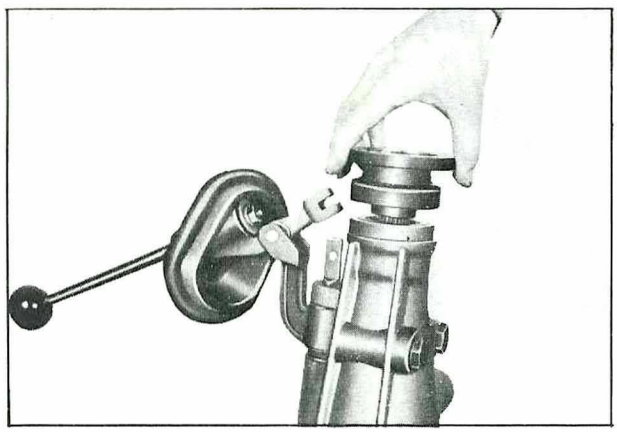


Fig. TM-3

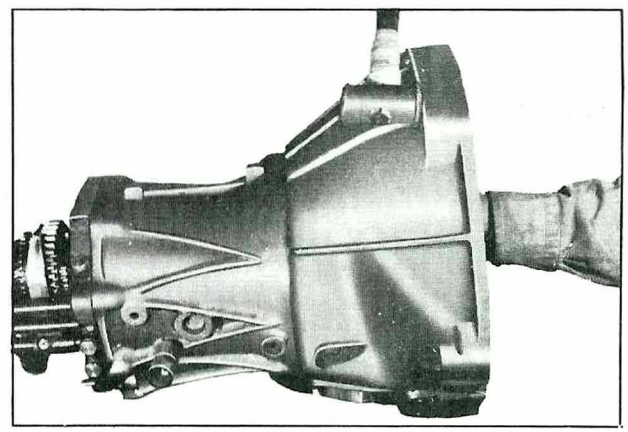


Fig. TM-5

9) Remove Stopper Ring on Main Drive Gear Bearing and detach Gear Ass'y from Transmission Gear Case.

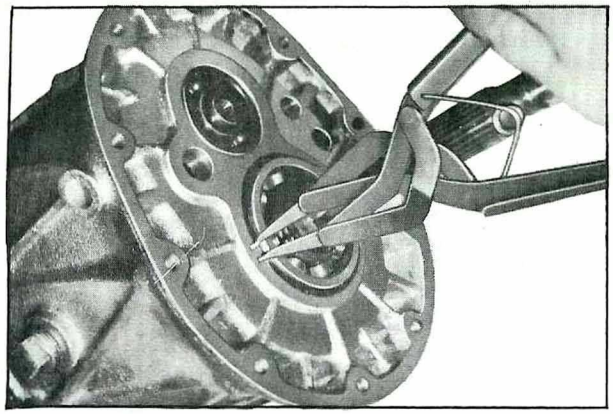


Fig. TM-6

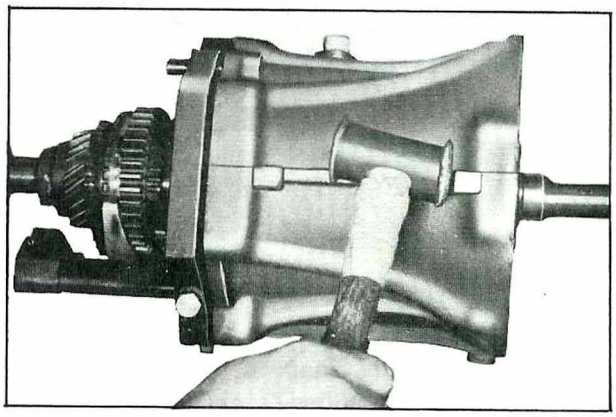


Fig. TM-7

Disassemble Gear Ass'y

1) Push out all Retaining Pins from Forks and Fork Rods, using a suitable drift.

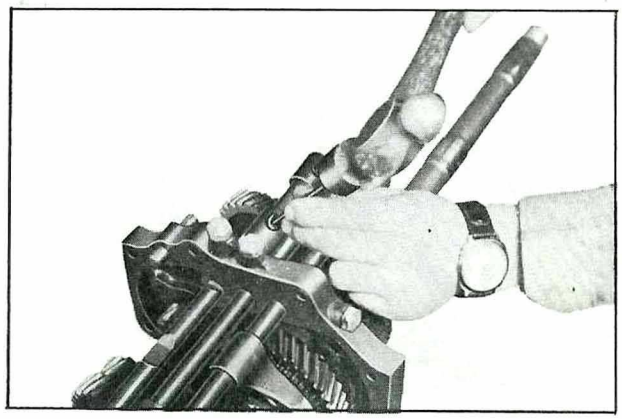


Fig. TM-8

2) Remove Checking Plugs and take out Checking Springs and Steel Balls.

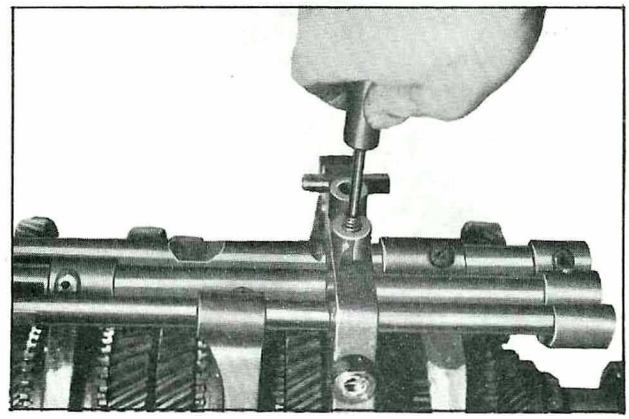


Fig. TM-9

3) Remove 1st-2nd, 3rd-4th & Reverse-5th Rods and four Check Balls.

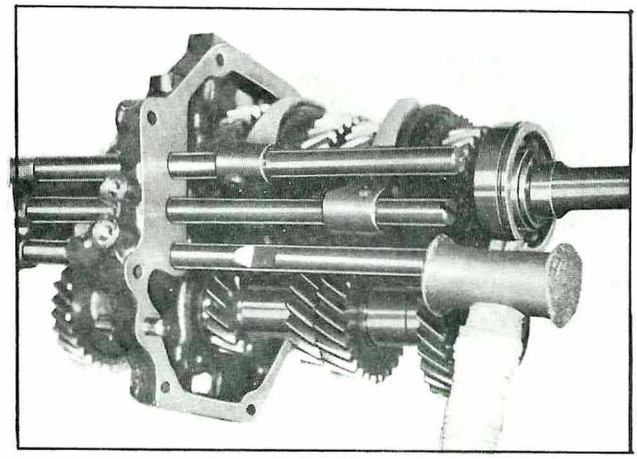


Fig. TM-10

4) Vise Adapter Plate on a suitable stand.

5) Remove Snap Rings on Main Shaft rear end and Speedometer Drive Gear rear end.
Then, pull out Speedometer Gear.

6) Remove two Snap Rings and pull out Bearing-Main Shaft Over Drive.
Remove a remaining Snap Ring.

7) Stretch Lock Plate and release Nut-Main Shaft.
Remove Nut, Lock Plate and Thrust Washer.

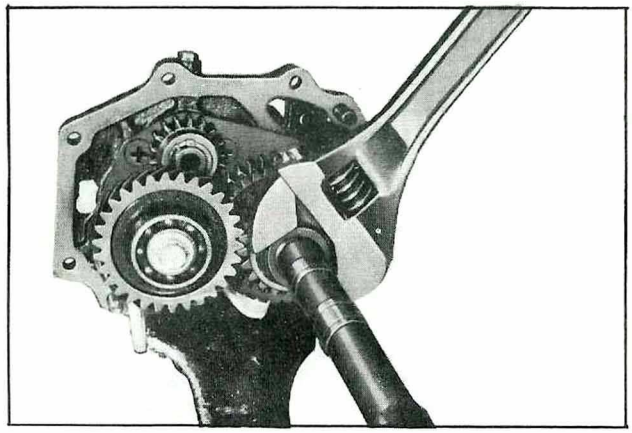


Fig. TM-11

8) Remove Bolt and Washer from Counter Shaft rear end and Pull out Bearing and Gear-Counter Shaft Over Drive together.

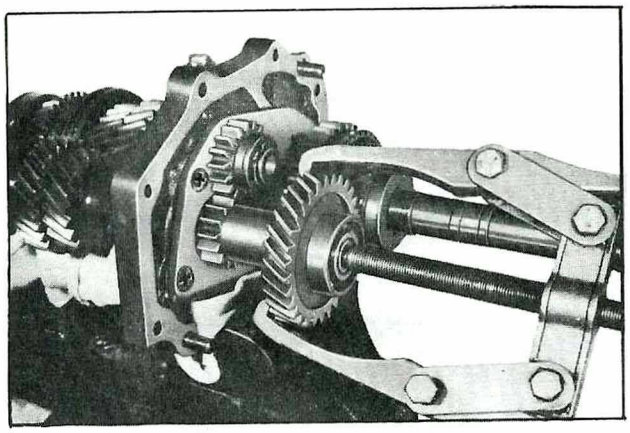


Fig. TM-12

9) Remove Over Drive Gear Ass'y, Needle Roller Bearing and Bushing.

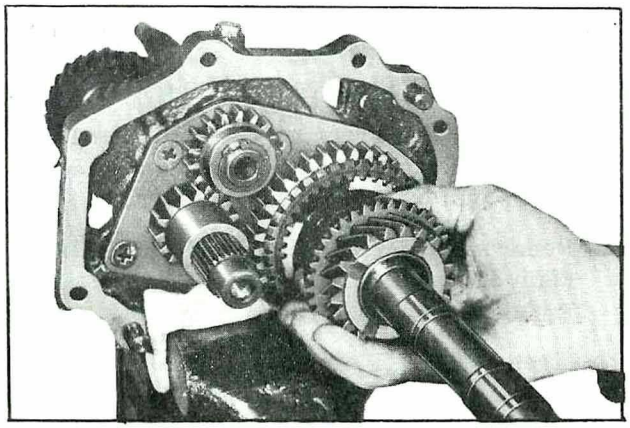


Fig. TM-13

10) Remove Reverse Gear Idler by removing Snap Ring.

11) Pull out Reverse Gear-Main Shaft and Reverse Gear-Counter Shaft.

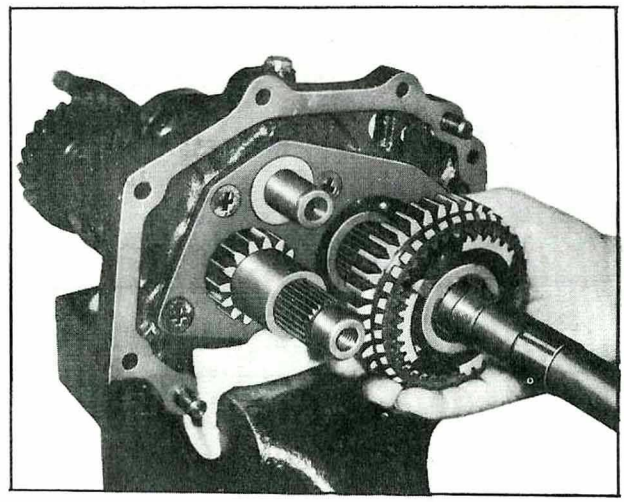


Fig. TM-14

12) Remove Main Shaft Bearing Retainer to Adapter Plate Screws and detach Bearing Retainer.

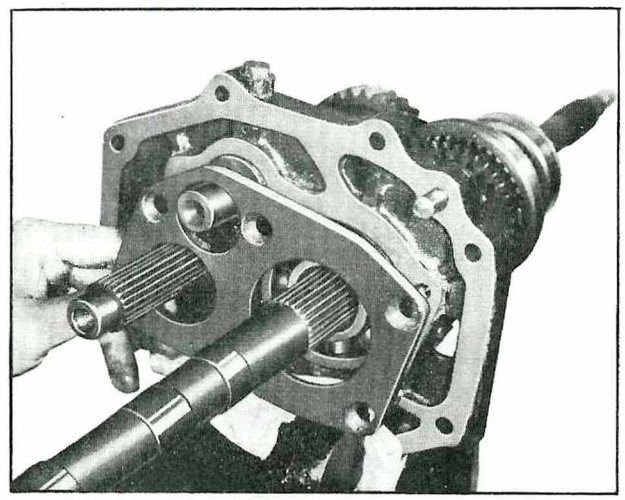


Fig. TM-15

13) Remove Counter Shaft and Main Shaft Assembly together, hitting lightly the outer races of Both Bearings.

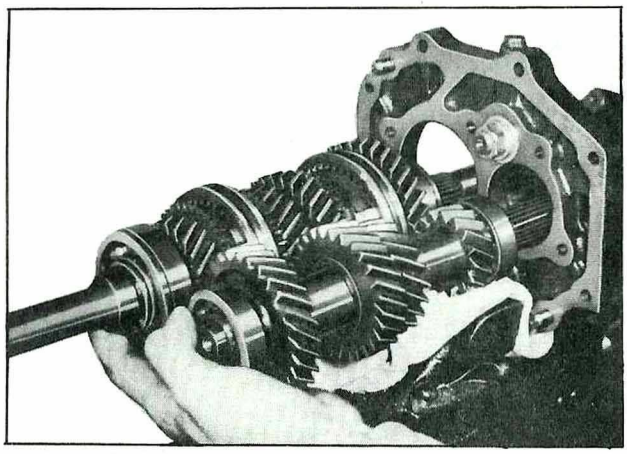


Fig. TM-16

Disassemble Main Shaft

1) Remove Main Shaft Bearing and Thrust Washer.

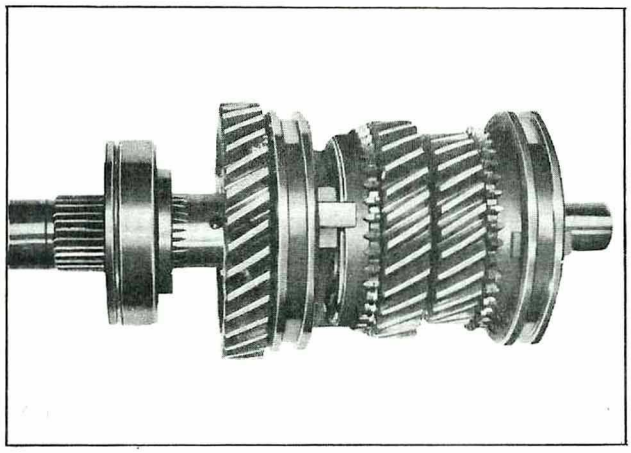


Fig. TM-17

2) Remove 1st Gear Ass'y, Needle Roller Bearing and Bushing.

3) Pull out Hub-Synchronizer and Coupling Sleeve.

4) Remove 2nd Gear Ass'y and Needle Roller Bearing.

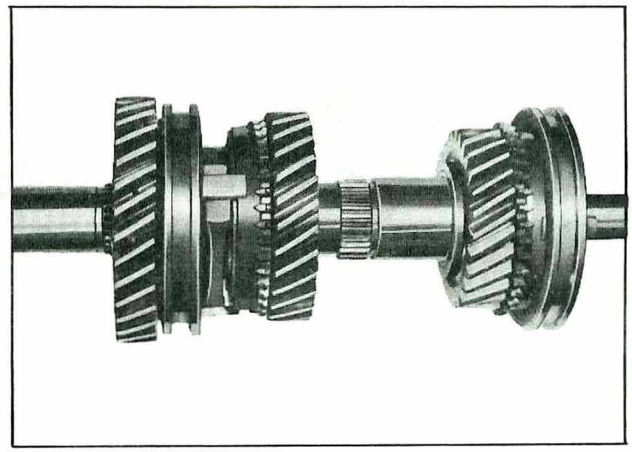


Fig. TM-18

5) Remove Snap Ring on Main Shaft front end and pull out Hub Synchronizer & Coupling Sleeve.

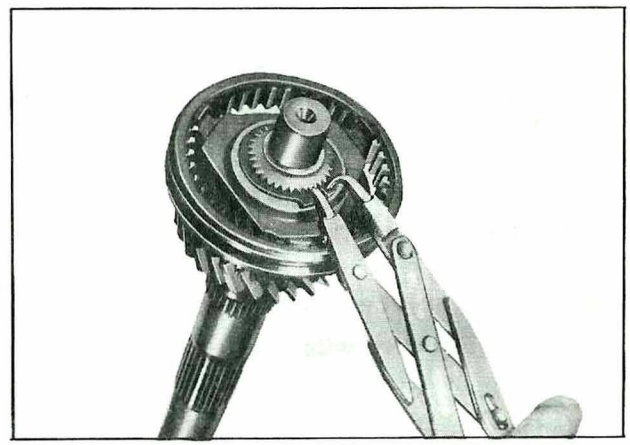


Fig. TM-19

6) Remove 3rd Gear Ass'y and Needle Roller Bearing.

Inspect and Replace Disassembled Parts

1) Check Oil Seals and "O" Rings for wear, damage, hardening of Oil Seal Lip and Outside condition.
Replace them, if they are damaged.

2) Check Bearings and replace if they are damaged.

3) Check Gears and replace if they are damaged.

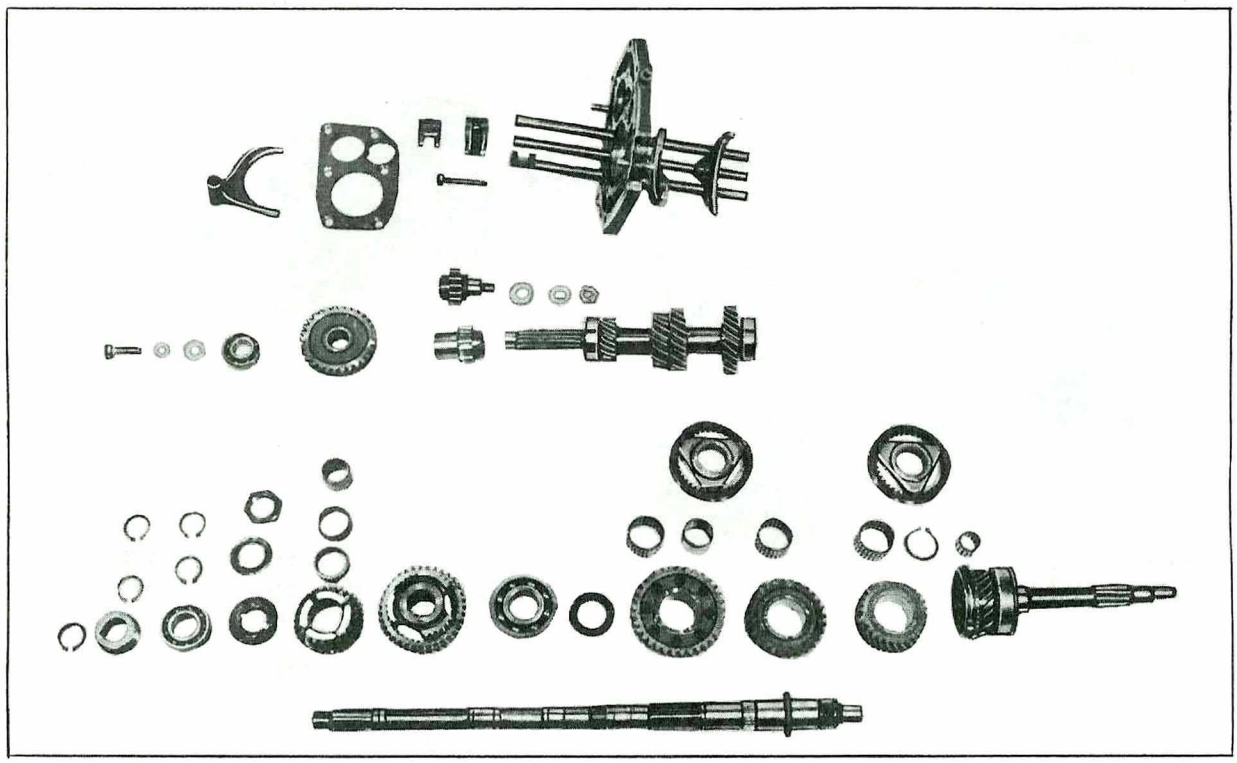


Fig. TM-20

ASSEMBLE AND MOUNT

Clean and Replace Each Part

1) Clean every part with clean solvent and lubricate with the transmission oil.
2) Remove the old gasket throughly and clean the trace of the sealing compound by thinner or carbon tetrachrolide.
   Coat the new gasket with the specified compound.
3) Replace Oil seals with new ones. Apply the multi-purpose grease to the lip of the oil seal.
4) Replace damaged snap rings with new ones.

Subassembling of Main Parts

1) Assemble Synchronizer ring to each gear.

1. Place each gear on a flat place.
2. Install Synchronizer ring into the inside of Clutch gear on each gear.
3. Install Thrust block to each gear.
4. Install Anchor block to each gear.

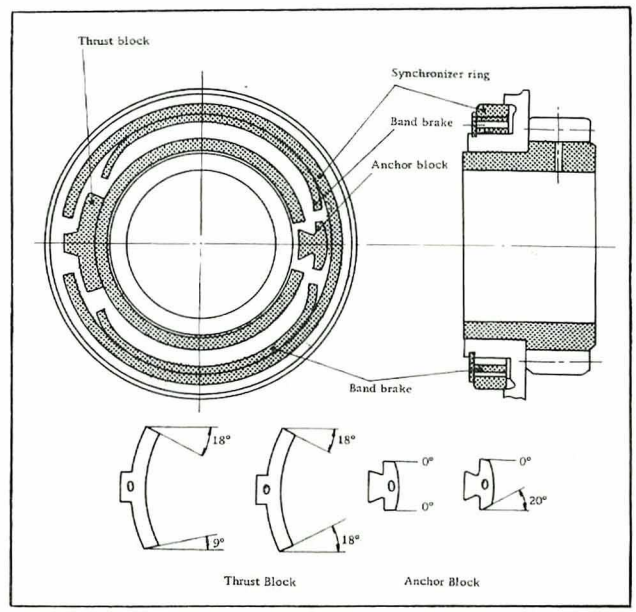


Fig. TM-21

	1st	2nd	3rd	M/D	O.D
Synchronizer ring	32611 14600	32611 14600	32611 14600	32611 14600	32316 20100
Thrust block	32617 14601 18°-9°	32612 14601 18°-18°	32612 14601	32612 14601	32362 20100 18°-18°
Anchor block	32618 14601 0°-20°	32613 14601 0°-0°	32613 14601	32613 14601	32363 20100 0°-0°
Band brake	32614 14604 2.5t 32615 14600 2.2t	32614 14600 2.5t	32614 14600	32614 14600	32364 20100 2.5t
Circlip	32616 14600	32616 14600	32616 14600	32616 14600	32366 20100

5. Install Brake band as shown in Fig. TM-21.
6. Install Circlip into the groove of each gear.

2) Install Reverse Idler Shaft to Adapter Plate.

1. Press Reverse Idler Shaft into Adapter Plate, with a suitable drift, setting the set-screw hole location.
2. Install Set-screw, smearing with some adhesive compound for sealing.
3. Install Washer, Spring washer and Nut into Reverse shaft and tighten to 6.3 ~ 7.3 kg-m (45.55 ~ 52.78 ft-lb) torque.

3) Rear Extension-Assemble

1. Install "O" rings on both ends of Control Arm.

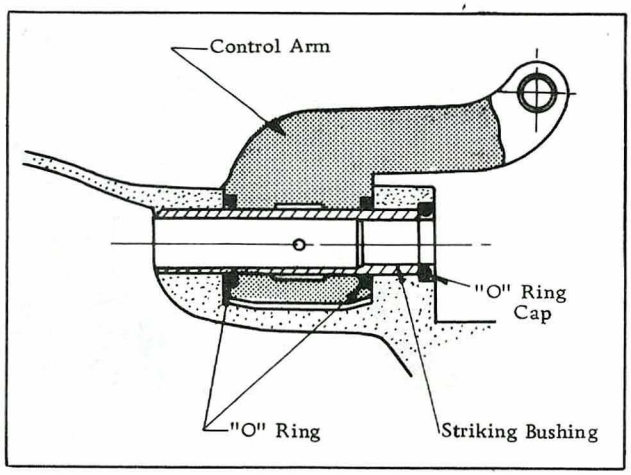


Fig. TM-22

2. Install Control Arm into Rear Extension and press in Striking Bushing by a suitable drift.
3. Install "O" ring and Retainer into Striking bushing rear end.
4. Install Control lever bracket into Control arm and insert control lever pin with washers.
5. Retain Control lever pin with Retaining pin.

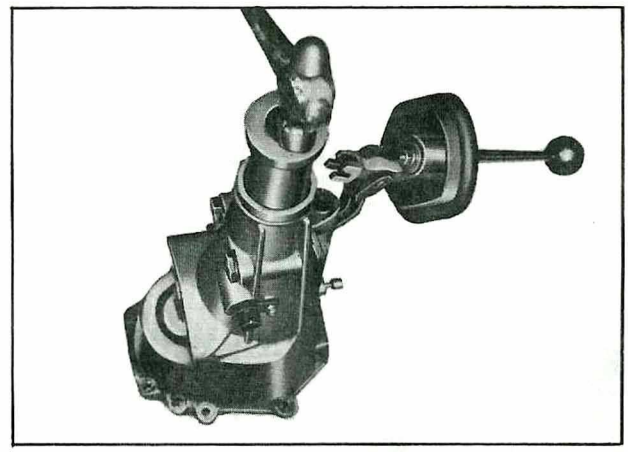


Fig. TM-23

6. Press Rear Extension Bearing into Rear Extension, using a drift.
7. Install Oil Seal.

4) Main Shaft-Assemble

1. Install Needle roller bearing and 3rd Gear Assembly into Main Shaft front end.

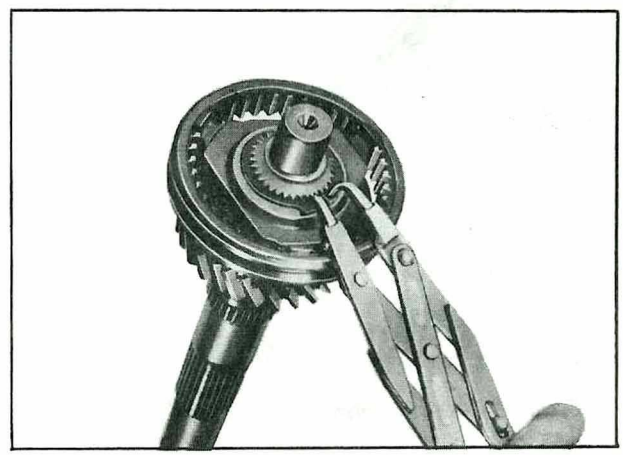


Fig. TM-24

2. Install Synchronizer Hub and retain with Snap Ring.
3. Install Coupling Sleeve.
4. Install Needle roller bearing and 2nd Gear Assembly into Main Shaft from the rear end.
5. Press Synchronizer Hub into Main Shaft with a suitable drift.
6. Install Coupling Sleeve into 1st & 2nd Synchronizer Hub.
7. Press 1st speed gear bushing into Shaft.
8. Install Needle roller bearing and 1st Gear assembly.
9. Install Thrust washer and Lock ball.
10. Press in Main Shaft Bearing, using a suitable drift.

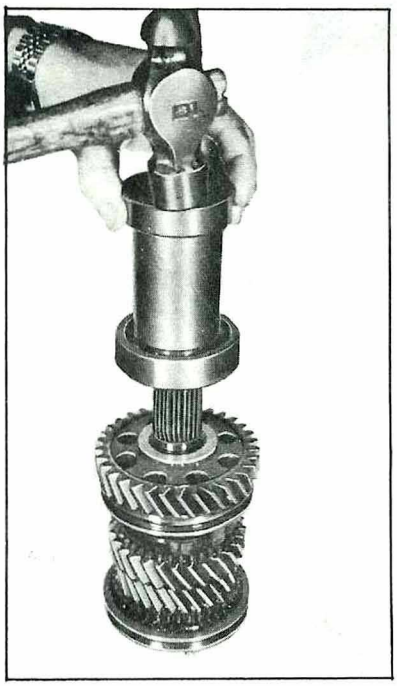


Fig. TM-25

5) Counter Shaft-Assemble

Press Counter Shaft Bearings into both ends of Counter Shaft, using a suitable drift.

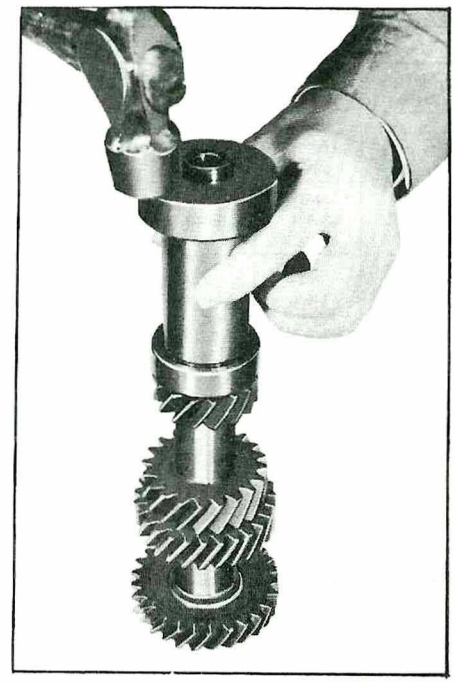


Fig. TM-26

Assemble Gear Ass'y

1) Vise Adapter Plate on a suitable stand.
2) Assemble Main Shaft Ass'y, Main Drive Shaft Ass'y and Counter Shaft Ass'y together into Adapter Plate.

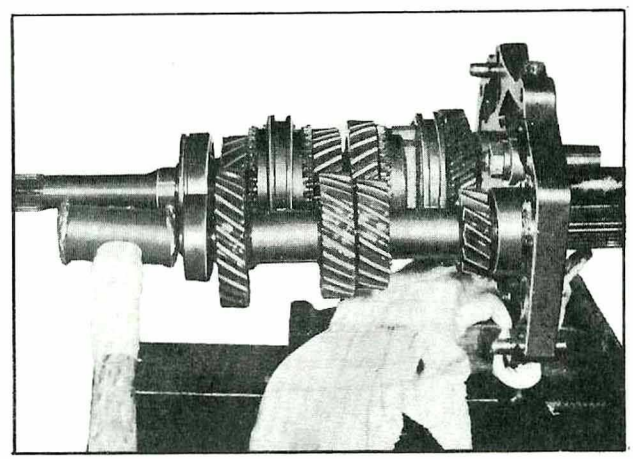


Fig. TM-27

3) Install Counter Shaft Bearing Ring at the rear end of Counter Shaft Bearing and Stopper Ring at Main Shaft Bearing.

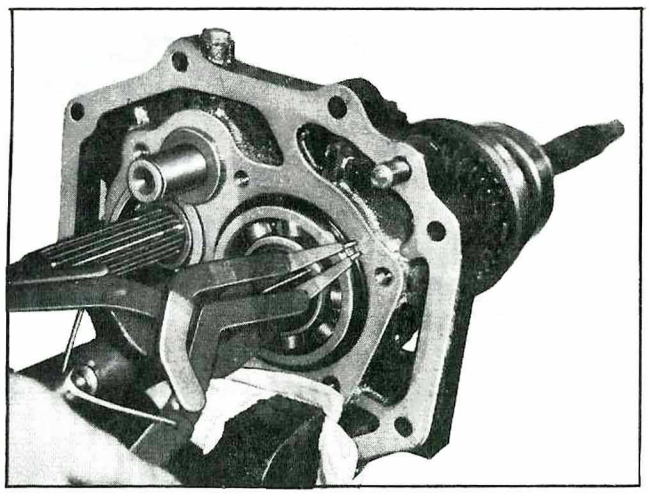


Fig. TM-28

4) Install Main Shaft Bearing Retainer. Tighten Screws to 1.1 ~ 1.4 kg-m (7.95 ~ 10.12 ft-lb) torque.

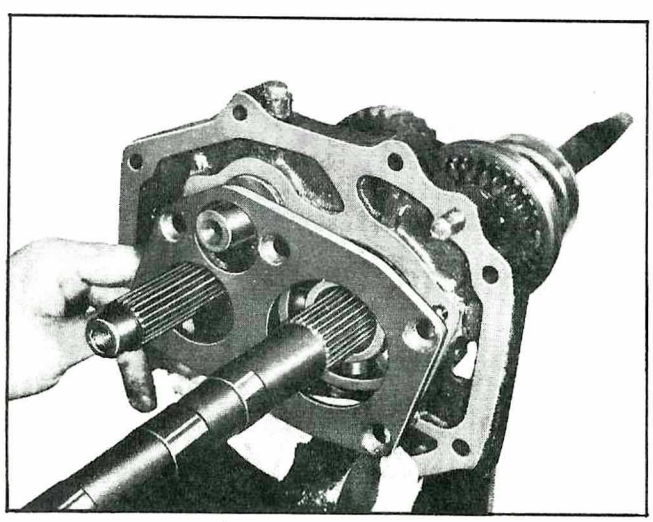


Fig. TM-29

5) Install Hub Synchro-Over Drive and Reverse Gear into Main Shaft, using a suitable drift.

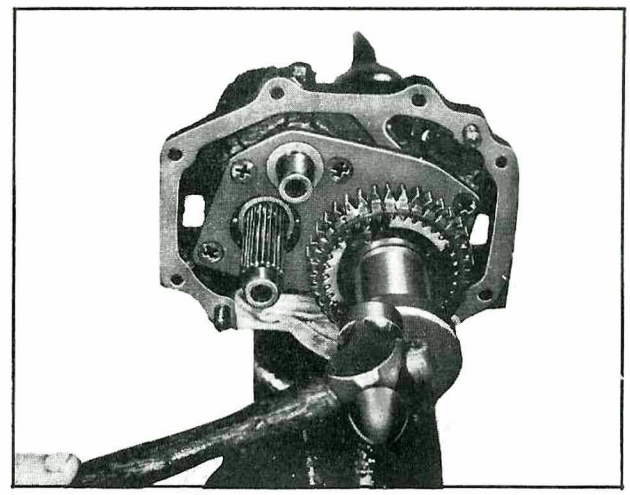


Fig. TM-30

6) Press Reverse Gear into Counter Shaft, using a drift.

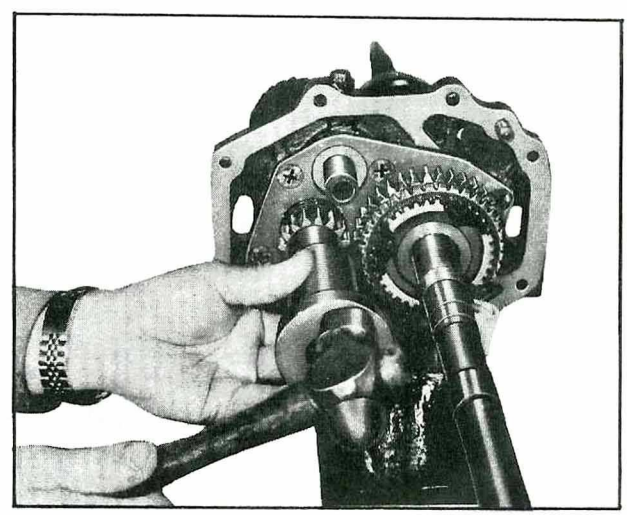


Fig. TM-31

7) Install Needle Roller Bearing, Reverse Idler Gear and Thrust Washer into Reverse Idler Shaft.
Retain with Snap Ring.

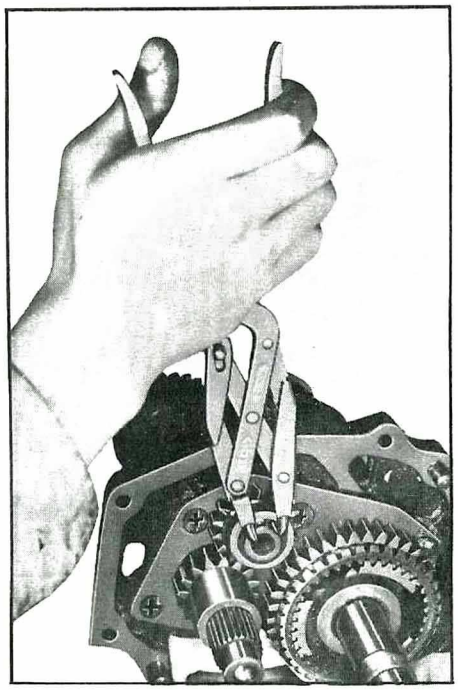


Fig. TM-32

8) Install Bushing-Main Shaft Over Drive, using a suitable drift.

9) Install Needle Roller Bearing and Over Drive Gear Assembly.

10) Press Over Drive Gear-Counter Shaft into Counter Shaft.

11) Press Bearing-Counter Shaft Over Drive into the rear end of Counter Shaft.

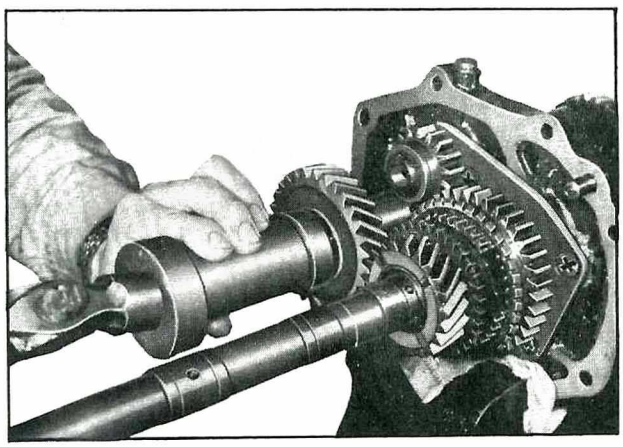


Fig. TM-33

12) Install Washer, Spring Washer and Bolt into Counter Shaft.

13) Tighten Bolt-Counter Shaft to 4.3 ~ 5.5 kg-m (31.09 ~ 39.77 ft-lb) torque.

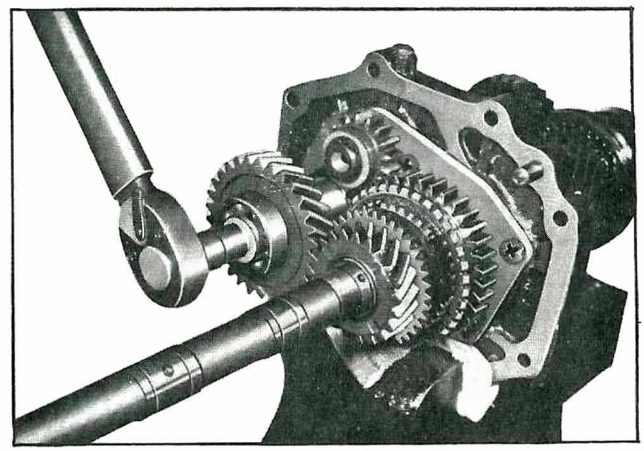


Fig. TM-34

14) Install Lock Ball and Thrust Washer.

15) Install Lock Plate and Nut. Do not tighten.

16) Tighten Nut-Main Shaft to 17 ~ 20 kg-m (122.9 ~ 144.6 ft-lb) torque, and turn over the lock plate to lock the nut.

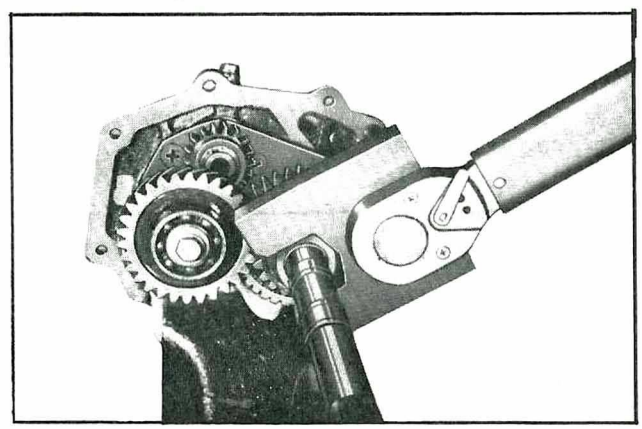


Fig. TM-35

17) Install Snap ring into the groove.

18) Press Over Drive bearing into Main shaft and retain with Snap ring in order.

19) Install Snap ring, Steel ball, Speedometer gear and Snap ring.

20) Install Reverse fork and insert Fork rod-reverse & Over drive with bracket.

21) Match Fork rod hole with the hole of Reverse Fork and insert Retaining pin.

22) Install two steel balls into Check ball hole.

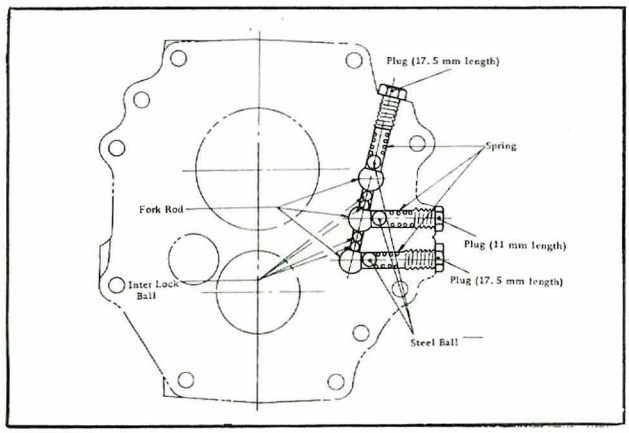


Fig. TM-36

23) Install Fork-3rd & 4th and insert Fork rod with bracket.

24) Insert Retaining pin.

25) Install two steel balls into Check ball hole.

26) Install Fork-1st & 2nd and insert Fork rod with bracket.

27) Insert Retaining Pin.

28) Install two steel balls into Check ball hole. into each check ball hole and screw in Checking plugs, smearing with the adhesive compound.

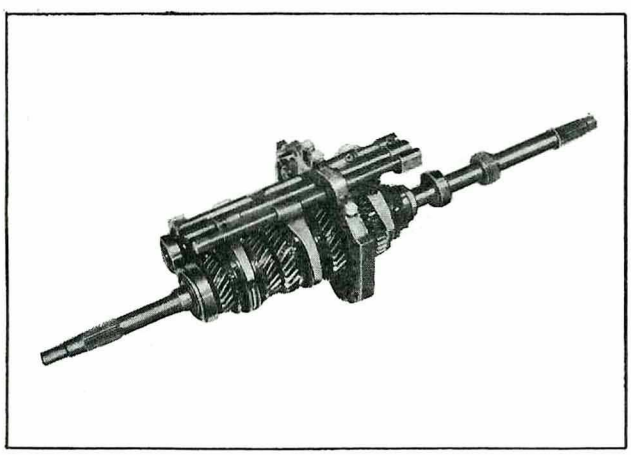


Fig. TM-37

29) Tighten Checking plugs to 2.2 ~ 3.0 kg-m (15.91 ~ 21.69 ft-lb) torque.

30) Check the end plays of Gears.
End play of Main Shaft Gears should be 0.1 ~ 0.2 mm (0.0039 ~ 0.0079 in.).

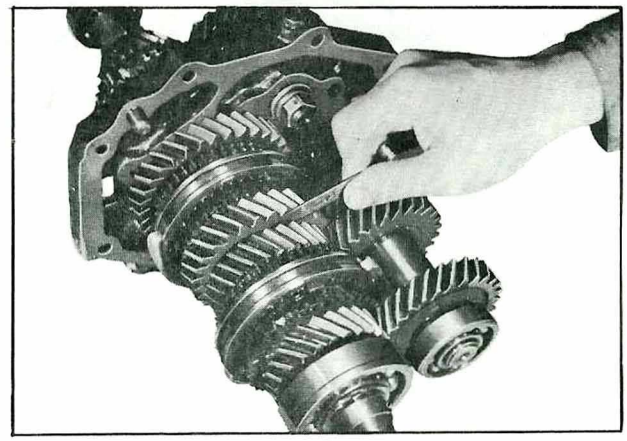


Fig. TM-38

Assemble Gear Ass'y, Gear Case, Clutch Housing and Rear Extention

1) Install Gear Ass'y into Gear Case, using a new gasket.

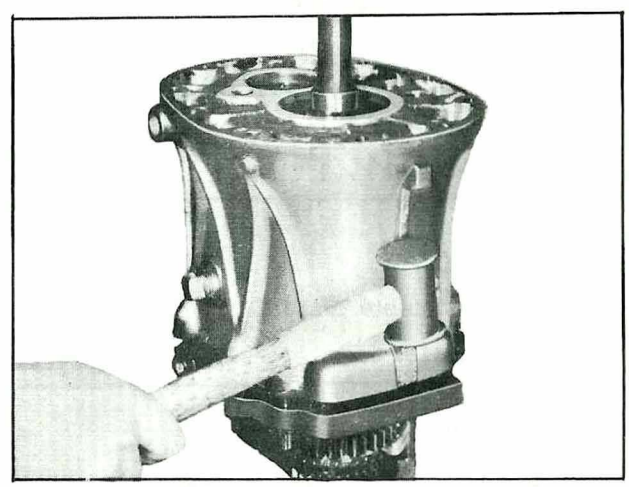


Fig. TM-39

2) Measure the depth from Gear case face to Bearing face and select a suitable shim. Available Counter Shaft Bearing Shims are

0.4 mm (0.0158 in.), 0.5 mm (0.0197 in.),

0.6 mm (0.0236 in.), 0.7 mm (0.0276 in.),

0.8 mm (0.0315 in.), 0.9 mm (0.0354 in.),

1.0 mm (0.0394 in.).

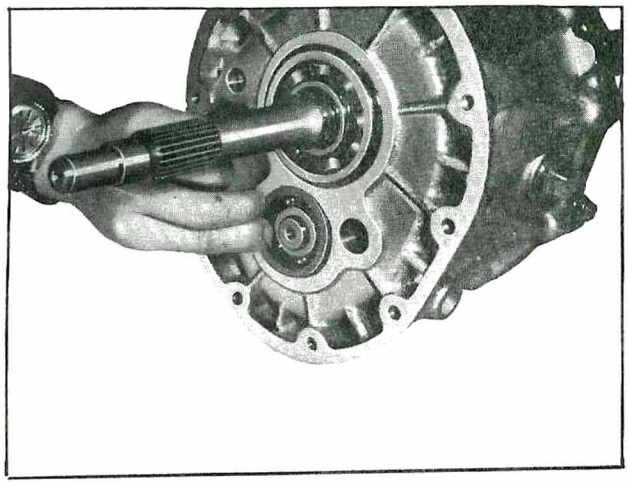


Fig. TM-40

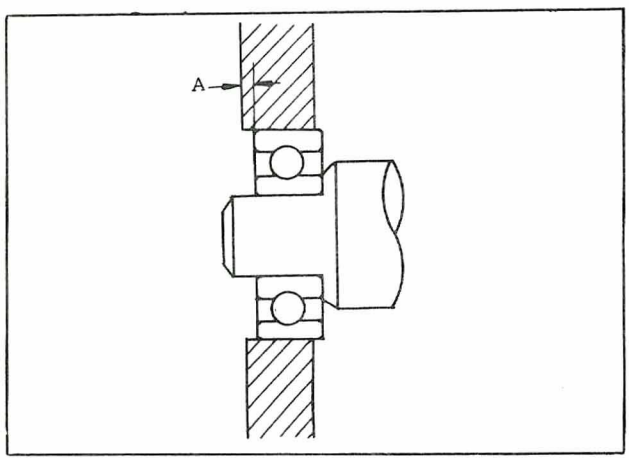


Fig. TM-41

3) Select a suitable Main Drive Gear Bearing Ring.

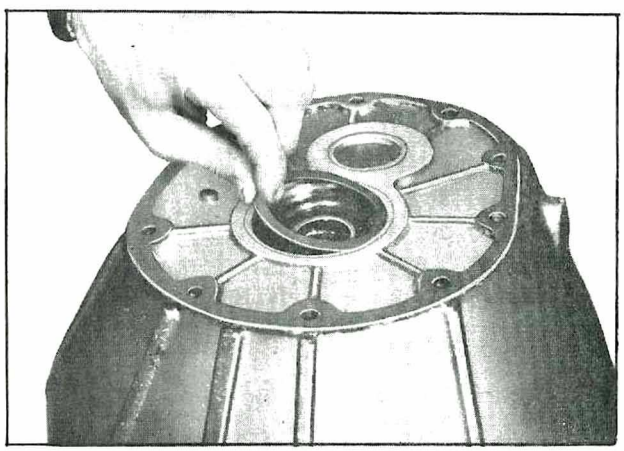


Fig. TM-42

- Install a Stopper Ring into Main Drive Gear Bearing and Press in Bearing until Stopper Ring contacts with Gear Case Face.
- Measure the height (B) of Bearing face from gear case face.

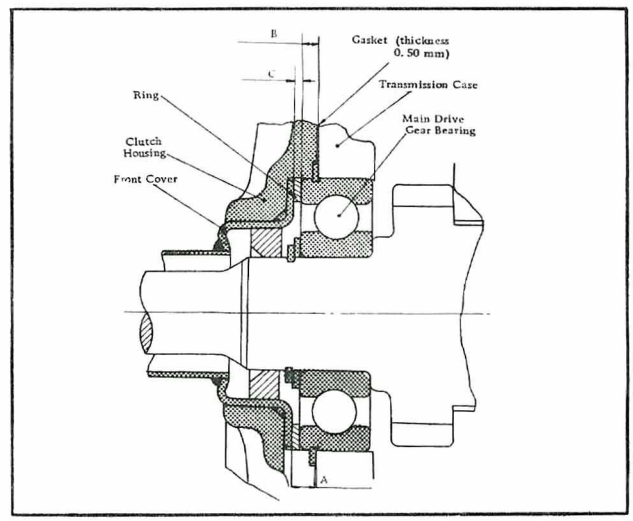


Fig. TM-43

- Measure the depth (A) of Front cover rear flange face from Clutch housing face.

  Standard dimension:
  A = 6.0 ~ 6.2 mm (0.2362 ~ 0.2441 in.)
  B = 4.70 ~ 5.00 mm (0.1850 ~ 0.1969 in.)

- Select Main Drive Bearing Ring (thickness C) such as will satisfy the following equation.
  A - B - C = -0.20 mm ~ +0.20 mm (-0.0079 in. ~ +0.0079 in.).
  Three kinds of Main Drive Bearing Rings are avairable {C = 1.2 mm (0.0472 in.), 1.4 mm (0.0551 in.) & 1.6 mm (0.0630 in.)}.

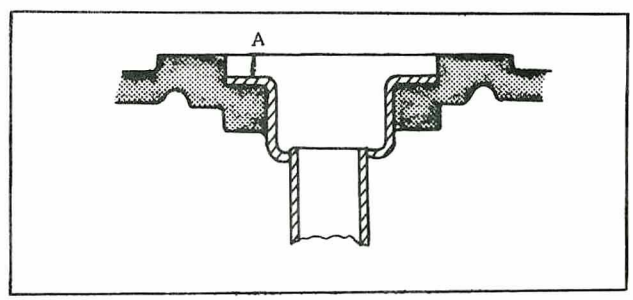


Fig. TM-44

4) Install Clutch housing, using a new gasket.

5) Install Clutch housing to Transmission bolts and spring washers.

6) Tighten to 1.9 ~ 2.2 kg-m (13.74 ~ 15.91 ft-lb) torque.

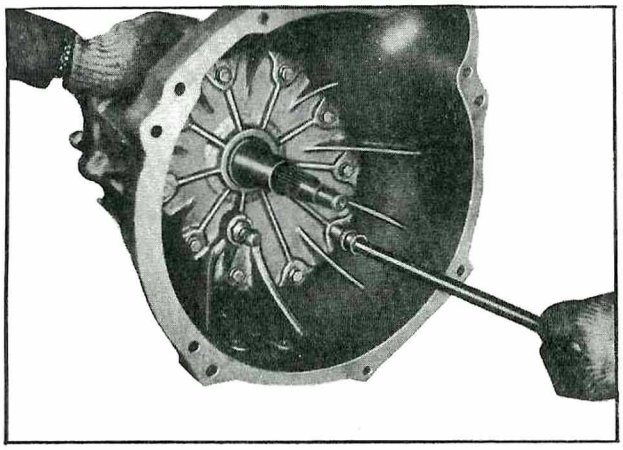


Fig. TM-45

7) Install Rear Extension Ass'y, engaging Striking Rod with Fork Rod.
Use a new gasket.

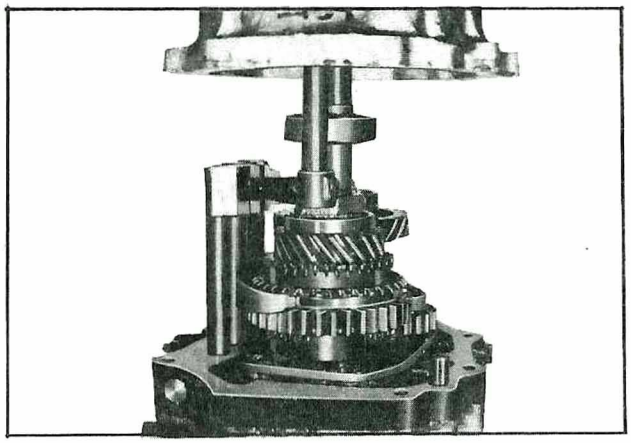


Fig. TM-46

8) Install eight bolts and spring washers.
Tighten bolts to 1.5 ~ 2.2 kg-m (10.85 ~ 15.91 ft-lb) torque.

9) Install Companion Flange Ass'y.

10) Install Plane Washer and Nut.
After tightening to 14 ~ 17 kg-m (101.2 ~ 122.9 ft-lb) torque, retain with Cotter pin.

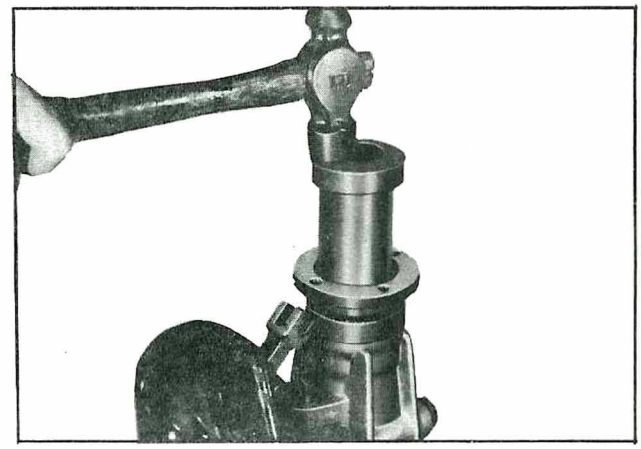


Fig. TM-47

11) Connect Striking Rod with Control Lever.

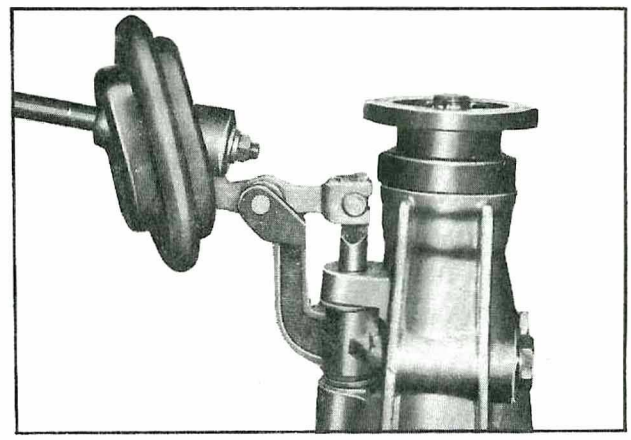


Fig. TM-48

SERVICE DATA

GENERAL SPECIFICATION

Model		FS5C71A
Control Type		Floor Shift
Synchro Type		Servo Type
Gear Ratio		1st = 2.957
		2nd = 1.858
		3rd = 1.311
		4th = 1.000
		5th = 0.852
		Rev. = 2.922
Number of Teeth		
Main Shaft	Drive gear	23
	3rd gear	28
	2nd gear	29
	1st gear	34
	Rev. gear	36
	O.D. gear	21
Counter Shaft	Driven gear	28
	3rd gear	26
	2nd gear	19
	1st gear	14
	Rev. gear	15
	O.D. gear	30
Reverse Idler Gear		17
Speedometer	Drive gear	6
	Driven gear	18

TIGHTENING TORQUE

Reverse Idler Shaft Nut	6.3 ~ 7.3 kg-m (45.55 ~ 52.78 ft-lb)
Reverse Idler Shaft Set-Screw	1.1 ~ 1.3 kg-m (7.95 ~ 9.40 ft-lb)
Main Bearing Retainer Screws	1.1 ~ 1.4 kg-m (7.95 ~ 10.12 ft-lb)
Counter Shaft Overdrive Bearing Bolt	4.3 ~ 5.5 kg-m (31.09 ~ 39.77 ft-lb)
Main Shaft Rear Nut	17 ~ 20 kg-m (122.9 ~ 144.6 ft-lb)
Check Ball Plugs	2.2 ~ 3.0 kg-m (15.91 ~ 21.69 ft-lb)
Rear Extension Fitting Bolts	1.5 ~ 2.2 kg-m (10.85 ~ 15.91 ft-lb)
Companion Flange Nut	14 ~ 17 kg-m (101.2 ~ 122.9 ft-lb)
Clutch Housing to Gear Case Bolts	1.9 ~ 2.2 kg-m (13.74 ~ 15.91 ft-lb)
Speedometer Sleeve Lock Plate Bolt	0.5 ~ 0.6 kg-m (3.62 ~ 4.34 ft-lb)
Clutch Housing to Engine Bolt	Large 2.7 ~ 3.7 kg-m (19.52 ~ 26.75 ft-lb) Small 1.1 ~ 1.4 kg-m (7.95 ~ 10.12 ft-lb)

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