CABRIOLETS

1500 Type 118K

1600S Type 118SB

SPECIFICATIONS AND FEATURES
MAIN SERVICING INSTRUCTIONS

FIAT - SERVICE DEPARTMENT - TURIN

CABRIOLETS

1500 Type 118 K

1600 S Type 118 SB

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SERVICE DEPARTMENT - TURIN

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GENERAL INFORMATION

In this publication are outlined the main specifications and features as well as the service procedures of more current use covering 1500 and 1600 S Cabriolets.

All data and repair directions in the following pages are intended to apply to both Models whenever no specific mention of the type is made. Differing parts are dealt with separately and each of them comes with the applicable Model name.

MAIN SPECIFICATIONS - 1500 CABRIOLET

IDENTIFICATION DATA

Chassis type	118 K
Engine type	115 C.005

ENGINE

Arrangement	front
Cycle and strokes	Otto, 4 - stroke
No. of cylinders	four, in - line
Bore	3.03″ (77 mm)
Stroke	3.13″ (79.5 mm)
Displacement	90.37 cu.in (1,481 cm^3)
Compression ratio	9 to 1
Maximum horsepower, SAE standards	83
at	5,400 rpm
Taxable horsepower (Italy)	16
Cooling	water

CLUTCH

Dry, single plate type with spring cushioned hub.
Driven plate lining O. D. . . . . $7\,^7/_8$″ (200 mm)

TRANSMISSION

Five forward speeds and reverse.

Gear ratios:

First, synchromeshed	3.242 to 1
Second, synchromeshed	1.989 to 1
Third, synchromeshed	1.410 to 1
Fourth, synchromeshed	1 to 1
Fifth (O. D.), synchromeshed	0.864 to 1
Reverse	3.340 to 1

PROPELLER SHAFT

Two-section with center pillow bearing.
A flexible joint and two universal joints.

REAR AXLE

Hypoid final drive gear set.
Gear ratio: . . . . . 4.1 to 1 (10/41)

FRONT SUSPENSION

Independent-wheel type.
Control arms counteracted by coil springs and hydraulic shock absorbers.
Sway eliminator bar.
Toe-in, fully laden . . . . .0394″ to .1181″ (1 to 3 mm)
Camber, fully laden . . . . . $0^o\ 30' \pm 20'$
Caster, fully laden . . . . . $2^o\ 10' \pm 30'$

REAR SUSPENSION

By semi-elliptic springs and hydraulic shock absorbers.
Sway eliminator bar.

STEERING SYSTEM

Worm and roller steering gear.
Gear ratio . . . . . 16.4 to 1
Turning circle . . . . . $34\,^1/_2$ ft (10.5 m)
Steering column mounted on two ball bearings and fitted with a pair of end universal joints.
Linkage end joints, of the « for life » type, need not be lubricated.

BRAKES

Front: disc type.
— Disc diameter . . . . . $9\,^{27}/_{32}$″ (250 mm)
— Bore of caliper outer cylinders $1\,^{11}/_{32}$″ (33.985 mm)
— Bore of caliper inner cylinder . $1\,^{15}/_{16}$″ (48.132 mm)

Rear: drum type, with self-centering shoes.
— Drum diameter . . . . . $9\,^{27}/_{32}$″ (250 mm)
— Wheel cylinder bore . . . . . 3/4″
— Master cylinder bore . . . . . 7/8″

Vacuum brake booster acting on four wheels.

WHEELS AND TIRES

Disc wheels with rim, type . . . . $3\,^1/_2$ J
Tire size . . . . . 145 x 14″
Tire inflation pressure:
— front . . . . . 22.8 psi (1.6 kg/cm^2)
— rear . . . . . 24.2 psi (1.7 kg/cm^2)

ELECTRIC SYSTEM

Voltage 12
Battery capacity (at 20-hour discharge rate) . . . . . 48 Amp/hr
FIAT generator type D 115/12/28/4.
FIAT generator regulator type GN 2/12/28.
FIAT starting motor type E 100-1,5/12 Var. 1.

WEIGHTS

Curb weight (with water, oil, petrol, spare wheel, tool kit and accessories) . . . . . 2,127 lbs (965 kg)
No. of seats . . . . . two
Carrying capacity . . 2 people plus 110 lbs (50 kg)

Laden weight . . . . . 2,546 lbs (1,155 kg)
Distribution of laden weight:
— front axle . . . . . 1,290 lbs (585 kg)
— rear axle . . . . . 1,256 lbs (570 kg)

PERFORMANCE

Speeds, maximum, on flat road (run-in and fully laden):

first gear	31 mph (50 km/h)
second gear	50 mph (80 km/h)
third gear	68 mph (110 km/h)
fourth gear	93 mph (150 km/h)
fifth gear (overdrive)	100 mph (160 km/h)
reverse	31 mph (50 km/h)

Gradients, maximum climbable (run-in and fully laden):

first gear	40 %
second gear	22 %
third gear	14 %
fourth gear	9 %
fifth gear (overdrive)	6.5 %
reverse	40 %

CAPACITIES

UNIT	Quantity				FILL-IN
	lt	kg	Imp. units	U.S. units	
Fuel tank	38	—	8.36 gals	10.04 gals	Gasoline: ON 92 (Research Meth)
Radiator, engine and heating system	6	—	1.32 gals	1.52 gals	Pure water (1)
Oil pan (*)	3.500	3.150	3.1 qts	3.7 qts	FIAT oil (3)
Transmission	1.60	1.50	1.4 qts	1.7 qts	FIAT W 90/M oil (SAE 90 EP)
Rear axle	0.90	0.85	0.79 qts	0.95 qts	
Steering gear	0.16	0.15	0.14 qts	0.17 qts	
Hydraulic brake circuit	0.37	0.37	0.65 pts	0.78 pts	FIAT special blue label fluid
Front shock absorbers, each	0.165	0.15	0.29 pts	0.35 pts	FIAT S.A.I. fluid
Rear shock absorbers, each	0.185	0.165	0.33 pts	0.39 pts	
Windshield washer bag	—	(2)	(2)	(2)	Water and FIAT D.P./1 fluid mixture (concentrated solution)

(*) Total oil capacity of pan, filter and pipings is 3.79 Imp. qts - 4.55 U.S. qts (3.900 kg). Figure specified in table refers to the amount recommended for periodical oil changes.

(1) When temperature is close to 32° F (0° C), replace radiator water by **FIAT special anti-freezing mixture.**

(2) Pure water .66 Imp. qts - .79 U.S. qts (0.75 kg) plus .6 oz - 17 g (Summer) or 1.2 oz - 34 g (Winter) cleaner.

(3) Use the following grades of oil:

TEMPERATURE	**FIAT Unigrade Oil**	**FIAT Multigrade Oil**	TEMPERATURE	**FIAT Unigrade Oil**	**FIAT Multigrade Oil**
	Supplement 1 level oils which fill MS sequence requirements			**Supplement 1** level oils which fill MS sequence requirements	
Below 5° F (—15° C) - minimum	**VS 10 W** (SAE 10 W)	—	Above 32° F (0° C) - minimum	**VS 30** (SAE 30)	**20 W - 40**
Between 32° F (0° C) and 5° F (—15° C) - minimum	**VS 20 W** (SAE 20 W)	**10 W - 30**	Above 86° F (30° C) - average	**VS 40** (SAE 40)	

CAUTION!: These are detergent oils; do not top up with oils of different make or grade; when first using **detergent** oils on engines other than new, carry out an accurate **flushing** of the lubrication system.

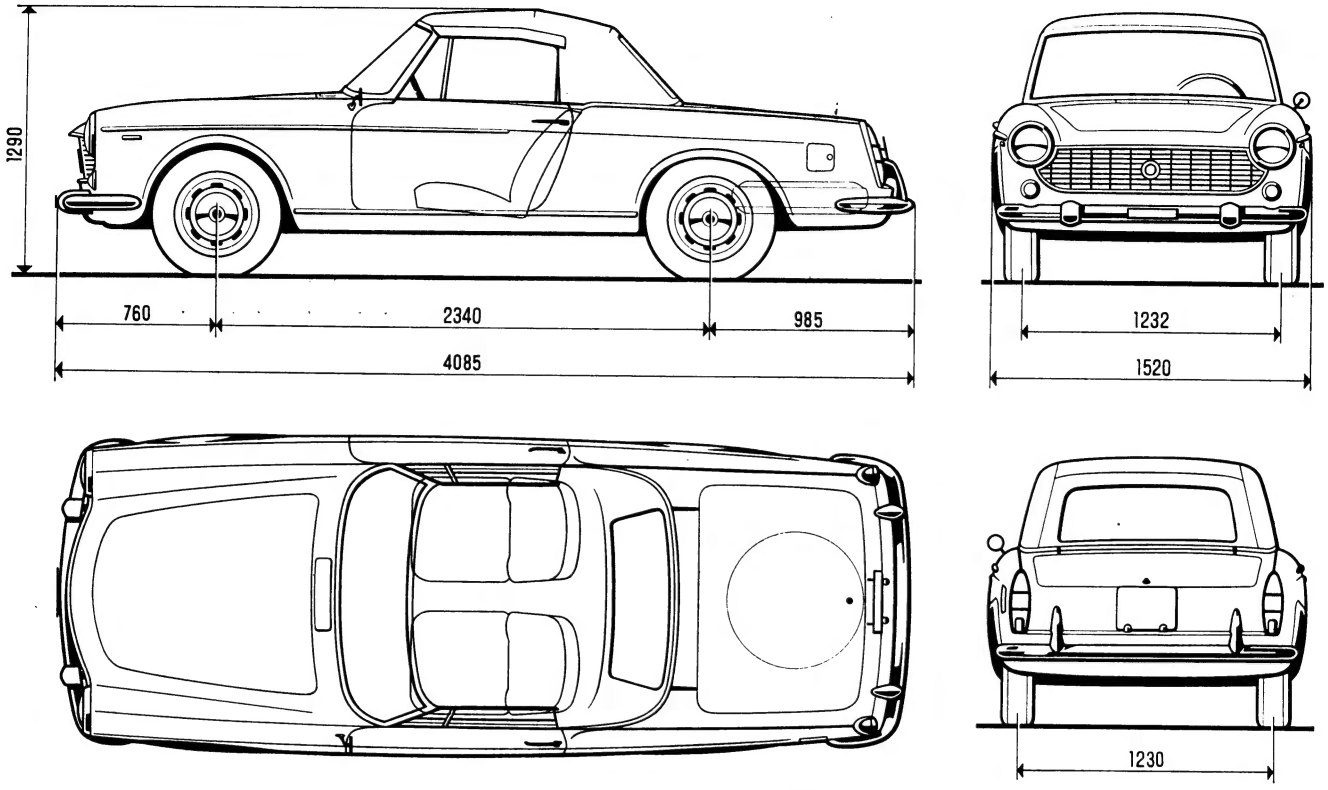
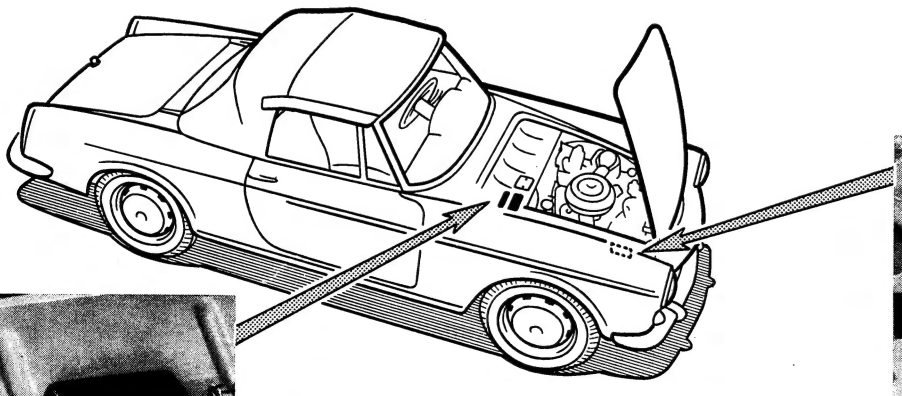


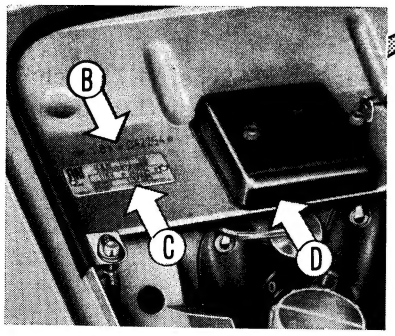
Fig. 1. - Leading dimensions of FIAT 1500 Cabriolet (in mm).

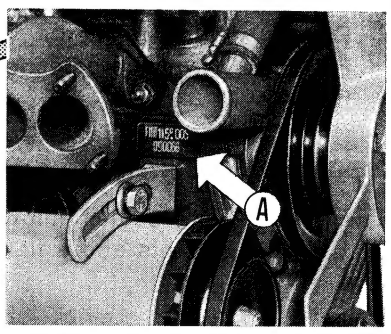
Overall height applies to an unladen vehicle.

UNIT IDENTIFICATION DATA

Fig. 2. - Location of FIAT 1500 Cabriolet identification data.







A. Engine type (115 C.005) and serial number.

B. Chassis type (118 K) and serial number.
C. Unit identification plate.
D. Fuse box.

MAIN SPECIFICATIONS - 1600 S CABRIOLET

IDENTIFICATION DATA

Chassis type	118 SB
Engine type	118 B.000

ENGINE

Arrangement	front
Cycle and strokes	Otto, four - stroke
No. of cylinders	four, in - line
Bore	3.15″ (80 mm)
Stroke	3.07″ (78 mm)
Displacement	95.69 cu.in (1,568 cm^3)
Compression ratio	8.6 to 1
Maximum horsepower, SAE standards	100
at	6,000 rpm
Taxable horsepower (Italy)	17
Cooling	water

CLUTCH

Dry, single-plate type.
Driven plate lining O. D. . . . $8\,1/2$″ (216 mm)
Hydraulic control of clutch.

TRANSMISSION

Five forward speeds and reverse.
Gear ratios:

First, synchromeshed	3.242 to 1
Second, synchromeshed	1.989 to 1
Third, synchromeshed	1.410 to 1
Fourth, synchromeshed	1 to 1
Fifth (O. D.), synchromeshed	0.864 to 1
Reverse	3.340 to 1

PROPELLER SHAFT

Two-section with center pillow bearing.
Two universal joints and a flexible joint.

REAR AXLE

Hypoid final drive gear set.
Gear ratio: . . . . . 4.4 to 1 (9/40)

FRONT SUSPENSION

Independent-wheel type.
Control arms counteracted by coil springs and oleo-pneumatic shock absorbers; sway eliminator bar.

Toe-in, fully laden	.0394″ to .1181″ (1 to 3 mm)
Camber, fully laden	$0^o\,30' \pm 20'$
Caster, fully laden	$1^o \pm 30'$

REAR SUSPENSION

By semi-elliptic springs and oleo-pneumatic shock absorbers; sway eliminator bar.

STEERING SYSTEM

Worm and roller steering gear.
Gear ratio . . . . . 16.4 to 1
Turning circle . . . . . $34\,1/2$ ft (10.5 m)
Steering column mounted on two ball bearings and fitted with a pair of end universal joints.
Linkage end joints, of the « for life » type, need not be lubricated.

BRAKES

Disc type throughout.
Disc diameter . . . . . $10\,5/8$″ (270 mm)
Master cylinder bore . . . . . 7/8″
Bore of front caliper outer cylinders $1\,1/2$″ (38.195 mm)
Bore of front caliper inner cylinder . $2\,1/8$″ (54 mm)
Bore of rear caliper outer cylinders $1\,3/16$″ (30.251 mm)
Bore of rear caliper inner cylinder $1\,11/16$″ (42.874 mm)
Pressure regulator controlling front circuit.
Vacuum brake booster acting on four wheels.

WHEELS AND TIRES

Disc wheels with rim, type	$4\,1/2$ J
Tire size	155 x 15″

Tire inflation pressure:
— low speed, front and rear . . 24.2 psi (1.7 kg/cm^2)
— high speed, front and rear . 27 psi (1.9 kg/cm^2)

ELECTRIC SYSTEM

Voltage	12
Battery capacity (at 20-hour discharge rate)	48 Amp/hr

FIAT generator type D 115/12/28/4 C.
FIAT generator regulator type GN 2/12/28.
FIAT starting motor type E 100-1,5/12 Var. 1.

WEIGHTS

Curb weight (with water, oil, petrol, spare wheel, tool kit and accessories) . . . . . 2,315 lbs (1,050 kg)
No. of seats . . . . . two
Carrying capacity . . . 2 people plus 110 lbs (50 kg)

Laden weight . . . . . 2,734 lbs (1,240 kg)
Distribution of laden weight:
— front axle . . . . . 1,400 lbs (635 kg)
— rear axle . . . . . 1,334 lbs (605 kg)

PERFORMANCE

Speeds, maximum, on flat road (run-in and fully laden):

first gear	31 mph (50 km/h)
second gear	50 mph (80 km/h)
third gear	75 mph (120 km/h)
fourth gear	106 mph (170 km/h)
fifth gear (overdrive)	109 mph (175 km/h)
reverse	31 mph (50 km/h)

Gradients, maximum climbable (run-in and fully laden):

first gear	43 %
second gear	24 %
third gear	14.5 %
fourth gear	10 %
fifth gear (overdrive)	7 %
reverse	43 %

CAPACITIES

UNIT	Quantity				FILL-IN
	lt	kg	Imp. units	U.S. units	
Fuel tank	45	—	10 gals	12 gals	Premium gasoline: ON 98 (Research Method)
Radiator, engine and heating system	6	—	1.32 gals	1.52 gals	Pure water (1)
Oil pan (3)	6	5.4	5.3 qts	6.3 qts	FIAT oil (4)
Transmission	1.6	1.50	1.4 qts	1.7 qts	FIAT W 90/M oil (SAE 90 EP)
Rear axle	0.90	0.85	0.79 qts	0.95 qts	
Steering gear	0.16	0.15	0.14 qts	0.17 qts	
Hydraulic brake circuit	0.42	0.42	0.74 pts	0.88 pts	FIAT special blue label fluid
Hydraulic clutch control circuit	0.17	0.17	0.30 pts	0.36 pts	
Windshield washer bag	—	(2)	(2)	(2)	Water and FIAT D.P./1 fluid mixture (concentrated solution)

(1) When temperature is close to 32° F (0° C), replace radiator water by **FIAT special anti-freezing mixture.**

(2) Pure water .66 Imp. qts - .79 U.S. qts (0.75 kg) plus .6 oz - 17 g (Summer) or 1.2 oz - 34 g (Winter) cleaner.

(3) Total oil capacity of pan, filter and pipings is 5.9 Imp. qts - 7.1 U.S. qts (6.00 kg). Figure specified in table refers to the amount recommended for periodical oil changes.

(4) Use the following grades of oil:

TEMPERATURE	**FIAT Unigrade Oil**	**FIAT Multigrade Oil**	TEMPERATURE	**FIAT Unigrade Oil**	**FIAT Multigrade Oil**
	Supplement 1 level oils which fill MS sequence requirements			**Supplement 1** level oils which fill MS sequence requirements	
Below 5° F (—15° C) - minimum	**VS 10 W** (SAE 10 W)	—	Above 32° F (0° C) - minimum	**VS 30** (SAE 30)	**20 W - 40**
Between 32° F (0° C) and 5° F (—15° C) - minimum	**VS 20 W** (SAE 20 W)	**10 W - 30**	Above 86° F (30° C) - average	**VS 40** (SAE 40)	

CAUTION!: These are detergent oils; do not top up with oils of different make or grade; when first using **detergent** oils on engines other than new, carry out an accurate **flushing** of the lubrication system.

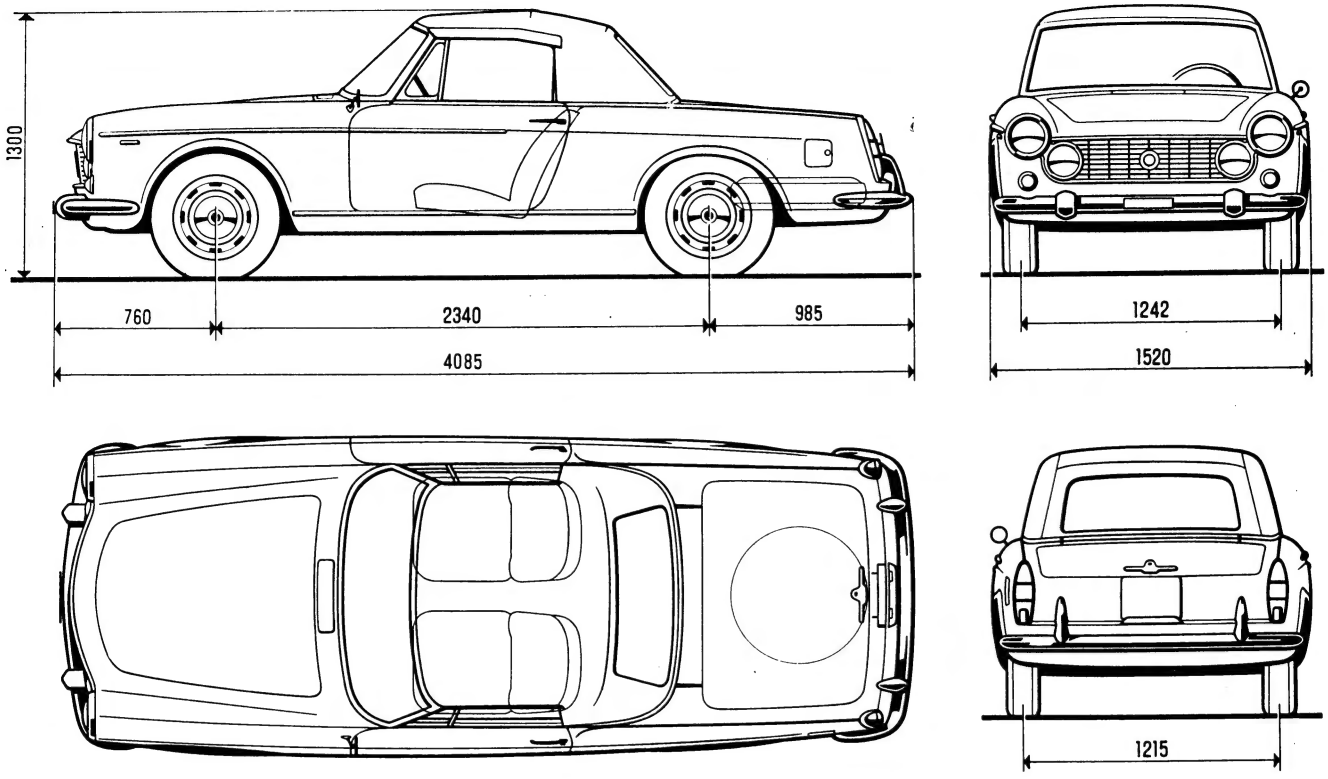
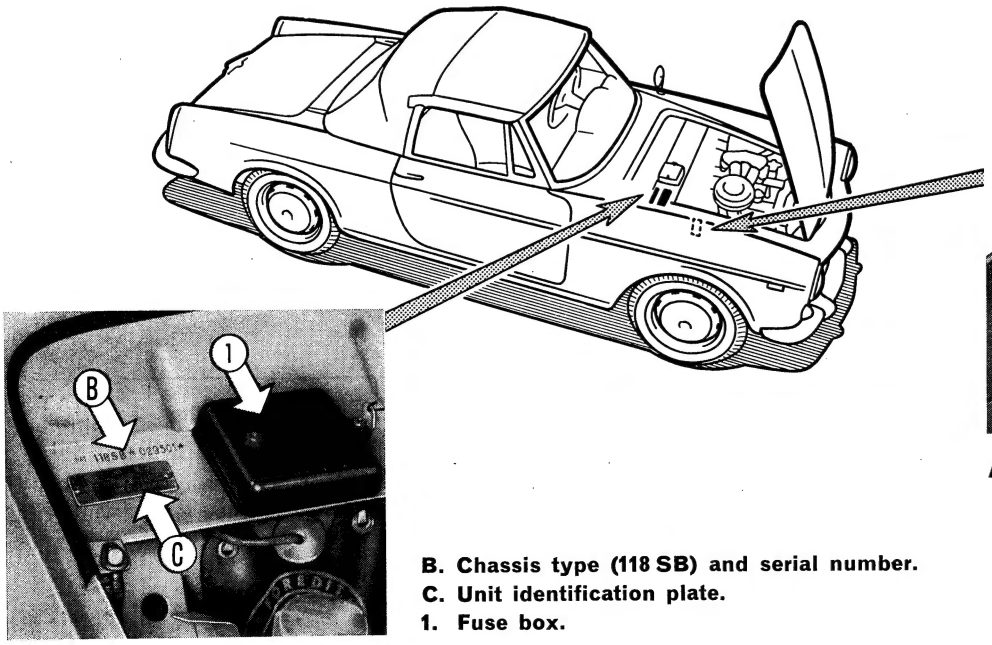
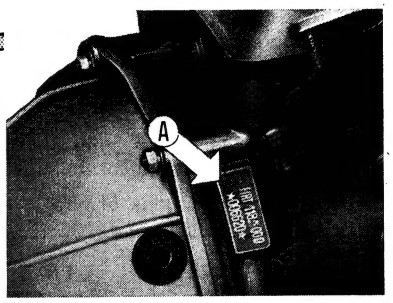


Fig. 3. - Leading dimensions of FIAT 1600 S Cabriolet (in mm).

UNIT IDENTIFICATION DATA

Fig. 4. - Location of FIAT 1600 S Cabriolet identification data.





A. Engine type (118 B.000) and serial number.

B. Chassis type (118 SB) and serial number.
C. Unit identification plate.
1. Fuse box.

MAIN FEATURES

Engine

ENGINE 115 C.005

The four-stroke gasoline engine is arranged at the front of the car.

The principal characteristics of engine 115 C.005 are tabulated on foot of this page.

Cylinder block and crankcase in one iron casting. Aluminum alloy **pistons** of the steel-belted type.

Pistons fitted with three **piston rings**: a compression ring (first), an oil ring (second) and a radial-slotted oil scraper ring (third).

The piston pin hole is .079″ (2 mm) offset.

On assembly, the offset piston should be positioned to the left in respect of cylinder axis, viewing from the valve gear end.

Aluminum **cylinder head** with cast iron valve seat inserts.

Crankshaft working on three supports; babbitt-lined thin-wall type **main bearings**; four half thrust rings fitted on center bearing shoulders.

Connecting rods steel forged with babbitt-lined thin-wall type **bearings**.

VALVE GEAR

Overhead valves operated through tappets, push rods and rockers off the camshaft in crankcase. Camshaft chain-driven by crankshaft.

Valve tappet clearance to check timing		.0177″ (0.45 mm)
Intake	opens	25° B.T.D.C.
	closes	51° A.B.D.C.
Exhaust	opens	64° B.B.D.C.
	closes	12° A.T.D.C.
Valve tappet clearance for engine operation, **cold:**		
— intake		.0079″ (0.20 mm)
— exhaust		.0098″ (0.25 mm)
Valve head diameter	intake	1.378″ (35 mm)
	exhaust	1.240″ (31.5 mm)
Valve face angle		45° 30′ ± 5′
Valve seat angle		45° ± 5′

LUBRICATION

Pressure metered flow system activated by a gear pump.

Centrifugal oil filter and by-pass supplementary filter with pleated paper cartridge.

MAIN SPECIFICATIONS OF ENGINE

Type	115 C.005
Cycle and strokes	Otto, four-stroke
No. of cylinders, lin line	4
Bore	3.03″ (77 mm)
Stroke	3.13″ (79.5 mm)
Displacement	90.37″ cu.in (1.481 cm³)
Compression ratio	9 to 1
Maximum horsepower (DIN)	75
Maximum horsepower (SAE) at	83 at 5,400 rpm
Maximum torque (DIN)	85.35 ft.lbs (11.8 kgm)
Maximum torque (SAE) at	88.97 ft.lbs (12.3 kgm) at 3,200 rpm
Taxable horsepower (Italy)	16
Timing	overhead valves
Dual-barrel carburetor: Weber, type	34 DCHD
Dual-barrel carburetor: Solex, type	C 34 PAIA 2

Pressure relief valve incorporated in oil pump.

Standard oil pressure, at rated speed: 56.9 to 64 psi (4 to 4.5 kg/cm^2).

FUEL SYSTEM

Air cleaner with pleated paper filtering element.

Fuel feed by a camshaft-driven mechanical pump of the diaphragm type, sucking from the tank.

Intake manifold with hot water jackets for heating fuel mixture.

Dual-barrel downdraft carburetor with air control of second throat throttle valve; gradual operation choke and accelerator pump.

Carburetor type: Weber 34 DCHD 4.

Recirculation device of blow-by gases and oil vapours which are drawn into carburetor air intake, hence burned in cylinders.

COOLING SYSTEM

Water is circulated by a centrifugal type pump located in front of cylinder block and V-belt driven off the crankshaft.

Water circulation control by thermostat on engine water outlet duct.

Vertical row tube, single-core type radiator in front of engine.

Automatic in-and-out fan operating through a solenoid controlled by a thermal switch in radiator to contact of coolant.

Temperature gauge sending unit, connected with the temperature gauge on dashboard.

IGNITION

Battery ignition, with distributor driven by a spindle off the camshaft. Combination vacuum and centrifugal weight advance. Manual variator of static advance.

Firing order	1-3-4-2
Static advance	10°
Manual adjustment of static advance	± 5°
Vacuum advance	15° ± 2°
Automatic advance	21° ± 2°
Breaker point gap	.0177″ ± .0012″ (0.45 ± 0.03 mm)

Spark plug types and gap:

— Marelli M 14-19 (CW 240 LP)	.0197″ to .0236″ (0.5 to 0.6 mm)
— Champion M 14-19 (N 9 Y)	.0197″ to .0236″ (0.5 to 0.6 mm)
— AC-Delco M 14-19 (44 XL)	.0197″ to .0236″ (0.5 to 0.6 mm)

STARTING

By electric motor. Drive solenoid actuated from key-type ignition switch adjacent to the steering column.

ENGINE MOUNTINGS

The engine-clutch-transmission unit is mounted at three points on rubber blocks, two of which are located on engine sides and one under transmission extension.

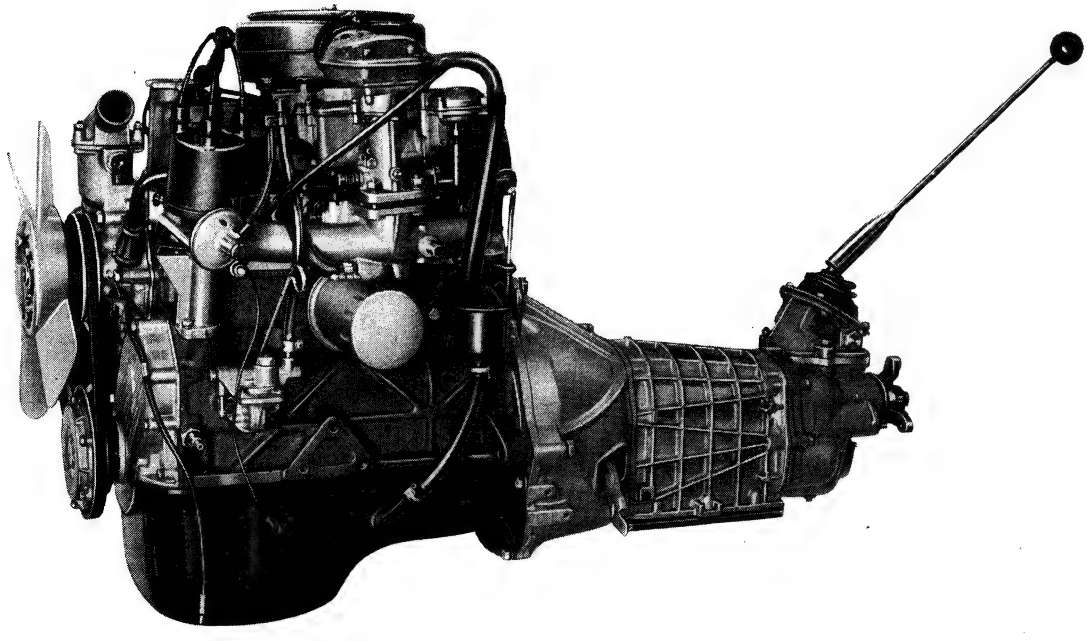


Fig. 5.

Left-hand side view of 1500 Cabriolet power plant.

ENGINE 118 B.000

The four-stroke gasoline engine is arranged at front of the car.

The principal characteristics of engine 118 B.000 are tabulated on foot of this page.

Cylinder block and crankcase in one iron casting.

Aluminum alloy **pistons** fitted with three **piston rings**: a compression ring (first), an oil ring (second) and a slotted oil scraper ring (third).

Aluminum **cylinder head** with cast iron valve seat inserts.

Crankshaft working on five supports; babbitt-lined thin-wall type **main bearings**; four half thrust rings fitted on rear bearing shoulders.

Connecting rods are steel forged with babbitt-lined thin-wall type **bearings**.

VALVE GEAR

Inclined overhead valves operated by two O. H. camshafts.

Twin double-chain drive.

Valve tappet clearance for both timing check and engine operation, **cold:**

— intake . . . . . .0118″ (0.30 mm)

— exhaust . . . . . .0138″ (0.35 mm)

Intake	opens	28° B.T.D.C.
	closes	64° A.B.D.C.
Exhaust	opens	63° B.B.D.C.
	closes	23° A.T.D.C.
Valve head diameter	intake	1.595″ (40.5 mm)
	exhaust	1.437″ (36.5 mm)
Valve face angle		55° 30′ ± 5′
Valve seat angle		55° ± 5′

LUBRICATION

Pressure metered flow system activated by a chain-driven gear pump.

Centrifugal oil filter and by-pass supplementary filter with pleated paper cartridge.

Pressure relief valve in the delivery line.

Standard oil pressure, at rated speed . . . . . 85.3 psi (6 kg/cm²)

MAIN SPECIFICATIONS OF ENGINE

Type	118 B.000
Cycle and strokes	Otto, four-stroke
Number of cylinders, in-line	4
Bore	3.15″ (80 mm)
Stroke	3.07″ (78 mm)
Displacement	95.69 cu.in (1.568 cm³)
Compression ratio	8.6 to 1
Maximum horsepower, DIN standards	85
at	5,800 rpm
Maximum horsepower, SAE standards	100
at	6,000 rpm
Maximum torque, DIN standards	87.52 ft.lbs (12.1 kgm)
at	3,800 rpm
Maximum torque, SAE standards	97.65 ft.lbs (13.5 kgm)
at	4,000 rpm
Taxable horsepower (Italy)	17
Timing	twin O.H. camshaft
Dual-barrel carburetors:	
— Weber type front	34 DCS 2
— Weber type rear	34 DCS 4

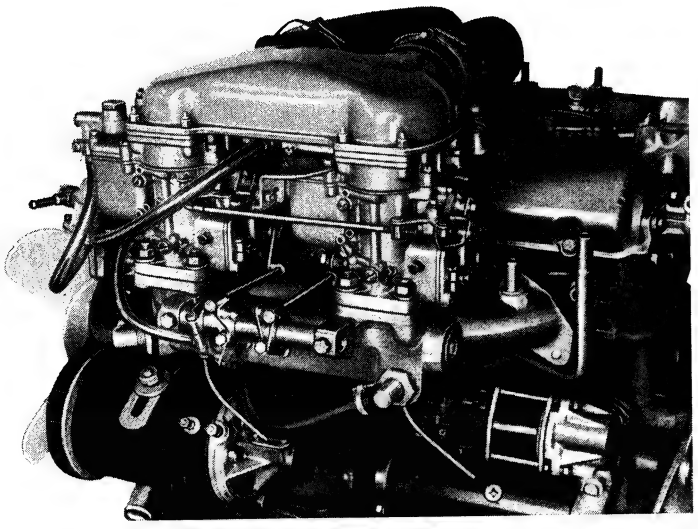


Fig. 6. - Weber carburetors in place on engine 118 B.000.

FUEL SYSTEM

Air cleaner with pleated paper filtering element.

Fuel feed by serially-connected mechanical diaphragm pump and electric pump; the latter operates on engine starting.

Intake manifold with hot water jackets for heating fuel mixture.

Two dual-barrel downdraft carburetors with simultaneous opening of throttle valves. Both carburetors feature an independent ckoke device and power pump.

Carburetor types: Weber 34 DCS 2 and 34 DCS 4.

Recirculation device of blow-by gases and oil vapours which are drawn into carburetor air intake, hence burned in cylinders.

COOLING SYSTEM

Water is circulated by a centrifugal type pump located in front of cylinder block and V-belt driven off the crankshaft.

Water circulation control by thermostat on engine water outlet duct.

Vertical row tube, single-core type radiator in front of engine.

Automatic in-and-out fan operating through a solenoid controlled by a thermal switch in radiator to contact of coolant.

Temperature gauge sending unit, connected with the temperature gauge on dashboard.

IGNITION

Battery ignition, with distributor chain-driven by the crankshaft via a spindle.

Firing order	1-3-4-2
Static advance	$0^{o} \pm 1^{o}$
Automatic advance	$33^{o} \pm 2^{o}$
Breaker point gap	.0165″ to .0189″ (0.42 to 0.48 mm)

Spark plug types and gap:

— Marelli M 14-19 (CW 230 LPS)	.0256″ to .0295″ (0.65 to 0.75 mm)
— Champion M 14-19 (N 9 Y)	.0197″ to .0236″ (0.50 to 0.60 mm)

STARTING

By electric motor. Drive solenoid actuated from key-type ignition switch adjacent to the steering column.

ENGINE MOUNTINGS

Support of engine-clutch-transmission unit is provided by means of two resilient blocks situated on engine sides, and a cross member being attached to the transmission extension, through rubber cushions, and to underbody.

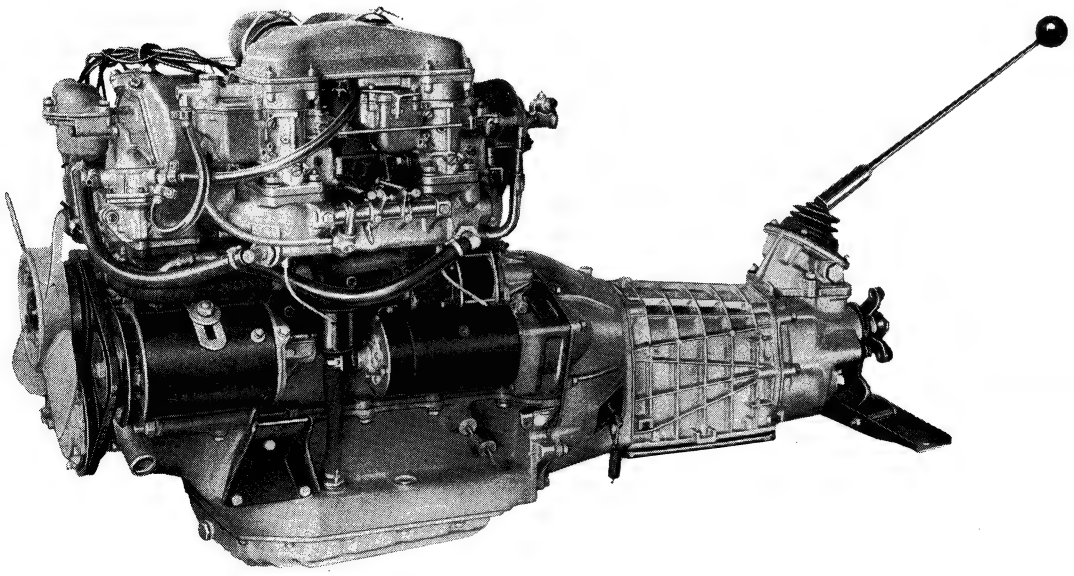


Fig. 7.

Left-hand side view of 1600 S Cabriolet power plant.

Running Gear

CLUTCH

Dry, single plate type with spring-cushioned hub and damper rings. Clutch is actuated mechanically in 1500 Cabriolet and hydraulically in 1600 S Cabriolet.

	1500	1600 S
Driven plate lining O. D.	$7\,^{7}/_{8}''$ (200 mm)	$8\,^{1}/_{2}''$ (216 mm)
Driven plate lining I. D.	$5\,^{19}/_{32}''$ (142 mm)	6″ (152 mm)
Pedal free play	23/32″ to 7/8″ (18 to 22 mm)	23/32″ to 7/8″ (18 to 22 mm)
Master cylinder bore	—	3/4″
Actuating cylinder bore	—	3/4″

TRANSMISSION

Five forward speeds (all synchromeshed) and reverse. Fifth speed is an overdrive.

All forward speeds are constant meshed.

Free-type synchromesh rings for first, second, third and fourth gears.

Fifth gear synchromesh ring of the **spring-type**.

Gearshift control by manual lever mounted on floor tunnel.

Gear ratios:

— first	3.242 to 1
— second	1.989 to 1
— third	1.410 to 1
— fourth	1 to 1
— fifth	0.864 to 1
— reverse	3.340 to 1

PROPELLER SHAFT AND JOINTS

Power is driven to rear wheels by means of two tubular shafts with center pillow block (fig. 131).

The front prop shaft is connected to the transmission through a flexible joint (fig. 131) and fitted with a bearing housing for the pillow block in the vicinity of the rear flange sleeve.

The rear prop shaft is connected to the front one and to rear axle through universal joints. Splined front end allows for sliding trip of « U » joint slip yoke.

REAR AXLE

of the semi-floating type.
Pressed steel sheet axle housing.
Cast-iron differential carrier.

Final drive hypoid gear ratio:

— 1500 Cabriolet	4.1 to 1 (10/41)
— 1600 S Cabriolet	4.4 to 1 (9/40)

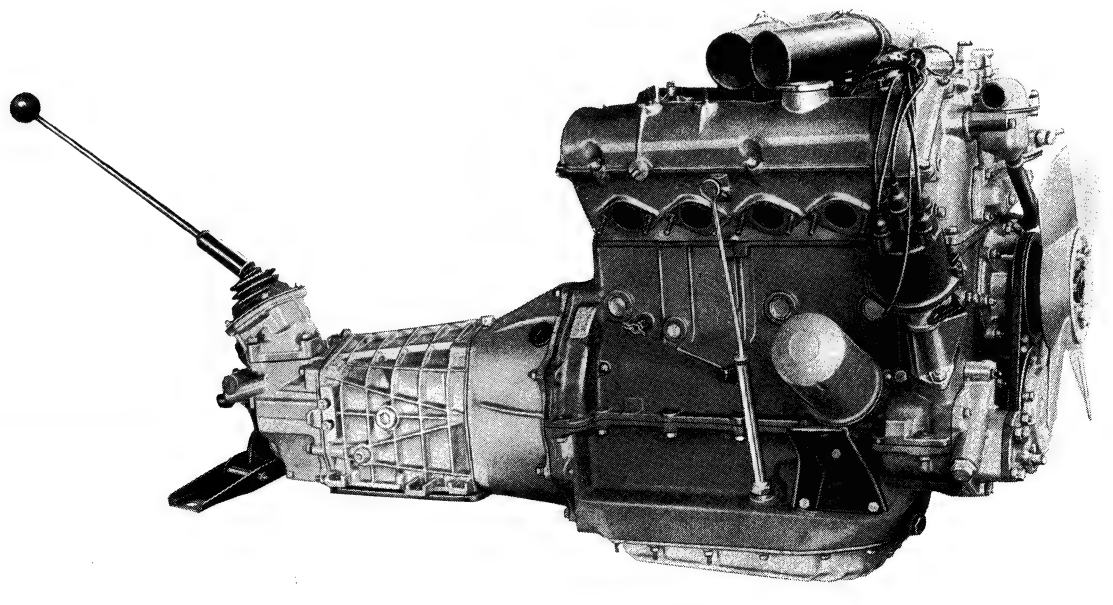


Fig. 8.

Right-hand side view of 1600 S Cabriolet power plant.

FRONT SUSPENSION

Independent-wheel type front suspension consisting of control arms, upper and lower, attached to the sub-frame and wheels and counteracted by coil springs; hydraulic double acting telescope shock absorbers fitted with a gradual action compression valve (1500), and oleo-pneumatic shock absorbers (1600 S).

Sway eliminator bar mounted on lower control arms and sub-frame.

A pair of rubber buffers, mounted on underbody, control up-and-down swings of upper control arm.

Control arms, both upper and lower, are attached to the frame by means of rubber bushings, while arm attachment to knuckle pillars is provided by spiders which, in turn, are tied to control arms through self-threading bushings.

Shock absorbers are secured to underbody on upside and to lower control arms on downside.

	1500	1600 S
Toe-in (*)	.0394″ to .1181″ (1-3 mm)	.0394″ to .1181″ (1-3 mm)
Camber (*)	$0^{o}\ 30' \pm 20'$	$0^{o}\ 30' \pm 20'$
Caster (*)	$2^{o}\ 10' \pm 30'$	$1^{o} \pm 30'$
Kingpin inclination	7^{o}	7^{o}

(*) Check with fully laden car.

REAR SUSPENSION

by semi-elliptic springs and:

— hydraulic double-acting telescope shock absorbers for 1500 Cabriolet;

— oleo-pneumatic shock absorbers for 1600 S Cabriolet;

— cross-mounted sway eliminator bar.

Semi-elliptic springs are pivoted, at the front end, in brackets welded on underbody; a bushing, press-fitted in the front eye of the main leaf, is attached to the underbody bracket by a screw with nut.

At rear, semi-elliptic springs are shackled to a bracket mounted on underbody. Attachment of springs to shackles and of shackles to bracket is assured by a rubber bushed pivot.

The axle housing is connected to the semi-elliptic springs through « U » bolts, whose lower saddle plate is fitted with a pin for lower mounting of shock absorbers.

Shock absorbers are mounted at top on a pin rigidly fastened to the underbody.

Seven rubber buffers, fixed to the body floor, control suspension swings. Arrangement of buffers: two on sides and one at center of each semi-elliptic spring; one at differential carrier.

STEERING SYSTEM

Worm and roller steering gear, ratio 16.4 to 1.

The steering column is mounted on a pair of ball bearings and fitted with two universal joints.

The pitman arm, press fitted on roller shaft, operates an intermediate track rod which is attached, at the opposite end, to an idler arm. Two side tie rods are connected to the idler arm and pivoted to knuckle arms at the opposite end.

The idler arm bracket is secured to the dash bracing in engine compartment interior.

During the whole turning travel, the inner wheel develops a 35^{o} angle, whereas the outer wheel turning angle is 27^{o}.

Turning circle: $34\ ^{1}/_{2}$ ft (10.50 m).

Both side tie rods are provided with an adjusting sleeve for correct positioning of front wheels.

Steering linkage joints are of the « for life » type and need not be lubricated.

BRAKES

Hydraulic service brakes on four wheels, pedal controlled, and mechanical parking brake on rear wheels, manually operated.

A vacuum brake booster relieves the driver's effort on pedal for brake application.

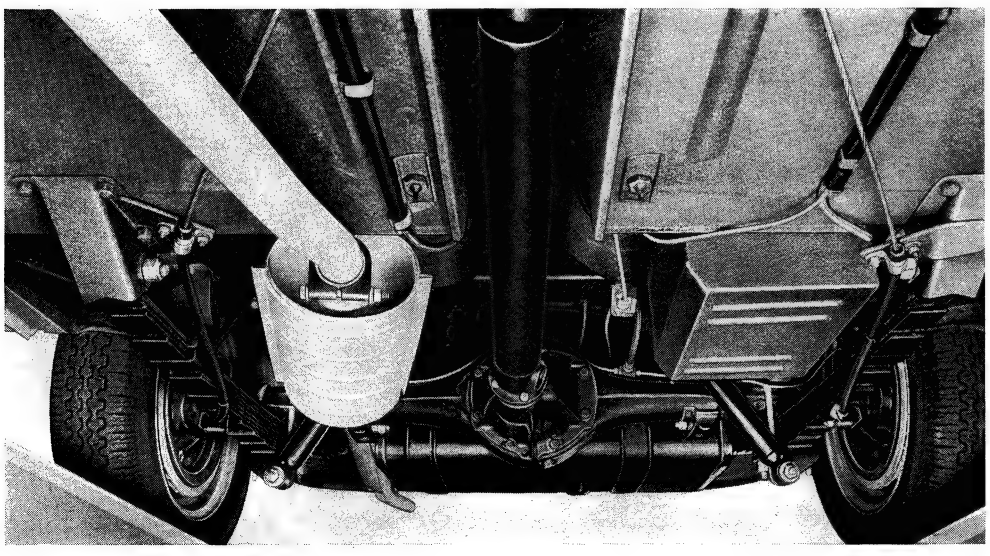
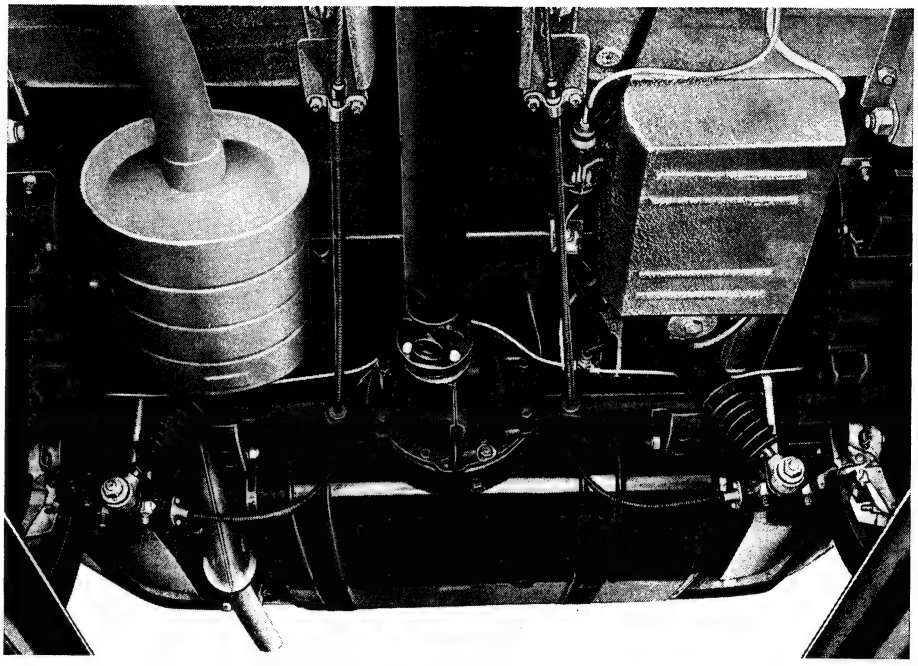


Fig. 9.

Bottom view of 1500 Cabriolet rear axle and suspension.

Fig. 10.

Bottom view of 1600 S Cabriolet rear axle and suspension.



The 1500 Cabriolet features service brakes of the disc type with lining pads at front and of the expanding type with self-centering shoes at rear.

Service brakes of the 1600 S Cabriolet are of the disc type throughout. A special device regulates line pressure on rear wheel brakes.

Disc brakes at each wheel are actuated by three hydraulic cylinders, one inboard and two outboard, working on lining pads.

Expansion brakes are actuated by one dual-piston wheel cylinder.

	1500	1600 S
Front brake disc dia.	9 27/32" (250 mm)	10 5/8" (270 mm)
Rear brake disc dia.	—	10 5/8" (270 mm)
Rear brake drum dia.	9 27/32" (250 mm)	—
Total working area	92.69 sq.in (598 cm²)	57.97 sq.in (374 cm²)
Master cylinder bore	7/8"	7/8"
Bore of front caliper outboard cylinders	1 11/32" (33.985 mm)	1 1/2" (38.195 mm)
Bore of front caliper inboard cylinder	1 15/16" (48.132 mm)	2 1/8" (54 mm)
Bore of rear caliper outboard cylinders	—	1 3/16" (30.251 mm)
Bore of rear caliper inboard cylinder	—	1 11/16" (42.874 mm)
Rear wheel cylinder diameter	3/4"	—

AIR CONDITIONING SYSTEM

Fresh air circulation, heating of passenger compartment and windshield demisting are assured thanks to: an air scoop on cowl, an electro-fan in air distributor assembly, a horizontal row tube radiator in engine cooling circuit, situated in car interior.

Summer Ventilation.

To admit fresh air inside the car (with the canvas top up), the following can be made:

a) lower door glasses;

b) set the lever (C, fig. 11) controlling water flow to heater radiator on « FREDDO » (cool) position and shift air scoop lever (B) to the « INTERNO » (interior) position; so air flows in through deflectors (D) on heater housing.

At low car speed, the amount of incoming air can be increased by turning on the switch (A) operating the front electrofan (the switch is energized only with ignition on).

Mid-Season Ventilation.

In this period, to avoid the misting of the windshield, just let fresh air in by leaving lever (C, fig. 11) in « FREDDO » (cool) position and setting lever (B) on « CRISTALLO » (windshield) position. So air admitted inside is flown exclusively toward the windshield out of six slots on instrument panel upper lining, via air hoses (E).

Winter Heating.

To admit warmed air inside the vehicle for heating purposes, and against the windshield to avoid misting and prevent frost and ice from building up on windshield exterior, arrange control levers as follows:

a) **Windshield.** Set lever (B, fig. 11) on « CRISTALLO » (windshield) position, lever (C) on « CALDO » (warm) position and operate the electrofan through switch (A).

b) **Car Interior.** Set lever (B) on « INTERNO » (interior) position, lever (C) on « CALDO » (warm) position, and operate the electrofan through switch (A).

c) **Windshield and Car Interior.** Set lever (B) midway between « INTERNO » (interior) and « CRISTALLO » (windshield) positions (in a manner to have

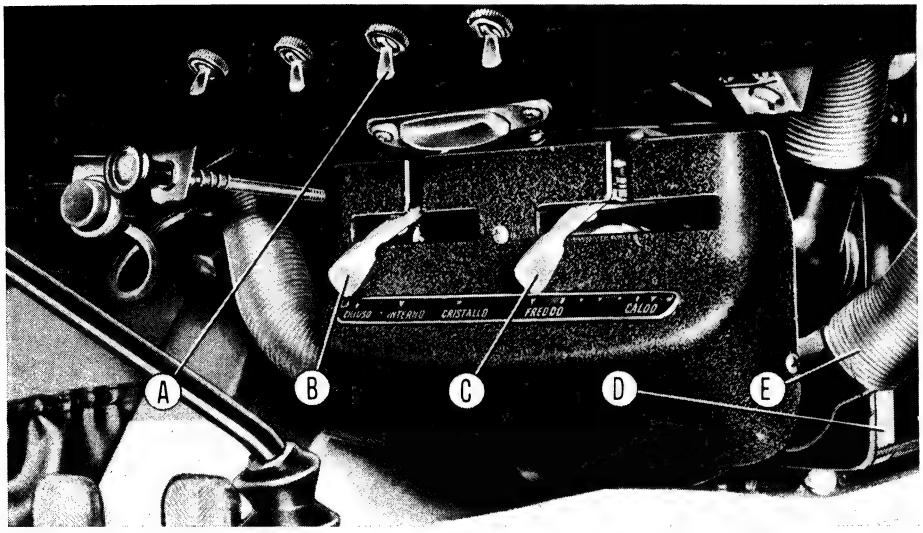


Fig. 11. - Car air conditioner control. A. Electrofan switch - B. Air scoop control lever - C. Engine-to-heater radiator water flow control lever - D. Air inlet deflectors - E. Windshield air delivery hoses.

air flow at the same time inside the vehicle and against the windshield), lever (C) on « CALDO » (warm) position, and operate the electrofan through switch (A).

NOTE - In addition to the extreme « wide open » (« CALDO » - warm) and « off » (« FREDDO - cool) positions, the air conditioner control lever (B) may be set at any intermediate position in the board, so that the desired temperature of incoming air can be obtained.

In winter, should the car be kept inoperative for a certain while without the anti-freeze mixture in the cooling system, in addition to draining the water radiator and engine, take care to let the residual water out also from the heater radiator by loosening the plug on right lower side of the heater housing.

Electric System

1500 Cabriolet

Voltage: 12.

Battery: 48 Amp/hr capacity (at 20 hr discharge rate).

Generator FIAT D 115/12/28/4, belt-driven, 500 W maximum output.

Current and voltage regulator FIAT GN 2/12/28, three-unit type: cut-out relay, voltage regulator, current regulator.

Starting motor FIAT E 100-1,5/12 Var. 1, overrunning clutch type. Solenoid drive controlled from key-type ignition switch with anti-theft device built-in.

Battery **ignition**, via ignition distributor and coil. Ignition distributor operated by a camshaft-driven spindle. Automatic vacuum and centrifugal weight advance. Manual adjustment of static advance.

Lighting Equipment:

— High and low beam headlights, recessed in fenders; asymmetrical low beam.
— Two engine compartment lights.
— Front parking and direction signal lights.
— Side direction signal blinking lights.
— Double license plate light (fitted on bumper).
— Rear tail, direction signal and stop lights with reflector lens.
— Deck light with jam switch.
— Dash light controlled by a toggle switch on instrument panel and a jam switch on door opening contour.
— Fuel gauge and temperature gauge light.
— Clock light.
— Speedometer-odometer light.

External and flashing light control by a switch lever under the steering wheel.

Direction signal light control by a switch lever under the steering wheel returning automatically to « off » position. Flasher unit.

Dual chime horns, with control button on steering wheel and relay switch.

Twin-arm **windshield wiper** with automatic parking-off device.

Fuel gauge tank unit, with reserve supply indicator. The unit incorporates the fuel suction tube and strainer.

Electrofan for interior heating and windshield defrosting.

Trouble light receptacle.

Spark plugs.

Thermal switch (in radiator) for electromagnetic control of cooling fan.

Temperature gauge sending unit (resistor and silicon diode for gauge).

Thermal switch (in cylinder head) for heat indicator.

Low oil pressure indicator sending unit.

Fuse holder, located on bulkhead in engine compartment.

Key-type ignition switch, also energizing warning lights and starting circuit, with anti-theft device built-in, situated on steering column support.

Instrument panel gauges and accessories: windshield washer, instrument light switch; wiper switch; direction signal light indicator (green); parking light indicator (green); master light switch; electro-fan switch; heat indicator.

Speedometer-odometer with high beam indicator (blue). Cluster including: fuel gauge, reserve supply indicator, low oil pressure and no-charge indicators, water temperature gauge.

Electric cigar lighter, ash receiver and electric clock.

1600 S Cabriolet

Voltage: 12.

Battery: 48 Amp/hr capacity (at 20 hr discharge rate).

Generator FIAT D 115/12/28/4 C, belt-driven, 500 W maximum output.

Current and voltage regulator FIAT GN 2/12/28, three-unit type: cut-out relay, voltage regulator, current regulator.

Starting motor FIAT E 100-1,5/12 Var. 1, overrunning clutch type 1.5 KW output. Solenoid drive controlled from key-type ignition switch with anti-theft device built-in.

Battery **ignition**, via ignition distributor and coil. Ignition distributor operated by a spindle chain driven from crankshaft. Automatic advance by centrifugal weights.

Lighting Equipment:

— Twin headlights: asymmetrical low beam by outer lamps, high beam by all lamps.
High beam controlled by outer light switch via a relay.

— Two engine compartment lights with jam switch.

— Front parking and direction signal lights.

— Side direction signal blinking lights.

— Double license plate light (fitted on lower rear panel).

— Rear tail, direction signal and stop lights with reflector lens.

— Deck light with jam switch.

— Dash light controlled by a toggle switch on instrument panel and a jam switch on door opening contour.

— Speedometer-odometer light.

— Clock light.

— Tachometer light.

— Cigar lighter spot light.

External and flashing light control by a switch lever under the steering wheel.

Direction signal light control by a switch lever under the steering wheel returning automatically to « off » position. Flasher unit.

Dual chime horns, with control button on steering wheel and relay switch.

Twin-arm **windshield wiper** with automatic parking-off device.

Fuel gauge tank unit, with reserve supply indicator. The unit incorporates the fuel suction tube and strainer.

Electrofan for interior heating and windshield defrosting.

Trouble light receptacle.

Spark plugs.

Thermal switch (in radiator) for electromagnetic control of cooling fan.

Temperature gauge sending unit (resistor and silicon diode for gauge).

Thermal switch (in cylinder head) for heat indicator.

Low oil pressure indicator sending unit.

Electric fuel pump with relay switch control.

Fuse holder, located on bulkhead in engine compartment.

Key-type ignition switch, also energizing warning lights and starting circuit, with anti-theft device built-in, situated on steering column support.

Instrument panel gauges and accessories: windshield washer, instrument light switch; wiper switch; direction signal light indicator (green); parking light indicator (green); master light switch; electro-fan switch; heat indicator.

Cluster including: speedometer-odometer, fuel gauge reserve supply indicator, high beam indicator (blue) and no-charge indicator.

Tachometer, including also oil pressure gauge and temperature gauge.

Electric cigar lighter, ash receiver and electric clock.

Body

Cabriolet: two-seater, with two doors and side windows. Integral body construction.

Hood: front-hinged, with catch control in car interior.

Windshield: non-adjustable, with curved laminated safety glass.

Doors: front-hinged. Windows with fixed (1500) or swivelling (1600 S) type front pane and adjustable crank-controlled rear pane. Side arm rests on door trim panels.

Canvas top: folding, metal framed, contained in a waterproof fabric case.

Trunk compartment: with front-hinged lid having a push-button key-locked release. Lid hand grip (1600 S only).

Spare wheel: stowed under trunk compartment floor.

Front and rear bumpers: with chromium plated overriders.

Rear license plate: mounted below deck lid.

Front license plate: mounted on bumper blade.

Adjustable bucket seats: with forward tilting and partially reclinable squabs.

Utility recess - arm rest: between seats.

Matting: rubber-and-moquette on passenger compartment floor, rubber on trunk compartment floor.

Air conditioner: under instrument panel, centrally arranged.

Instrument panel:

— 1500 Cabriolet, with chromium plated trim mouldings; plastic padded top and bottom surfaces.

— 1600 S Cabriolet, with imitation wood front trim moulding and chromium plated trim moulding; plastic padded top and bottom surfaces.

Rear view mirrors: internal with non-glare device centrally arranged at top of instrument panel, and external on driver's side fender.

Upholstery: artificial leather.

Door handles: inner and outer, chromium-plated.

Foot rest: tiltable, in front of passenger's seat (1600 S only).

Assist handle: on instrument panel, passenger side.

Tool kit: in trunk compartment.

Provision for safety belt installation (lap and skew types).

Optional: hard top and radio receiver.

Fig. 12. - FIAT 1600 S Cabriolet.

SERVICE PROCEDURES AND FITTING DATA

ENGINE 115 C.005

CYLINDER BLOCK

The cylinder block and crankcase are cast in a single unit of special cast iron.

On the lower face of crankcase letters are stamped at each barrel referring to the value of the bore diameter. In fact, cylinder barrels are graded into three size groups A, B, C, according to the bore size.

Bore sizes corresponding to the various groups are the following:

— Group A . . . 3.0315″ to 3.0319″ (77.000 to 77.010 mm)
— Group B over 3.0319″ to 3.0323″ (77.010 to 77.020 mm)
— Group C » 3.0323″ to 3.0327″ (77.020 to 77.030 mm)

PISTONS

Pistons are of the slipper, domed-crown type with a cavity to allow for intake valve opening.

The slipper type design of the bottom side (fig. 15) is to avoid any interference of the piston with the crankshaft counterweights.

Piston pin hole is .079″ (2 mm) offset.

Pistons are graded into three groups A, B, C, on the ground of their diametrical quotations shown in fig. 15; they are also graded into two groups 1 and 2 according to the boss bore for mating with pins; see paragraph **Connecting Rods**, page 21.

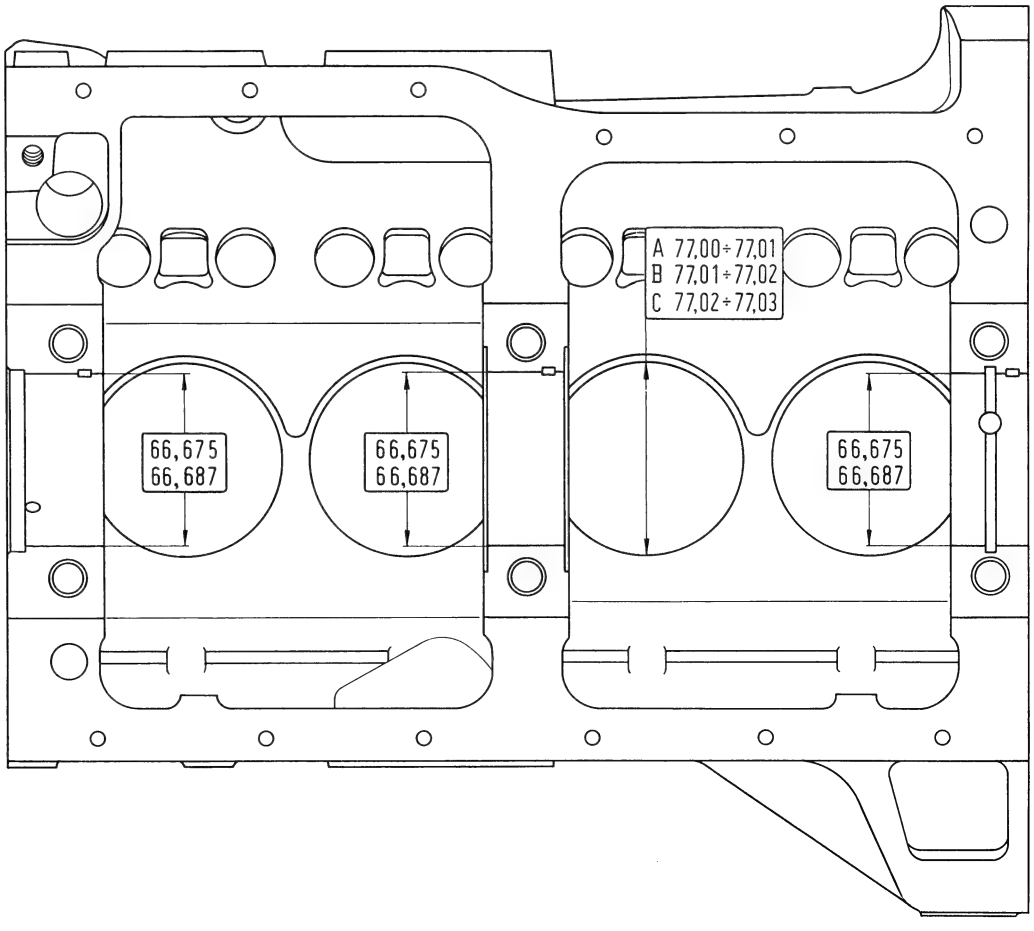


Fig. 13.

Critical dimensions of 115 C.005 engine crankcase (in mm).

Diametrical group sizes of cylinder bores.

Diametrical sizes of three main transverse members.

115C.005 ENGINE ASSEMBLY

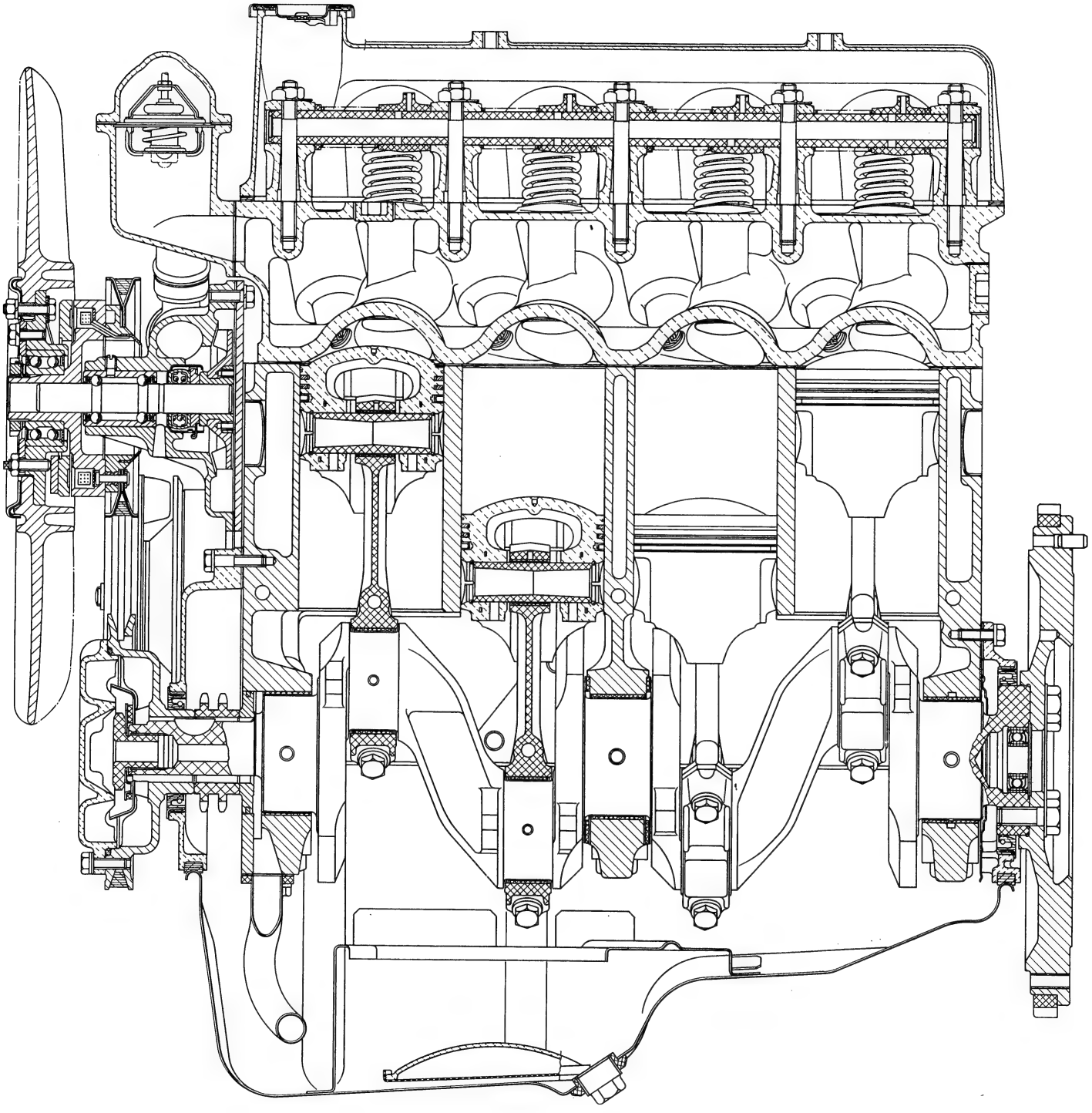


Fig. 14. - Side sectional view of engine 115 C.005 across cylinders.

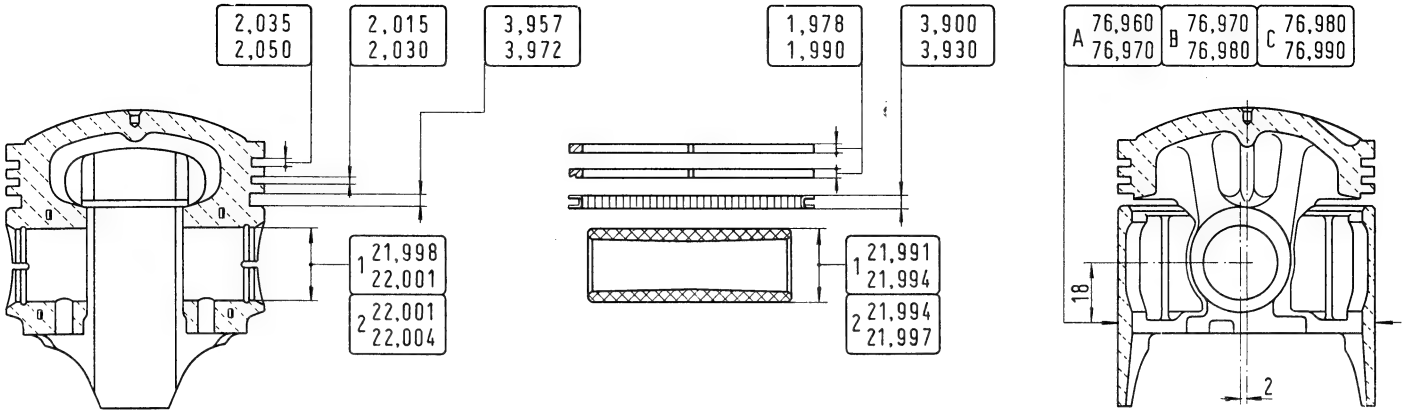


Fig. 15. - Critical dimensions of pistons, piston pins and rings to suit engine 115 C.005 (in mm).

CAUTION - Measurement of piston diameters square to the pin axis should be made 23/32″ (18 mm) apart from pin centerline, as shown in fig. 15.

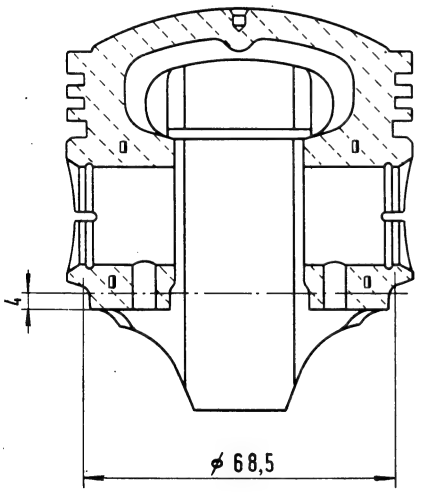


Fig. 16.

Milling diagram to equalize the weight in the same set of four pistons (engine 115 C.005).

4 = $^{5}/_{32}$″ - ø 68.5 = diam. 2 $^{11}/_{16}$″

Cylinder barrel-piston assemblies should be made according to the size group. Every cylinder barrel should be fitted with a piston belonging to the same size group.

Piston size group letter and number are stamped on piston crown on the opposite side to the head cavity (see 1, fig. 19).

Prior to installing pistons, check them for an even weight, maximum weight difference being ± .07 oz (± 2 gr). Should a set of pistons in specified weight range not be available, remove stock by milling at piston boss base as shown in fig. 16. Stock removal should not go over 5/32″ (4 mm) in depth and 2 $^{11}/_{16}$″ (68.5 mm) in circle diameter.

CONNECTING RODS - ROD BEARINGS

Prior to tying connecting rods with pistons check rod ends for a parallel relationship using fixture **Ap. 5051** at a distance of 4 $^{15}/_{16}$″ (125 mm) apart from connecting rod vertical centerline. Maximum out-of-true limit ± .0020″ (0.05 mm).

Thin-wall bearing shells cannot be reworked or adapted, lest the babbitt coat is reamed out.

Should deep scratches or signs of wear be evident, renew the bearings.

Connecting rod bearing shells come for replacement in the standard size and undersizes.

Connecting rods, piston pins and pistons are graded into two size groups **1** and **2** as follows:

— **connecting rods:** according to the bore of the small end bushing press-fitted and reamed.
— **piston pins:** according to their O.D.;
— **pistons:** according to pin boss bore.

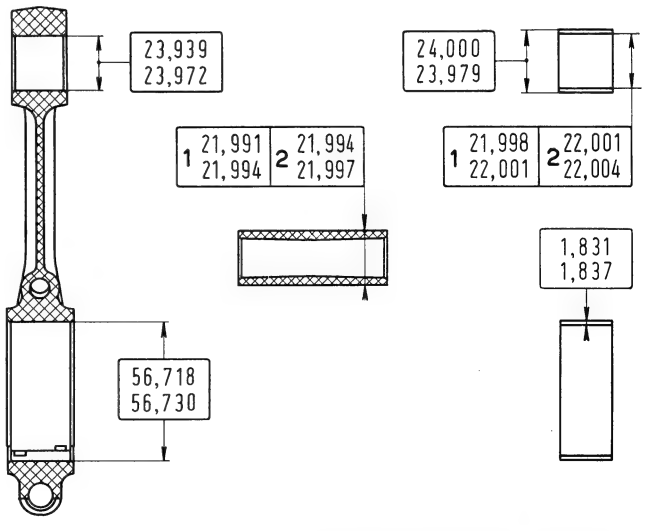


Fig. 17. - Critical dimensions of 115 C.005 engine connecting rods, small end bushings, rod bearings and piston pins (in mm). (Bushing bore specifications in figure apply to a smallend bushing reamed in place).

115C.005 ENGINE ASSEMBLY

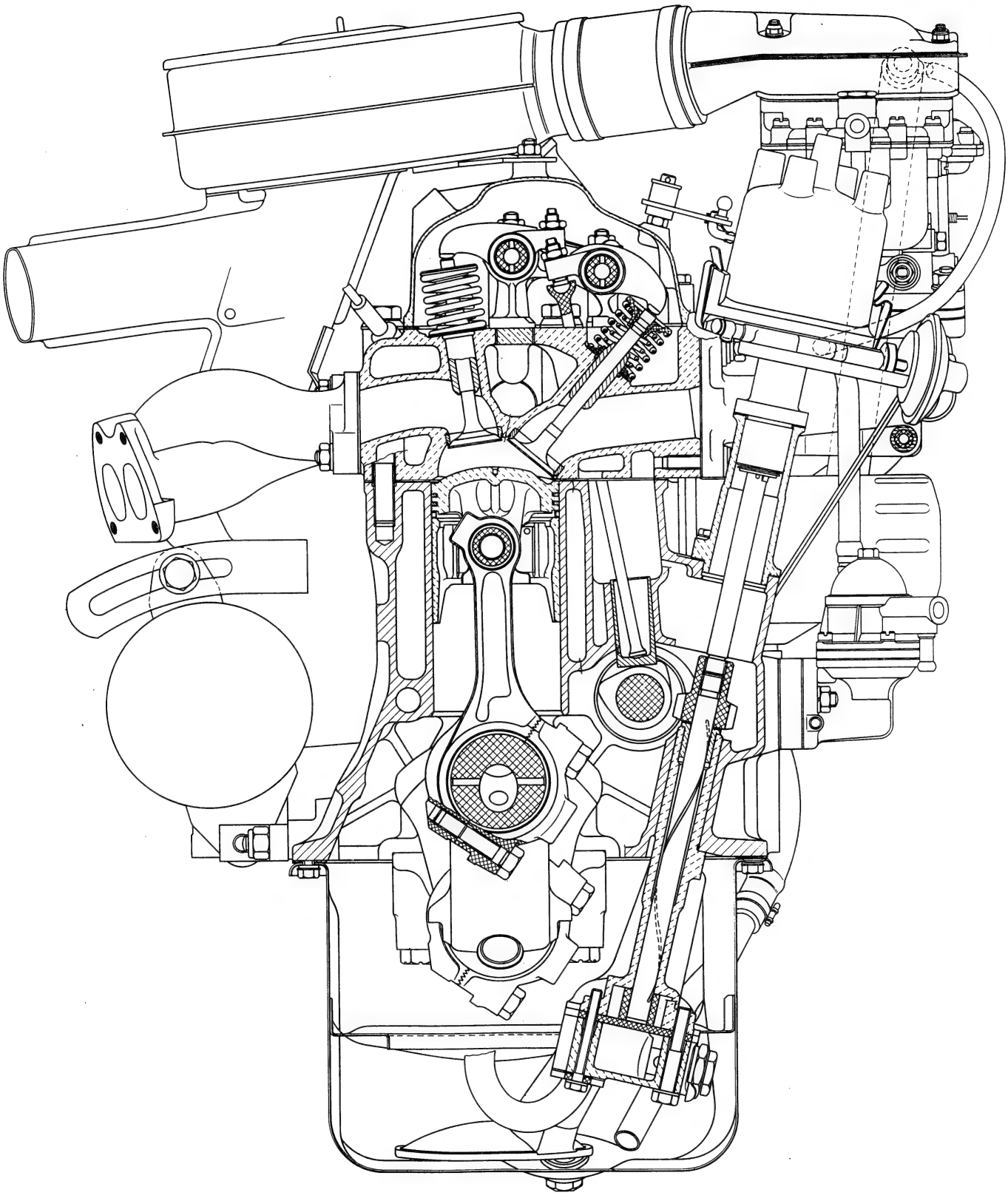


Fig. 18. - End sectional view of engine 115 C.005 across connecting rod, piston, valves, and oil pump and distributor drive mechanism.

Size group numbers are:

— stamped at 4, fig. 19 for connecting rods;

— stamped at 1, fig. 19 for pistons;

— electrically scribed on pin outer face for piston pins.

Connecting rod piston and pin assembly should be made by size group, that is all three items must have the same group number.

Assembly specifications pertaining to pistons, pins and connecting rods are tabulated on pages 43 and 44.

Connecting rod identification number to match with the cylinder bore number should be stamped at 5, fig. 19. Remember to stamp identification number whenever installing new connecting rods.

The connecting rod must be assembled to the piston so that the number stamped on the connecting rod face (5, fig. 19) is on the opposite side to the piston top cavity (2).

When fitting the connecting rod-piston assembly into the cylinder bore, take care that the connecting rod assembly number to the cylinder is facing on the opposite side to the camshaft.

To check the clearance between bearing shells and journals, use the « Plastigage » calibrated wire, type PG 1 or PR 1.

Clearance is indicated by the amount of flattening of the wire, which has been placed between the bearing and the crankshaft journal.

Compare the width of the flattened « Plastigage » with the graduations on the envelope; the value within the graduation on the envelope shows the bearing clearance (fig. 21) which should be, for new parts, .0122″ to .0299″ (0.031 to 0.076 mm).

CRANKSHAFT AND MAIN BEARINGS

The crankshaft is forged with counterweights and rotates on three bearings.

Four shoulder ring halves on center bearing take the end thrusts of the crankshaft.

Grinding Crankshaft Journals.

Crankshaft journals should be ground with the utmost care, otherwise an alteration of crankarm fillet radius may result in respect of the specifications given in fig. 22.

Main bearing halves are supplied for replacement in the standard size and undersizes.

As already outlined under « Connecting Rods-Rod Bearings », precision insert bearings should not be reworked or adapted; in case deep scores or signs of excessive wear are observed, renew main bearings using proper undersizes.

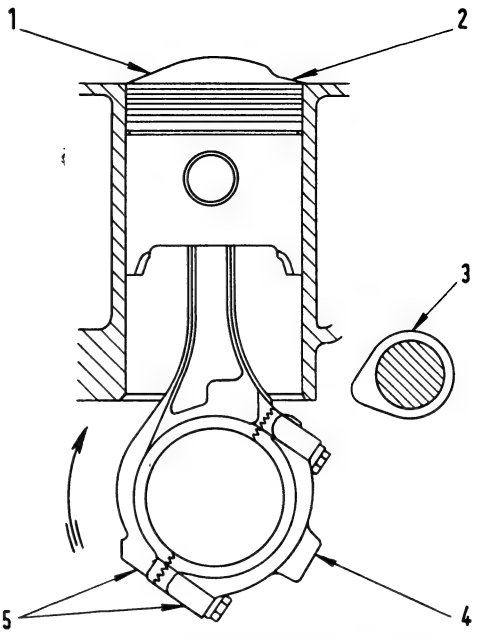


Fig. 19. - Connecting rod-piston assembly installation diagram. Engine 115 C.005.

1. Location of piston-cylinder size group letter and piston-piston pin size group number - 2. Piston top cavity - 3. Camshaft - 4. Location of small end bushing size group number - 5. Location of connecting rod-cylinder pairing number.

Arrow shows turning direction of front viewed engine.

MAIN BEARING JOURNAL DIAMETER SPECIFICATIONS

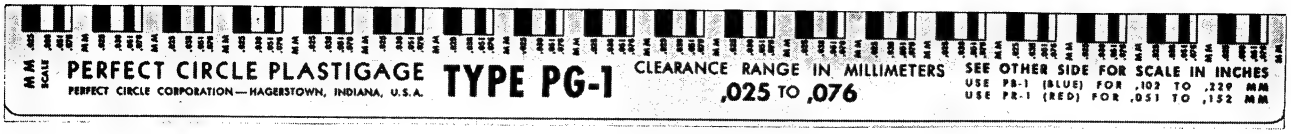
Standard Size	Undersizes			
	.0108″ (0.274 mm)	.0208″ (0.528 mm)	.0308″ (0.782 mm)	.0408″ (1.036 mm)
2.4788″ (62.962 mm) to 2.4796″ (62.982 mm)	2.4680″ (62.688 mm) to 2.4688″ (62.708 mm)	2.4580″ (62.434 mm) to 2.4588″ (62.454 mm)	2.4480″ (62.180 mm) to 2.4488″ (62.200 mm)	2.4380″ (61.926 mm) to 2.4388″ (61.946 mm)

MAIN BEARING SHELL THICKNESS SPECIFICATIONS

Standard Size	Undersizes			
	.0108″ (0.274 mm)	.0208″ (0.528 mm)	.0308″ (0.782 mm)	.0408″ (1.036 mm)
.0716″ (1.818 mm) to .0718″ (1.824 mm)	.0770″ (1.955 mm) to .0772″ (1.961 mm)	.0820″ (2.082 mm) to .0822″ (2.088 mm)	.0870″ (2.209 mm) to .0872″ (2.215 mm)	.0920″ (2.336 mm) to .0922″ (2.342 mm)

CON ROD JOURNAL DIAMETER SPECIFICATIONS

Standard Size	Undersizes			
	.0108″ (0.274 mm)	.0208″ (0.528 mm)	.0308″ (0.782 mm)	.0408″ (1.036 mm)
2.0863″ (52.992 mm) to 2.0871″ (53.013 mm)	2.0755″ (52.718 mm) to 2.0763″ (52.739 mm)	2.0655″ (52.464 mm) to 2.0663″ (52.485 mm)	2.0555″ (52.210 mm) to 2.0563″ (52.231 mm)	2.0455″ (51.956 mm) to 2.0463″ (51.977 mm)



CALIBRATED WIRE

Fig. 20. - « Plastigage » calibrated wire for checking crankshaft bearing shell-to-journal clearance, and envelope with graduation scale.

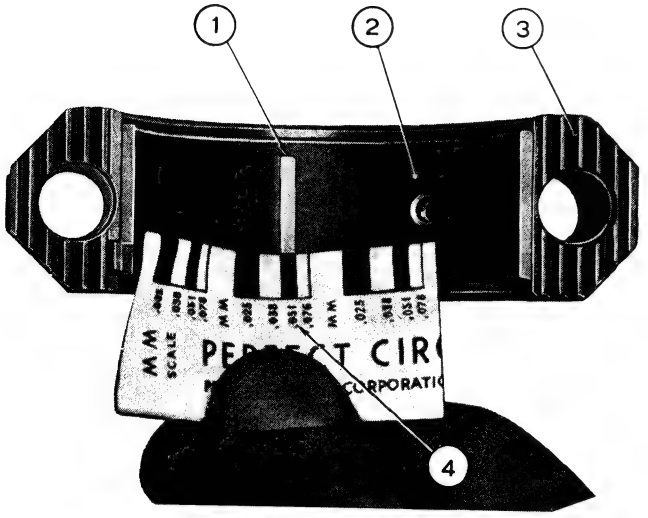


Fig. 21. - Comparing the width of the flattened « Plastigage » with the envelope graduation scale to check connecting rod bearing shell-to-journal clearance.

1. « Plastigage » wire - 2. Bearing shell - 3. Con rod bearing cap - 4. Clearance reading.

ROD BEARING SHELL THICKNESS SPECIFICATIONS

Standard Size	Undersizes			
	.0108″ (0.274 mm)	.0208″ (0.528 mm)	.0308″ (0.782 mm)	.0408″ (1.036 mm)
.0721″ (1.831 mm) to .0723″ (1.837 mm)	.0775″ (1.968 mm) to .0777″ (1.974 mm)	.0825″ (2.095 mm) to .0827″ (2.101 mm)	.0875″ (2.222 mm) to .0877″ (2.228 mm)	.0925″ (2.349 mm) to .0927″ (2.355 mm)

To check clearance (.0018″ to .0035″ - 0.045 to 0.089 mm) between main bearing shells and journals, just follow the procedure outlined for the clearance check of connecting rod bearing shells to journals (page 23).

Next check the side clearance of center main bearing thrust rings at crankshaft shoulder faces: it should be .0024″ to .0102″ (0.06 to 0.26 mm).

Should the shoulder-to-shoulder clearance exceed .0138″ (0.35 mm), replace thrust rings by thicker ones. Thrust rings come in .004″ (0.1 mm) oversize.

Checking Crankshaft.

These inspections are recommended after the crankshaft journals have been ground and the crankshaft balanced.

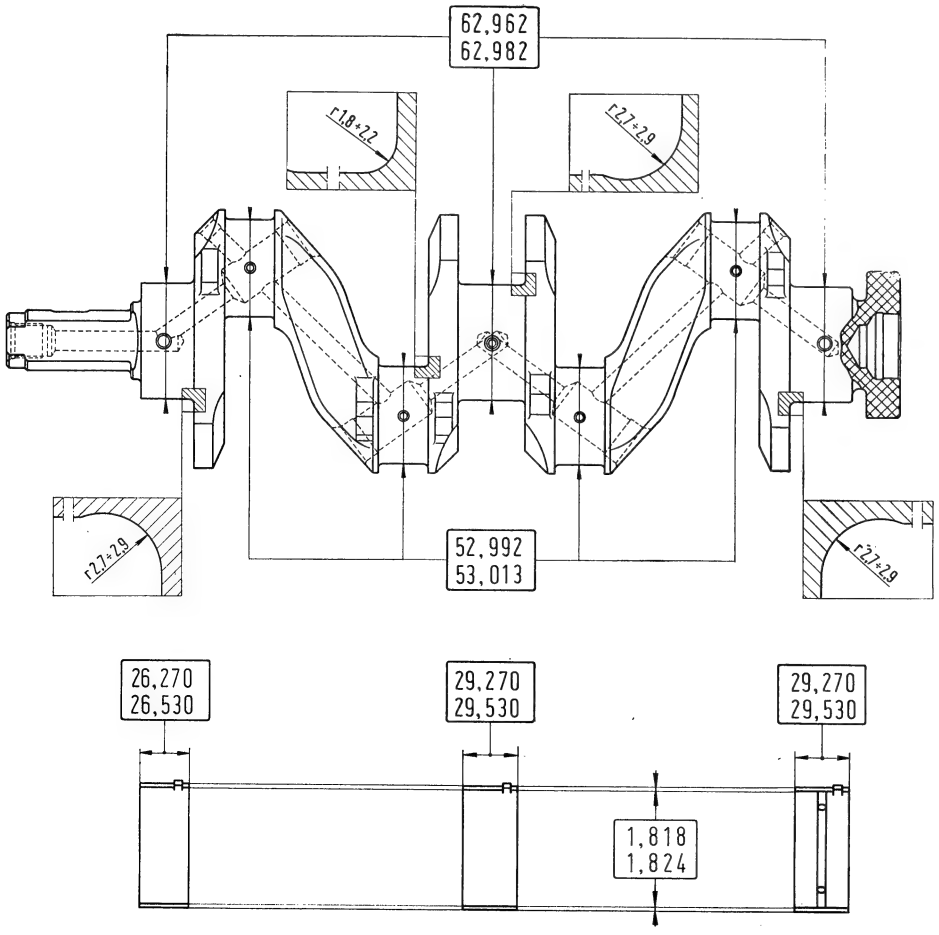


Fig. 22.

Critical dimensions of main bearing and connecting rod journals, and of main bearing shells (in mm). Engine 115 C.005.

Support the crankshaft at ends on V blocks **A. 95731** or between centers and using a dial indicator check for the following conditions:

1) Alignment of main bearing journals: maximum out-of-true limit .002″ (0.05 mm) (total reading of indicator dial).
2) Alignment of connecting rod bearing journals: maximum out-of-true of connecting rod bearing journals to main bearing journals ± .02″ (0.5 mm).
3) Out-of-round of main and connecting rod bearing journals: maximum limit after grinding .0002″ (0.005 mm).
4) Taper of main and connecting rod bearing journals: maximum limit after grinding .0002″ (0.005 mm).
5) Squared condition of flywheel mounting face to crankshaft: with a dial indicator set laterally at a distance of some 1 1/2″ (38 mm) from crankshaft axis, turn the crankshaft and check for no runout in excess of .0010″ (0.025 mm).

CYLINDER HEAD - VALVES - VALVE GUIDES AND SPRINGS

Aluminum cylinder head with cast-iron valve seat inserts. Valve seat angle 45° ± 5′.

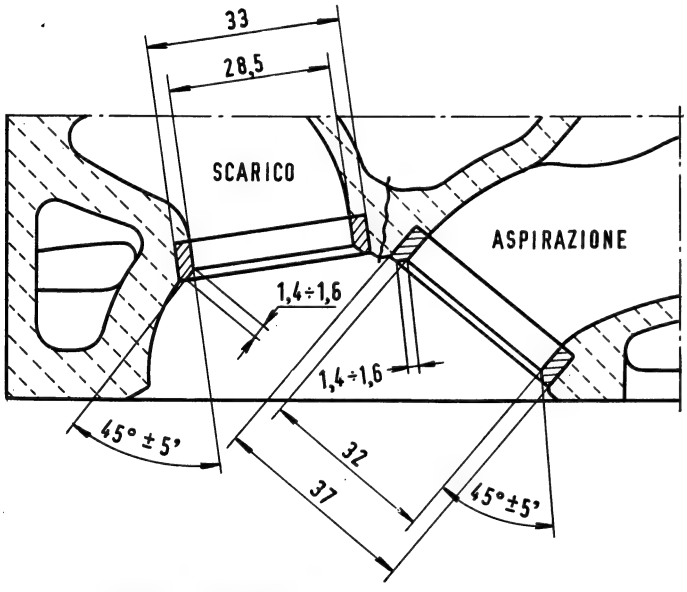


Fig. 23. - Critical dimesions (in mm) and angles of intake and exhaust valve seats. Engine 115 C.005.
SCARICO = EXHAUST - ASPIRAZIONE = INTAKE

To narrow the width of valve seats, both intake and exhaust, use the following cutters: **A. 94031** (20°) and **A. 94003** (75°).

Grind valve seats with taper grinder **A. 94078** (45°).

Both intake and exhaust valves are of the flat-headed type.

Valves are fitted with a double spring the load and deflection data of which are tabulated on page 26.

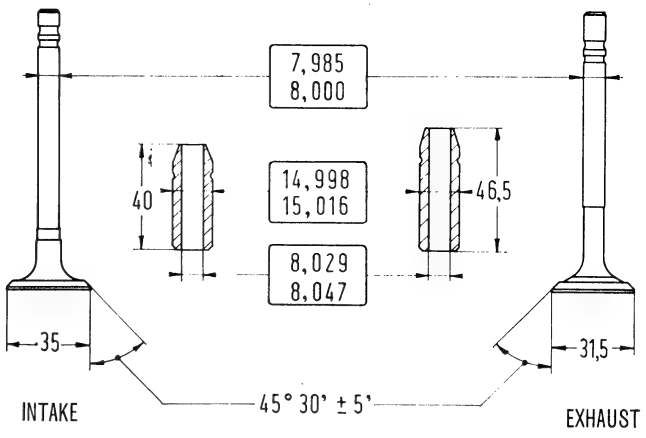


Fig. 24. - Critical dimensions of intake and exhaust valves and valve guides (in mm). Engine 115 C.005.

Cylinder head hold down screws should be tightened using a torque wrench in the sequence shown in fig. 27. Tighten head screws gradually, in no less than two passes:

— 1st pass: up to 21.7 ft.lbs (3 kgm) of torque;
— 2nd pass: draw up with prescribed torque, or 65.1 ft.lbs (9 kgm).

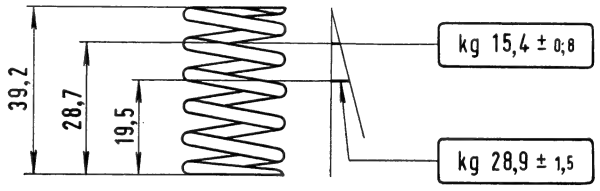


Fig. 25. - 115 C.005 engine inner valve spring testing data.
39,2 = 1.5433″ - 28.7 = 1.1299″ - 19,5 = .7677″
kg 15,4 ± 0,8 = 34 ± 1.8 lbs - kg 28,9 ± 1,5 = 63.7 ± 3.3 lbs

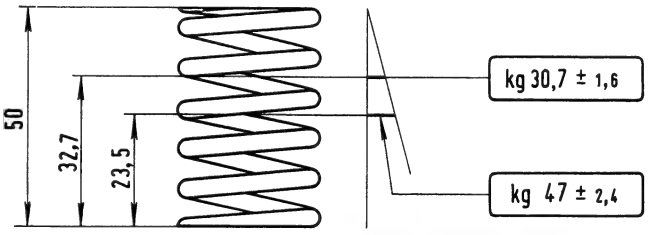


Fig. 26. - 115 C.005 engine outer valve spring testing data.
50 = 1.9685″ - 32,7 = 1.2874″ - 23,5 = .9252″
kg 30,7 ± 1,6 = 67.7 ± 3.5 lbs - kg 47 ± 2,4 = 103.6 ± 5.3 lbs

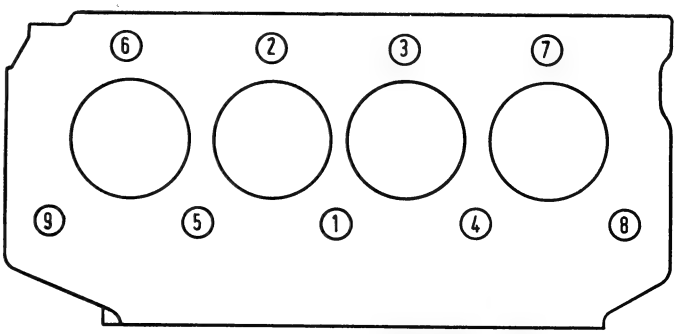


Fig. 27. - 115 C.005 engine head hold-down screw tightening sequence.

VALVE GUIDE - VALVE GUIDE SEAT FITTING SPECIFICATIONS

Valve Guide Seat Diameter	Valve Guide O. D.	Pinch Fit of New Parts
.5886″ to .5897″ (14.950 to 14.977 mm)	.5905″ to .5912″ (14.998 to 15.016 mm)	.0008″ to .0026″ (0.021 to 0.066 mm)

VALVE - VALVE GUIDE FITTING SPECIFICATIONS

Valve Guide I. D.	Valve Stem Diameter	Clearance of New Parts
.3161″ to .3168″ (8.029 to 8.047 mm)	.3144″ to .3150″ (7.985 to 8.000 mm)	.0011″ to .0024″ (0.029 to 0.062 mm)

VALVE SPRING SPECIFICATIONS

DESCRIPTION	Part No.	Working Coils No.	Total Coils No.	Spring I.D.	Wire Dia.	A	B		C		Minimum Load Referred to B
Outer Spring	4118615	4.5	6	1.0039″ (25.5 mm)	.1417″ (3.6 mm)	1.9685″ (50 mm)	1.2874″ (32.7 mm)	67.7 lbs (30.7 kg)	.9252″ (23.5 mm)	103.6 lbs (47 kg)	60.6 lbs (27.5 kg)
Inner Spring	4118614	5	6.5	.6829″ (17.6 mm)	.1063″ (2.7 mm)	1.5433″ (39.2 mm)	1.1299″ (28.7 mm)	34 lbs (15.4 kg)	.7677″ (19.5 mm)	63.7 lbs (28.9 kg)	29.8 lbs (13.5 kg)

A = Length, free spring. B-C = Length and load, spring check.

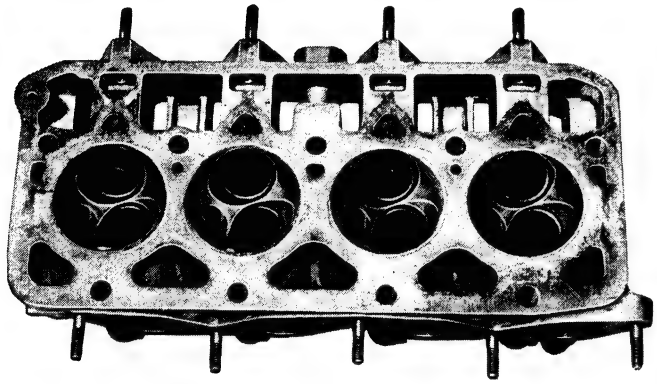


Fig. 28. - 115 C.005 engine head: view of block mating face.

VALVE GEAR

The three-bearing camshaft is situated in the crankcase and driven by the crankshaft, via a link chain.

Valve timing data (using increased tappet clearance of .0177″ - 0.45 mm) are as follows:

Intake:

— opens, B.T.D.C. . . . . 25°

— closes, A.B.D.C. . . . . 51°

Exhaust:

— opens, B.B.D.C. . . . . 64°

— closes, A.T.D.C. . . . . 12°

Tappet clearance, cold:

— intake . . . . . .0079″ (0.20 mm)

— exhaust . . . . . .0098″ (0.25 mm)

The front camshaft bushing is of aluminum and tin alloy, while the center and rear bushings are of babbitt-coated sheet steel.

Valves are controlled by the camshaft via tappets, push rods and rockers.

Rocker arms are working on two separate shafts (fig. 32), one intake valve rocker shaft and one exhaust valve rocker shaft.

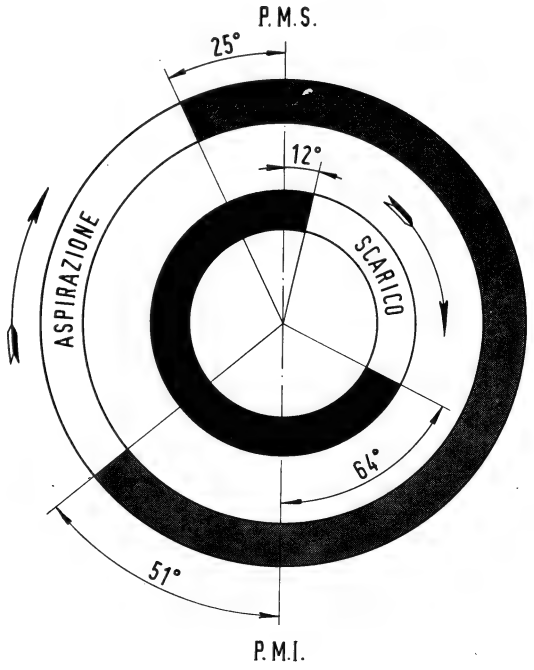


Fig. 29. - Valve timing diagram of engine 115 C.005 at increased tappet clearance of .0177″ (0.45 mm).

ASPIRAZIONE = INTAKE - SCARICO = EXHAUST
P.M.I. = B.D.C. - P.M.S. = T.D.C.

Intake valve rockers are different from exhaust valve rockers.

Push rods are varying in length for either intake or exhaust rockers: the length of intake push rods is lesser than that of exhaust push rods.

Replacing and Reaming Camshaft Bushings.

If camshaft bushings are proved to need replacement, remove them from their bores and install new ones as directed hereafter:

— the front bushing should be fitted loosely into relevant crankcase bore; the inside and outside faces of this bushing are precision-machined; with two screws, secure the bushing to the crankcase; the fact that fixing screws are arranged offset allows for one position of the bushing, which will be correct in any case.

— the center bushing and the rear one should be force driven into seat, because a press fit is specified between the bushings and their crankcase bores as tabulated on page 48. Use care, when driving in the bushings, that the inlet holes are indexing with oil passages on crankcase;

— bore specifications of center and rear bushings fitted into seat are tabulated on page 48;

— the center bushing and the rear one should be finish reamed to the camshaft journal mating bores as tabulated for these bushings in place in crankcase (see fig. 30); this will warrant perfect alignment and squareness of camshaft bearing axes; line ream bushings with reamer **A. 90327** complying with the manufacturer's directions contained in the tool kit.

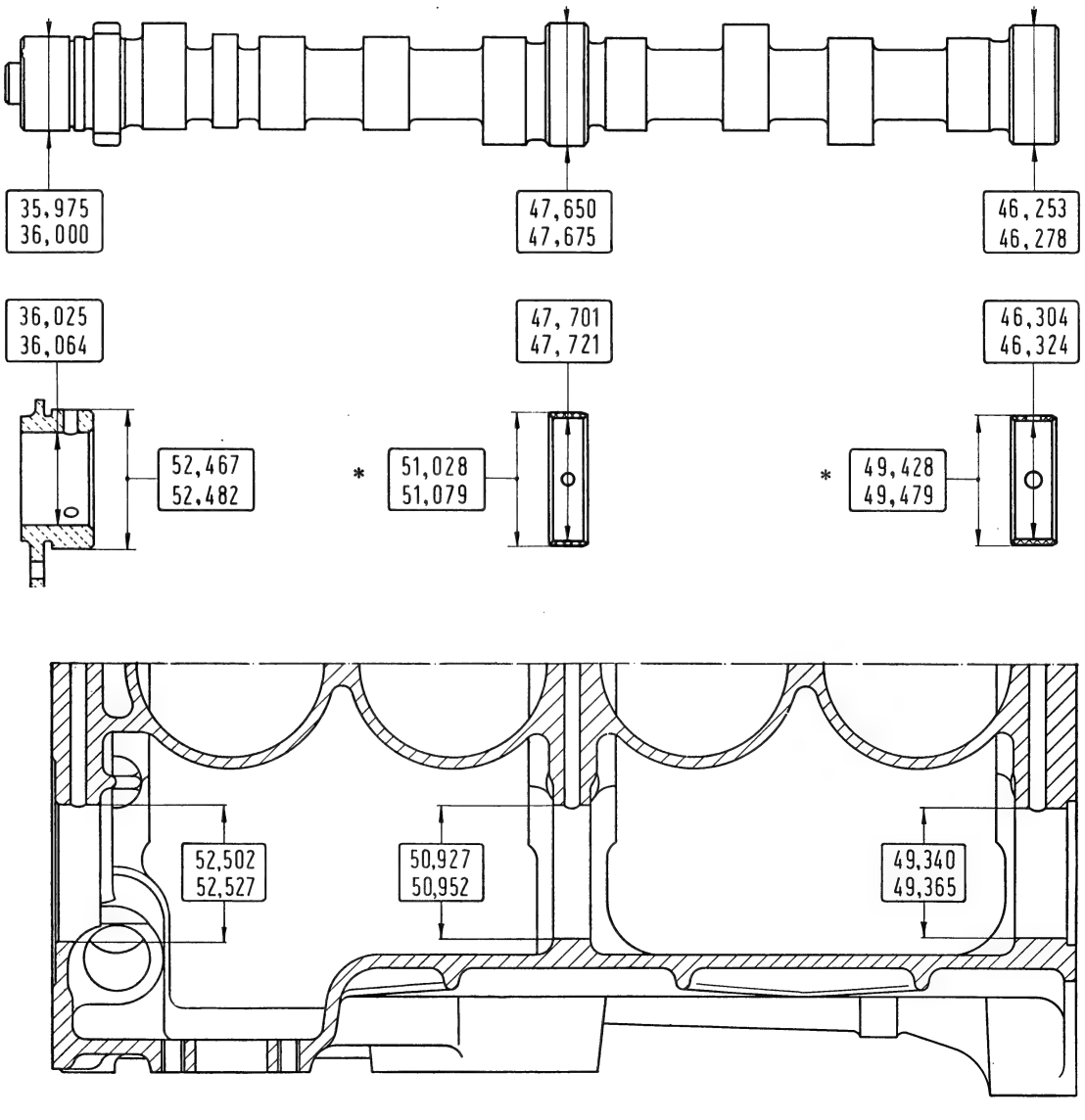


Fig. 30. - Critical dimensions (in mm) of camshaft, bushings and bushing seats.

Center and rear bushing bores apply to bushings seated and reamed.

* Figure refers to ring gauge bore (bushing fitted manually).

115 C.005 ENGINE ASSEMBLY

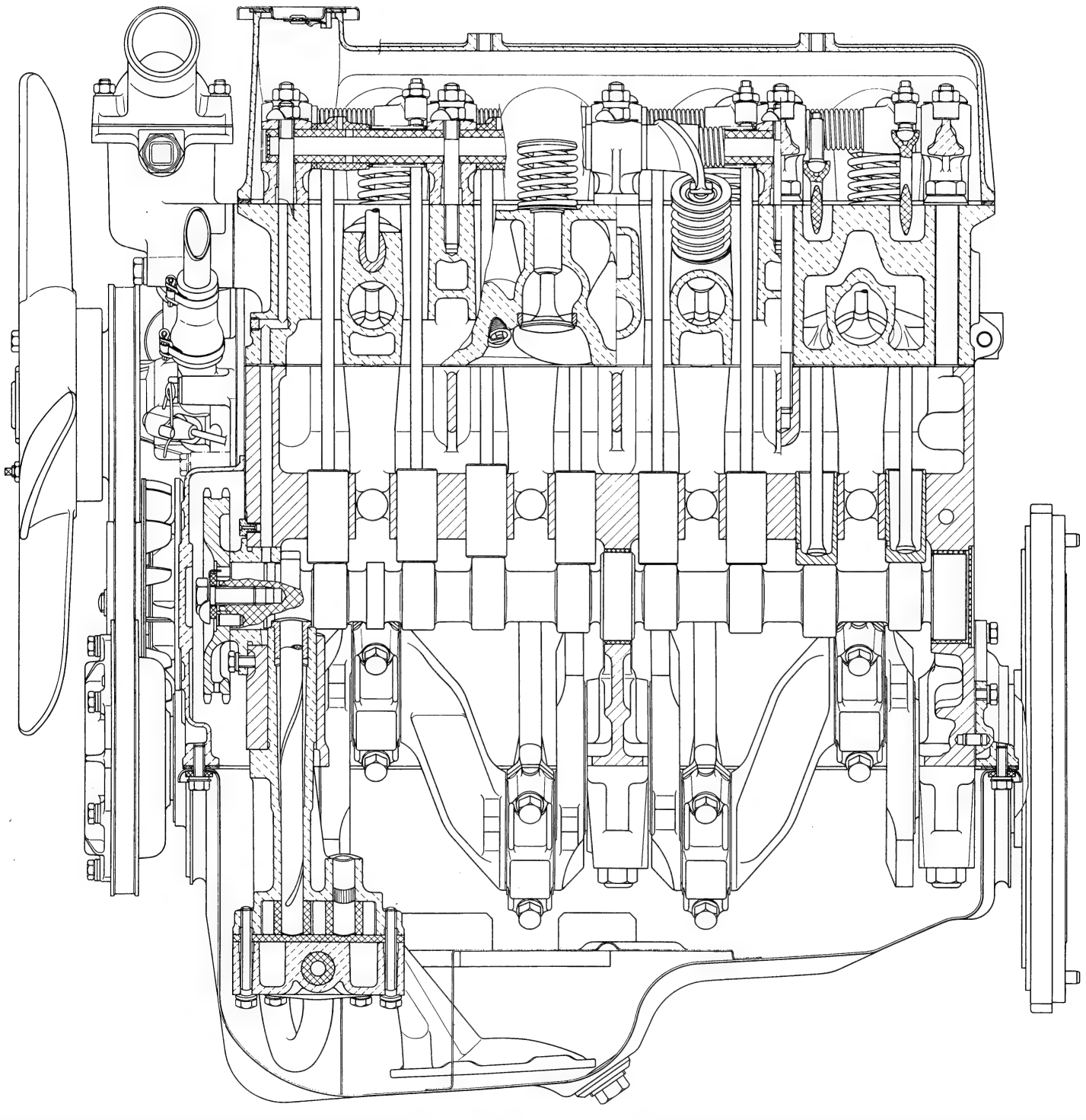


Fig. 31. - Side sectional view of engine 115 C.005 across camshaft, rocker shaft and oil pump.

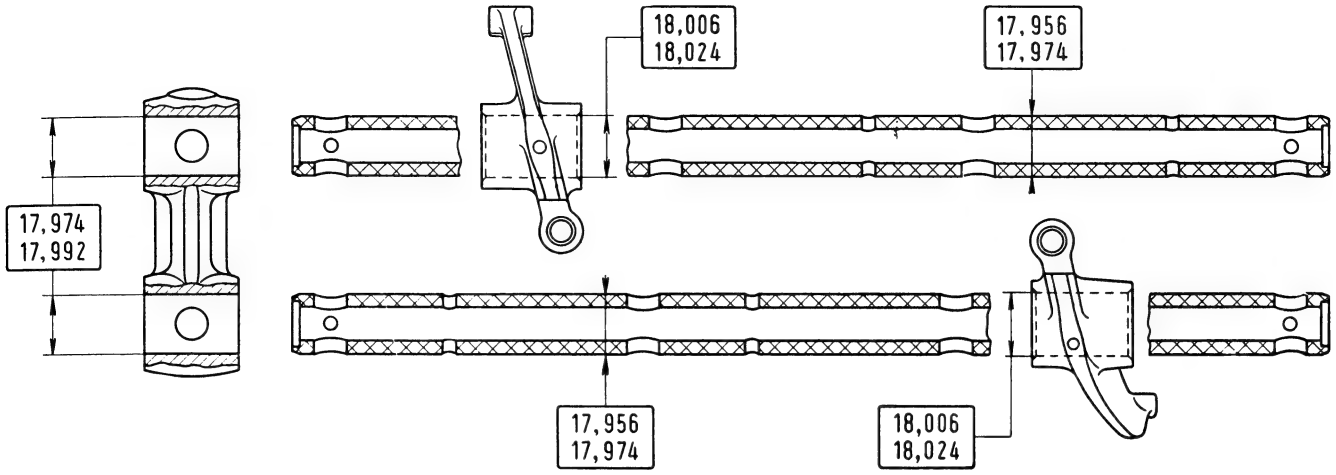


Fig. 32. - Critical dimensions of 115 C.005 engine rocker shafts, supports and rocker arms (in mm).

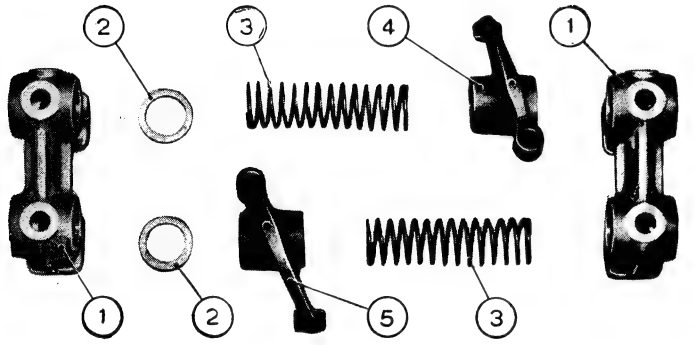


Fig. 33. - Components of a valve rocker assembly (engine 115 C.005).

1. Rocker shaft supports - 2. Spring and rocker arm backing washers - 3. Rocker arm springs - 4. Exhaust valve rocker arm - 5. Intake valve rocker arm.

Adjusting Valve Tappet Clearance.

Tappet clearance should be set at **.0079″ (0.20 mm),** intake, and **.0098″ (0.25 mm)**, exhaust, **with a cold engine**. The adjustment of tappet clearance deserves much care, because if it is other than specified an alteration of the valve timing diagram may result.

As a matter of fact, excessive tappet clearance, in addition to clicking noises, causes a delayed opening and advanced closing of valves, while insufficient tappet clearance reverses the effect. Eventually, should tappet clearance be reduced to nil, valves will stay in part open position all the time, with most harmful consequences on valve and valve seat life.

To adjust tappet clearance, proceed as follows:

— crank the engine until valves of cylinder No. 1 are « on balance », or the intake stroke is about to begin in this cylinder;

— adjust the valve stem-to-rocker arm clearance at cylinder No. 4; in fact this cylinder is at the end of the compression stroke and therefore both valves are closed. Using wrench **A. 50107**, hold the rocker arm setscrew and with a box wrench turn out the lock nut; insert the stock of feeler gauge **A. 95110** (.0079″ - 0.20 mm thick) or **A. 95111** (.0098″ - 0.25 mm thick) between the rocker arm and the valve stem, and by means of wrench **A. 50107** turn in or out the setscrew until the feeler stock slides in with some drag; now, firmly hold the setscrew and lock the nut with the box wrench.

After this procedure has been completed at both valves of cylinder No. 4, adjust the tappet clearance at remaining cylinders, recalling that: with valves of cylinder No. 4 « on balance », clearance must be set at

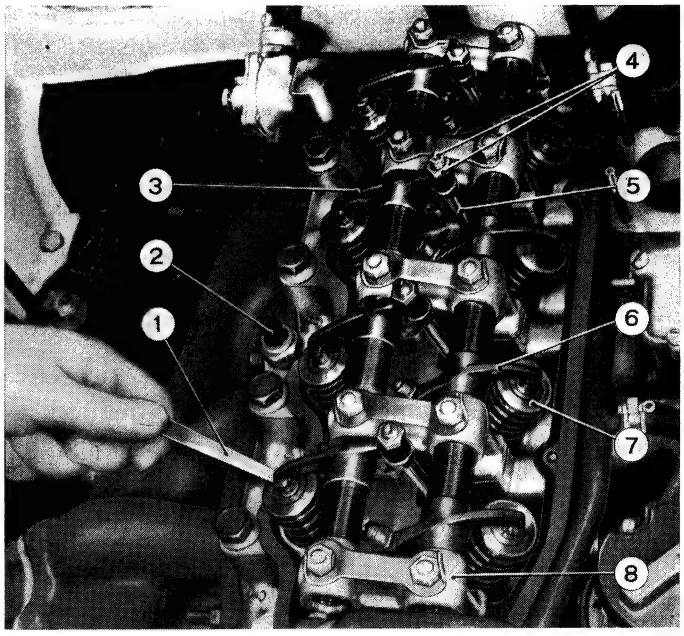


Fig. 34. - Close-up view of cylinder head, showing tappet clearance adjustment (engine 115 C.005).

1. Feeler gauge - 2. Heat indicator sending unit - 3. Exhaust valve rocker arm - 4. Tappet clearance adjusting screw and nut - 5. Push rod - 6. Intake valve rocker arm - 7. Cup - 8. Rocker shaft support.

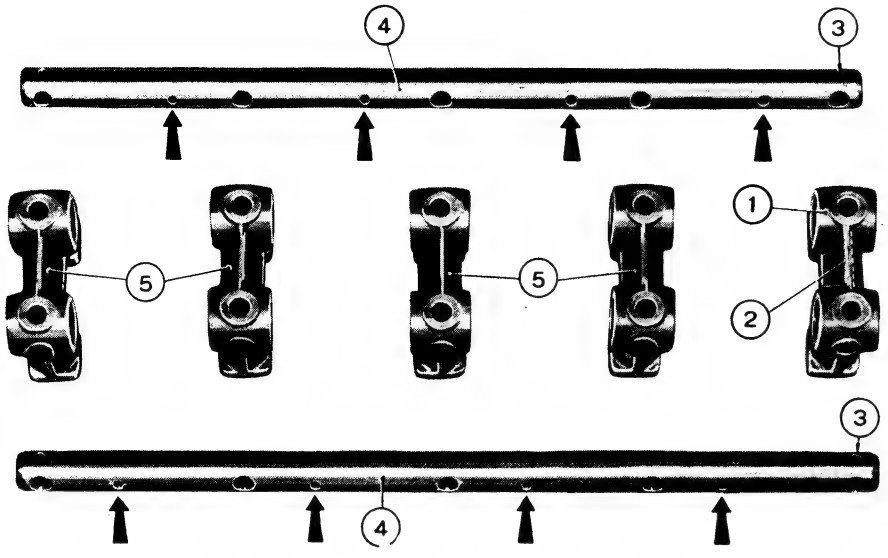


Fig. 35.

Rocker shafts and supports.

1. Front support - 2. Oil delivery passage from intake valve rocker shaft to exhaust valve rocker shaft - 3. Oil inlet holes - 4. Rocker shafts - 5. Intermediate and rear rocker shaft supports.

For satisfactory lubrication of rocker arms, on assembly rocker shafts should be placed with the oil holes, which are evidenced by arrows, in the same position relative to support as shown in figure.

cylinder No. 1, with valves of cylinder No. 3 « on balance », clearance must be set at cylinder No. 2, and vice versa.

Valve Timing.

The correct valve timing is obtained when the timing marks on sprockets are indexing as shown in fig. 36.

To line up the timing marks on sprockets, proceed as follows:

— insert the drive sprocket on the front end of crankshaft;

— install the driven sprocket on camshaft and turn it about until the mark machined on its outskirts is in line with the notch on the drive sprocket;

— without moving the camshaft, **take out the driven sprocket**, and mesh the timing chain with the sprockets; reinstall the driven sprocket and chain, using care that the timing marks are indexing (fig. 36); lock the crankshaft and camshaft by placing tool **A. 60193** on the flywheel; use a torque wrench and draw up the driven sprocket screw with 36.2 ft.lbs (5 kgm) of torque, then bend down the lock plate.

Should the necessity arise to check whether the timing marks are stamped in the right place and consequently the correct valve timing has been obtained, proceed as follows:

— affix the sector scale **A. 95677** on crankcase;

— fit the crank **A. 60186** on the flywheel;

— temporarily set the tappet clearance of cylinder No. 1 at .0177″ (0.45 mm);

— using the crank, turn about the flywheel until the cylinder No. 1 begins the compression stroke, that is the intake valve is just on the way of opening: at this point the flywheel mark (showing T.D.C. of cylinder Nos. 1 and 4) should register 25° before T.D.C.; go on cranking the flywheel until its mark is indexing with the zero sign on sector scale;

— in this position observe the marks on timing sprockets: they should be lined up (fig. 36).

Next to valve timing, crank the flywheel and verify on sector scale that the advance angle at the beginning and the retard angle at the end of the intake stroke as well as the advance angle at the beginning and the retard angle at the end of the exhaust stroke, are as specified in fig. 29.

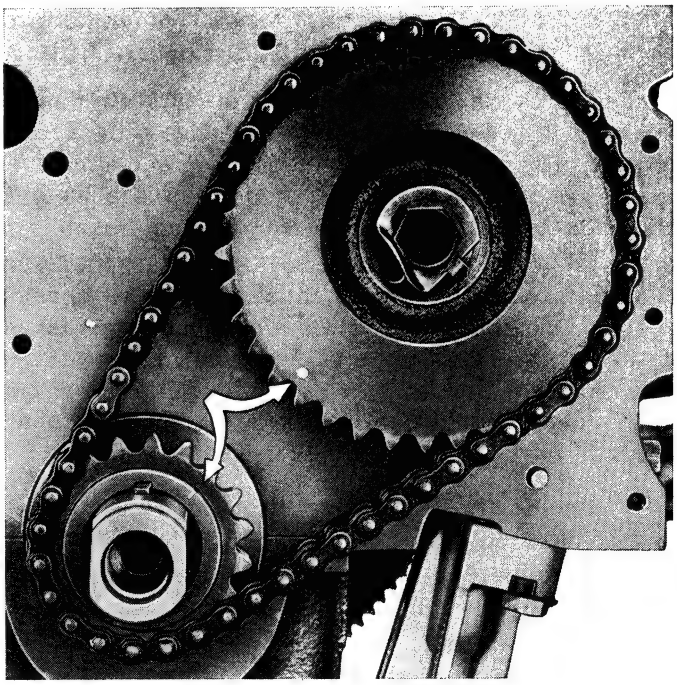


Fig. 36. - Valve timing marks on drive and driven sprocket (engine 115 C.005).

ENGINE 118 B.000

Service procedures not dealt with in the following text must be taken as common to those covering engine 115 C.005 and reference to them should be made.

CYLINDER BLOCK

Standard cylinder barrels are graded into four size groups A-B-C-D according to the bore diameter.

Bore sizes corresponding to the various groups are the following:

Group A . . 3.1496″ to 3.1500″ (80.000 to 80.010 mm)
Group B . . 3.1500″ to 3.1504″ (80.010 to 80.020 mm)
Group C . . 3.1504″ to 3.1508″ (80.020 to 80.030 mm)
Group D . . 3.1508″ to 3.1512″ (80.030 to 80.040 mm)

PISTONS

Standard pistons are graded into four size groups A-B-C-D on the ground of their diametrical quotation as shown in fig. 40; they are also graded into two groups 1 and 2 according to the boss bore for mating with pins.

NOTICE - Piston skirt diameter should be measured at right angle to the pin at two points being 9/32″ (7 mm) and 1 $^{9}/_{16}$″ (40 mm), respectively, apart from skirt top as shown in fig. 40.

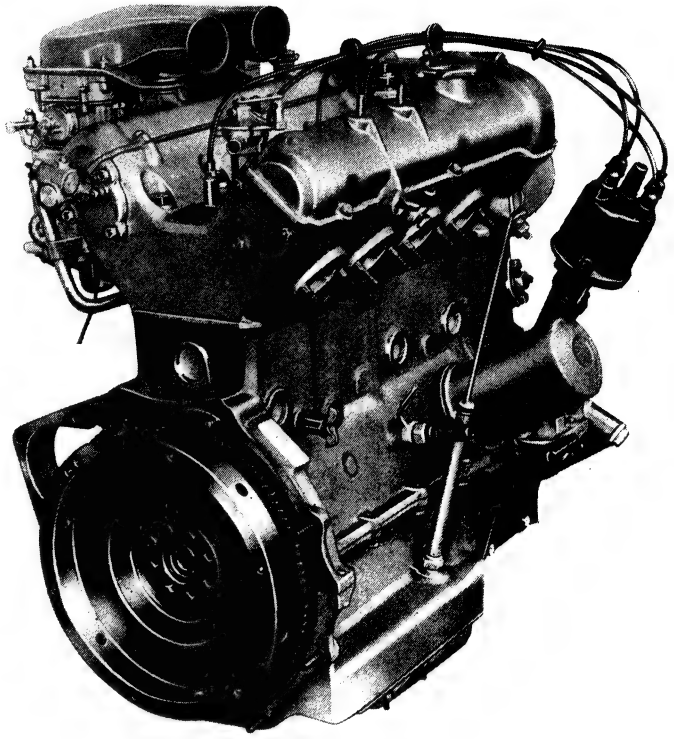


Fig. 37. - Engine 118 B.000 viewed from the right hand side.

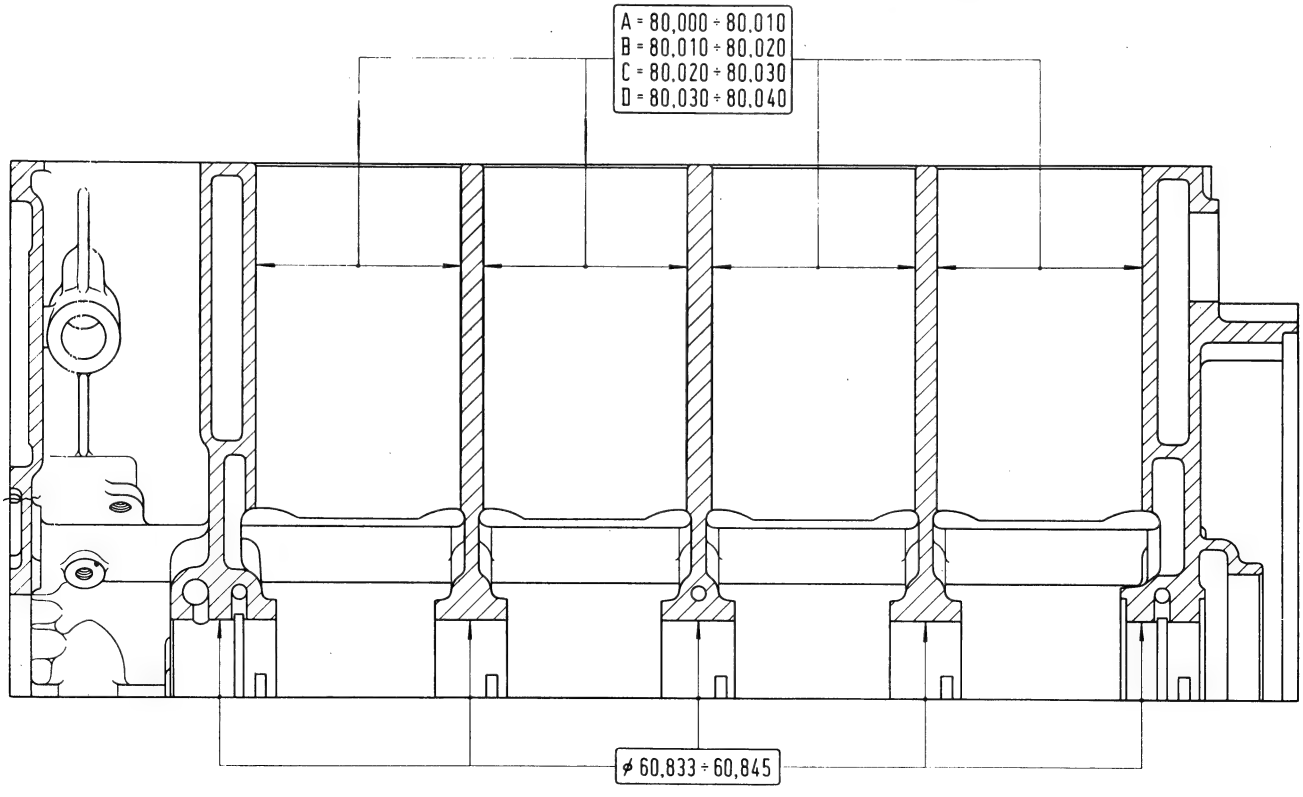


Fig. 38. - Critical dimensions of 118 B.000 engine crankcase (in mm): diametrical sizes of cylinder bore grades and of five main bearing saddles.

118B.000 ENGINE ASSEMBLY

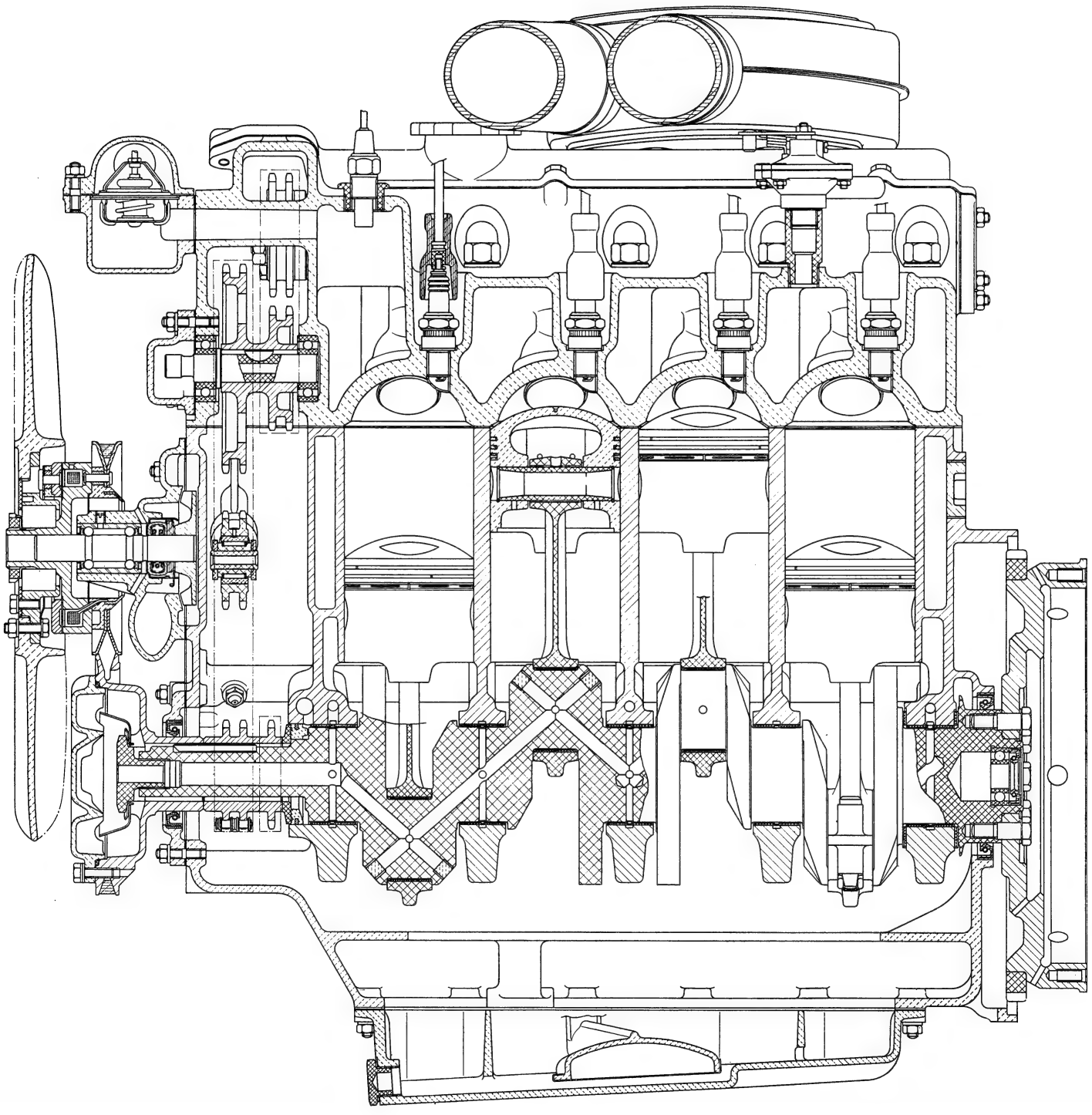


Fig. 39. - Side sectional view of engine 118 B.000 across cylinders.

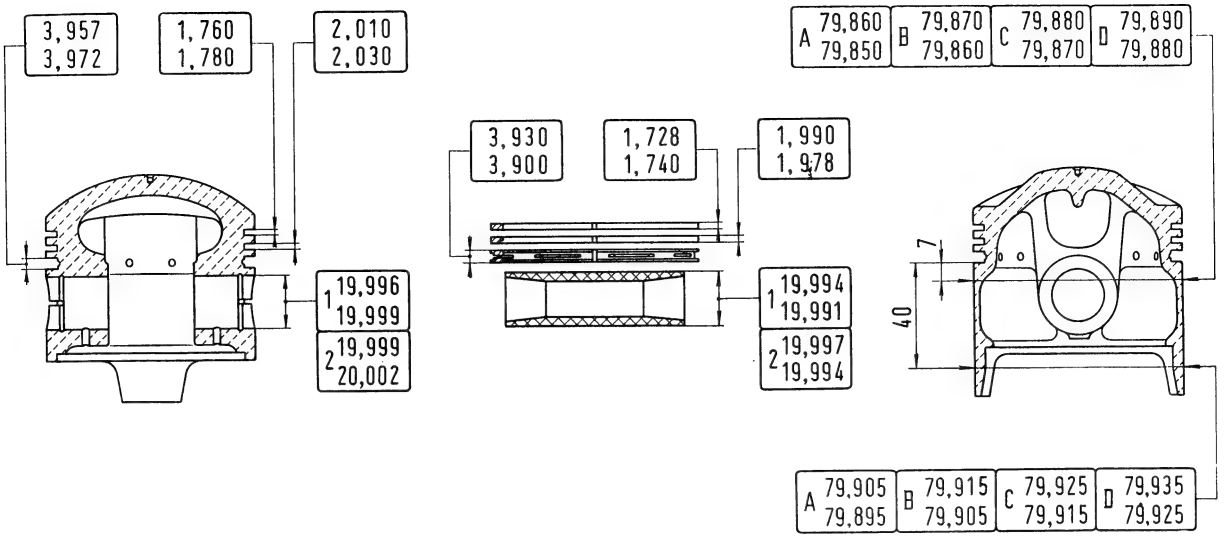


Fig. 40. - Critical dimensions (in mm) of 118 B.000 engine pistons, pins and rings. Piston and pin come for replacement in a matched set.

Pistons come paired with the pin in sets of four ranging in the prescribed weight tolerance.

CONNECTING RODS - ROD BEARINGS

For installation of connecting rod-piston-pin assembly see fig. 41.

Fitting data for assembly of parts are tabulated on page 43.

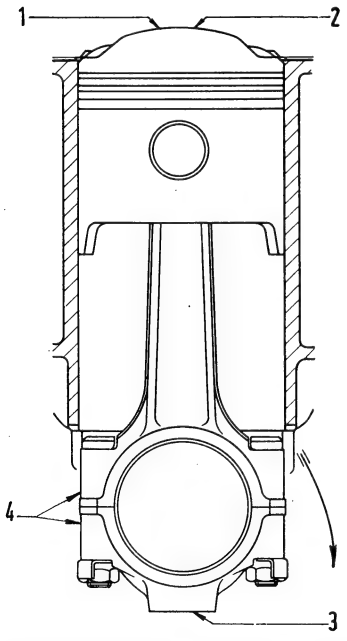


Fig. 41. - Installation diagram of 118 B.000 engine connecting rod-piston-pin assembly.

1. Location of piston-cylinder size group letter - 2. Location of piston -piston pin size group number - 3. Location of connecting rod-piston pin size group number - 4. Location of connecting rod-cylinder pairing number.

Arrow shows turning direction of front-viewed engine.

CRANKSHAFT AND MAIN BEARINGS

The crankshaft is forged with counterweights and rotates on five bearings.

Four half shoulder rings on rear bearing take the end thrusts of the crankshaft.

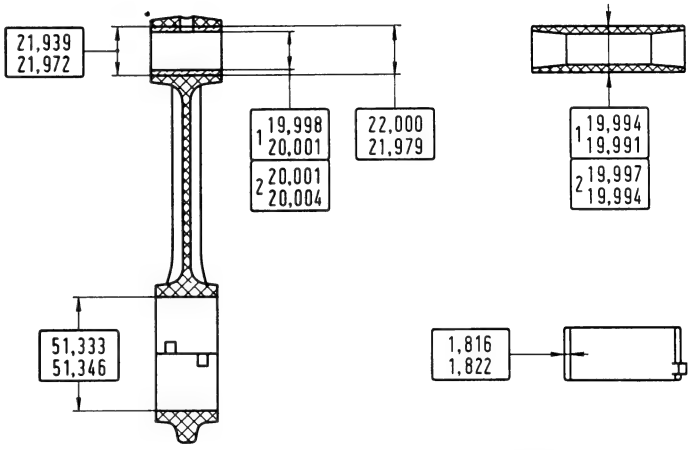


Fig. 42. - Critical dimensions (in mm) of 118 B.000 engine connecting rods, piston pins and small end bushings.

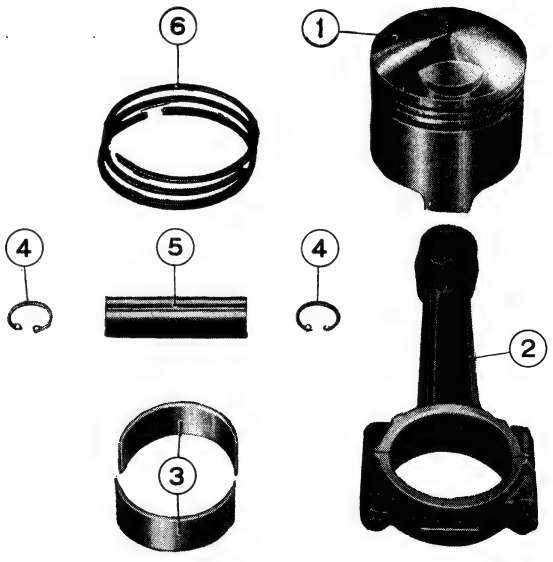


Fig. 43. - Connecting rod-piston assembly components.
1. Piston - 2. Con rod with cap - 3. Bearing shells - 4. Snap rings - 5. Piston pin - 6. Piston rings.

MAIN BEARING JOURNAL DIAMETER SPECIFICATIONS

Standard Size	Undersizes			
	.01″ (0.254 mm)	.02″ (0.508 mm)	.03″ (0.762 mm)	.04″ (1.016 mm)
2.2470″ (57.073 mm) to 2.2474″ (57.086 mm)	2.2370″ (56.819 mm) to 2.2374″ (56.832 mm)	2.2270″ (56.565 mm) to 2.2274″ (56.578 mm)	2.2170″ (56.311 mm) to 2.2174″ (56.324 mm)	2.2070″ (56.057 mm) to 2.2074″ (56.070 mm)

CON ROD JOURNAL DIAMETER SPECIFICATIONS

Standard Size	Undersizes			
	.01″ (0.254 mm)	.02″ (0.508 mm)	.03″ (0.762 mm)	.04″ (1.016 mm)
1.8755″ (47.638 mm) to 1.8763″ (47.658 mm)	2.8655″ (47.384 mm) to 1.8663″ (47.404 mm)	1.8555″ (47.130 mm) to 1.8563″ (47.150 mm)	1.8455″ (46.876 mm) to 1.8463″ (46.896 mm)	1.8355″ (46.622 mm) to 1.8363″ (46.642 mm)

MAIN BEARING SHELL THICKNESS SPECIFICATIONS

Standard Size	Undersizes			
	.005″ (0.127 mm)	.010″ (0.254 mm)	.015″ (0.381 mm)	0.20″ (0.508 mm)
.0727″ (1.845 mm) to .0729″ (1.851 mm)	.0777″ (1.972 mm) to .0779″ (1.978 mm)	.0827″ (2.099 mm) to .0829″ (2.105 mm)	0.877″ (2.226 mm) to .0879″ (2.232 mm)	.0927″ (2.353 mm) to .0929″ (2.359 mm)

ROD BEARING SHELL THICKNESS SPECIFICATIONS

Standard Size	Undersizes			
	.005″ (0.127 mm)	.010″ (0.254 mm)	.015″ (0.381 mm)	.020″ (0.508 mm)
.0716″ (1.816 mm) to .0718″ (1.822 mm)	.0766″ (1.943 mm) to .0768″ (1.949 mm)	.0816″ (2.070 mm) to .0818″ (2.076 mm)	.0866″ (2.197 mm) to .0868″ (2.203 mm)	.0916″ (2.324 mm) to .0918″ (2.330 mm)

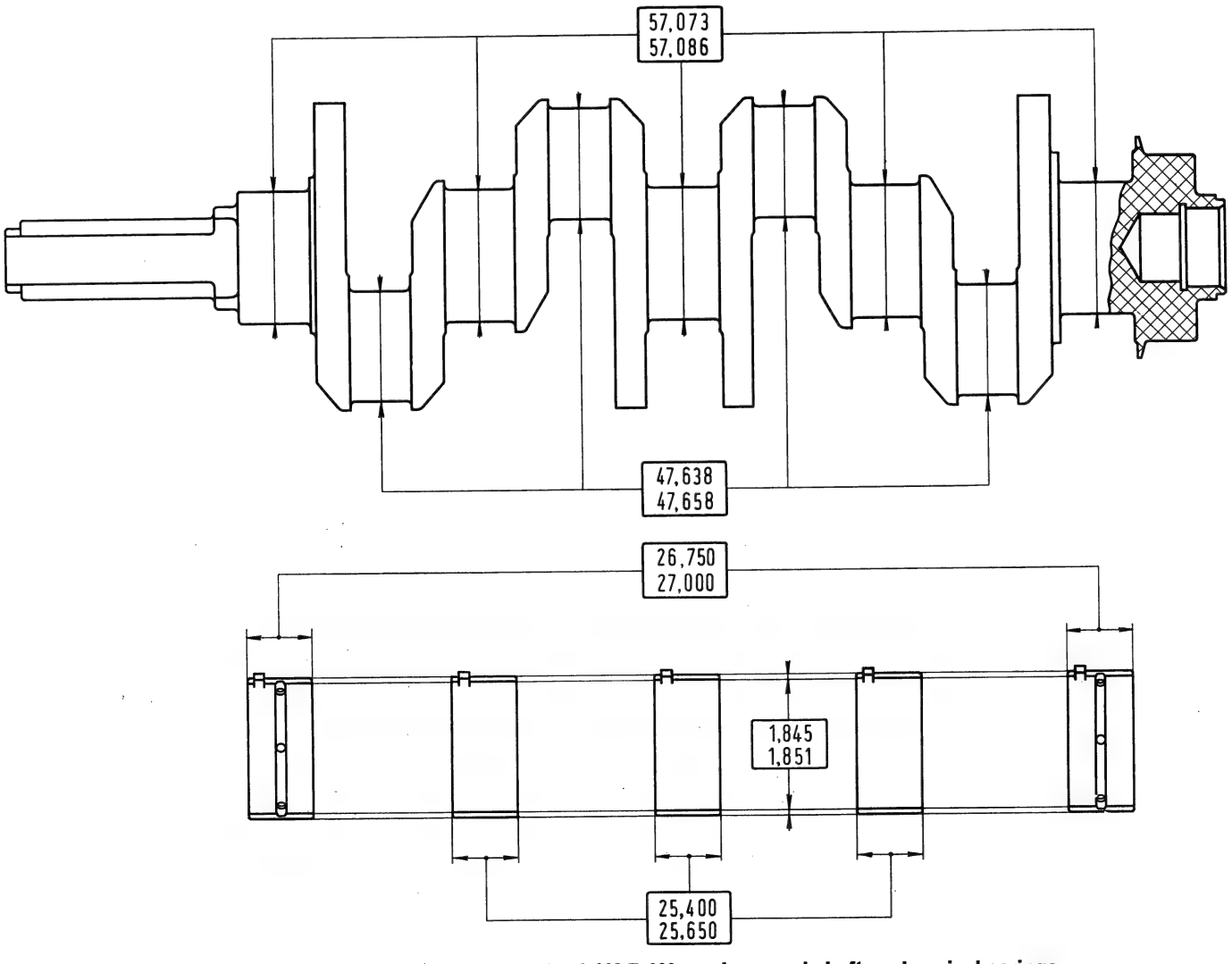


Fig. 44. - Critical dimensions (in mm) of 118 B.000 engine crankshaft and main bearings.

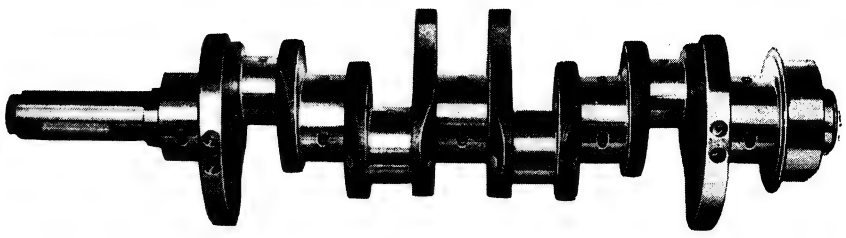


Fig. 45.
118 B.000 engine crankshaft.

Grinding Crankshaft Journals.

As a result of grinding operation, no alteration of crankarm fillet should be observed in respect of the radius specification: r = .0866″ to .0945″ (2.2 to 2.4 mm).

Checking Crankshaft.

Using a dial indicator check as follows:

— Alignment of main bearing journals: maximum out-of-true limit .002″ (0.05 mm) (fig. 47) (total reading of indicator dial).

— Alignment of connecting rod bearing journals: maximum out-of-true of connecting rod bearing journals to main bearing journals ± .01″ (0.25 mm) (fig. 47).

— Out-of-round of main and connecting rod bearing journals: maximum limit after grinding .0002″ (0.005 mm).

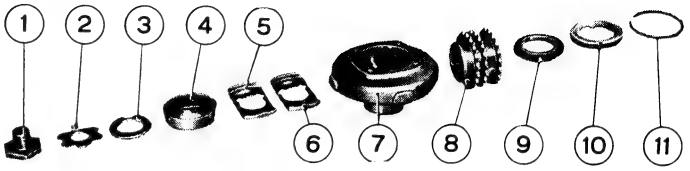


Fig. 46. - Items fitted at front end of crankshaft.
1. Centrifugal oil filter mounting screw - 2. Lock plate - 3. Washer - 4. Oil slinger - 5-6. Baffle plates - 7. Filter thrower - 8. Timing gear drive sprocket - 9. Thrust ring - 10. Oil seal disc - 11. Oil seal ring.

— Taper of main and connecting rod bearing journals: maximum limit after grinding .0002″ (0.005 mm).

— Squared condition of flywheel mounting face to crankshaft: with a dial indicator set laterally (A, fig. 47) at a distance of some 1 1/2″ (38 mm) from crankshaft axis, turn the crankshaft and check for no runout in excess of .0008″ (0.02 mm).

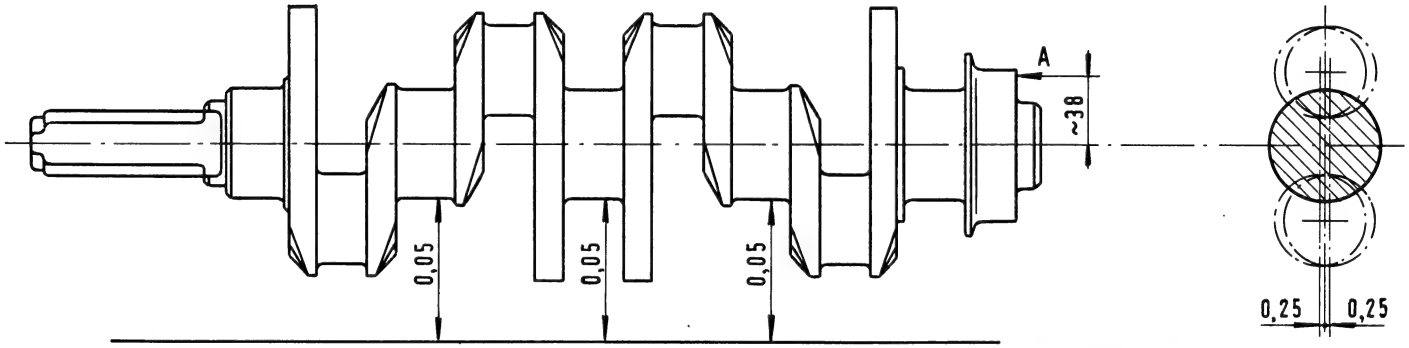


Fig. 47. - Maximum out-of-true allowances on alignment of main bearing journals and of connecting rod journals to main bearing journal axis; quotation for squareness inspection of flywheel resting face to crankshaft centerline (engine 118 B.000).
0,05 = .002″ - 0,25 = .01″ - ~ 38 = 1 1/2″

CYLINDER HEAD - VALVES - VALVE GUIDES AND SPRINGS

Valve seats on cylinder head are angled at 55° ± 5′.

To narrow the width of valve seats, both intake and exhaust, use the following cutters: **A. 94046** (20°) and **A. 94003** (75°).

Grind valve seats with taper grinder **A. 94060** (55°).

The load and deflection data of valve springs are tabulated on page 37.

Cylinder head hold-down screws should be tightened, using a torque wrench, in the sequence shown in fig. 50.

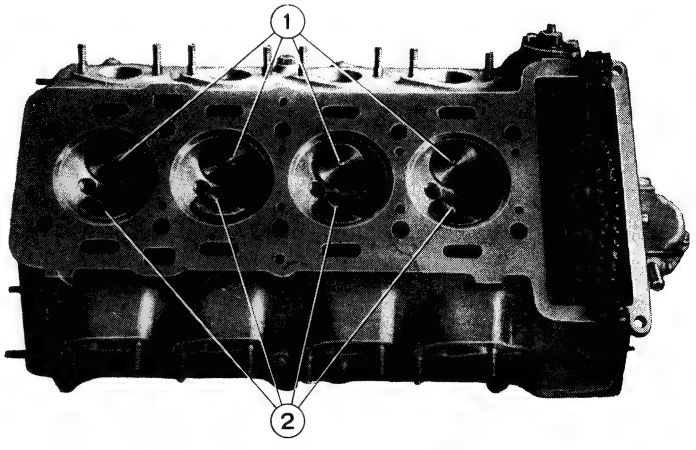


Fig. 48. - Bottom view of 118 B.000 engine head.
1. Intake valves - 2. Exhaust valves.

118 B.000 ENGINE ASSEMBLY

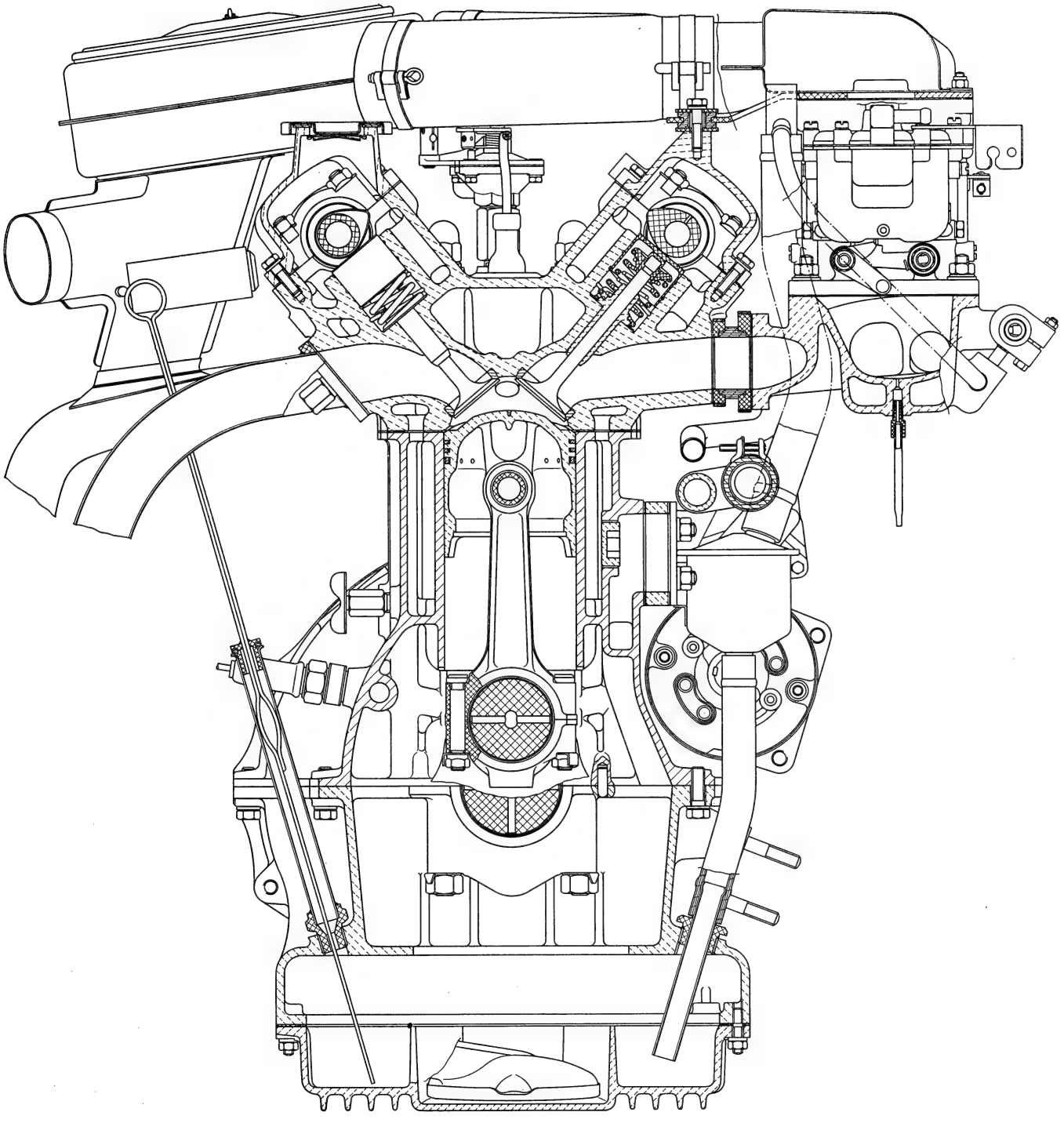


Fig. 49. - End sectional view of engine 118 B.000 across connecting rod, piston and valves.

118 B.000 ENGINE VALVE SPRING SPECIFICATIONS

DESCRIPTION	Part N°	Working Coils No.	Total Coils No.	Spring I.D.	Wire Dia.	A	B		C		Minimum Load Referred to B
Outer Spring	4046108	4.25	5.75	.9449″ (24 mm)	.1378″ (3.50 mm)	1.7126″ (43.5 mm)	1.4173″ (36 mm)	33 lbs (15 kg)	1.0630″ (27 mm)	72.8 lbs (33 kg)	26.5 lbs (12 kg)
Inner Spring	4046107	5.50	7.00	.6693″ (17 mm)	.1083″ (2.75 mm)	1.4370″ (36.5 mm)	1.2205″ (31 mm)	18.6 lbs (8.45 kg)	.8661″ (22 mm)	49.2 lbs (22.3 kg)	15 lbs (6.8 kg)

A = Length, free spring. B-C = Length and load, spring check.

Tighten the head screws gradually, in no less than two passes:

— 1st pass: up to some 18.1 ft.lbs (2.5 kgm) of torque;

— 2nd pass: turn in with the prescribed torque, or 65.1 ft.lbs (9 kgm).

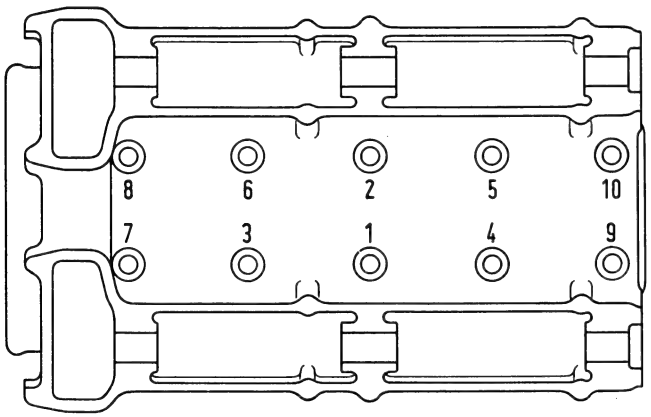


Fig. 50. - 118 B.000 engine head hold-down screw tightening sequence.

VALVE GUIDE-TO-SEAT FITTING SPECIFICATIONS

Valve Guide Seat I. D.	Valve Guide O. D.	Pinch Fit of New Parts
.5118″ to .5125″ (13.000 to 13.018 mm)	.5138″ to .5142″ (13.052 to 13.062 mm)	.0013″ to .0024″ (0.034 to 0.062 mm)

VALVE-TO-VALVE GUIDE FITTING SPECIFICATIONS

Valve Guide I. D.	Valve Stem Dia.	Clearance of New Parts
.3150″ to .3156″ (8.000 to 8.015 mm)	.3139″ to .3146″ (7.975 to 7.990 mm)	.0004″ to .0016″ (0.010 to 0.040 mm)

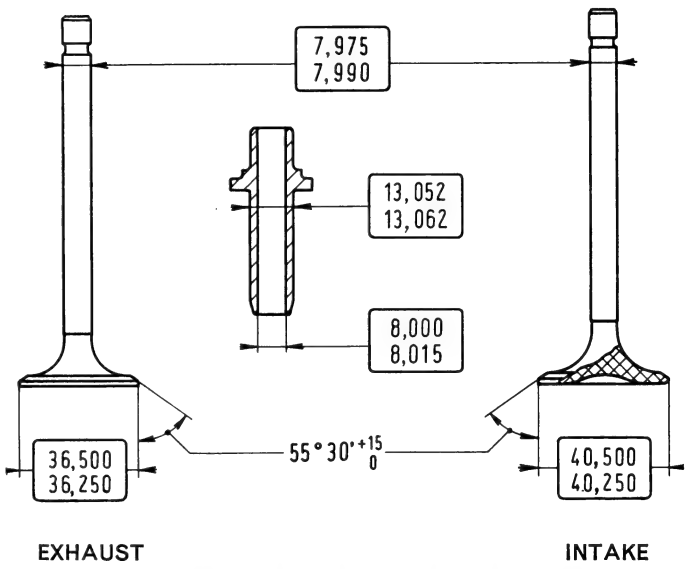


Fig. 51. - Critical dimensions (in mm) and angles of 118 B.000 engine exhaust and intake valves and valve guides.

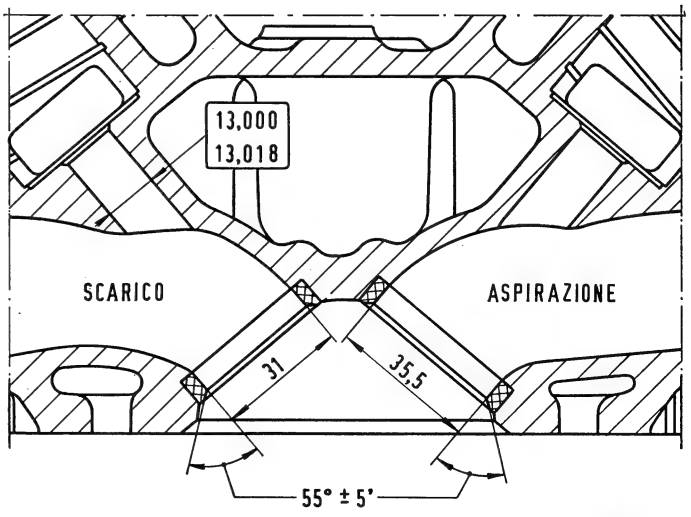


Fig. 52. - Critical dimensions (in mm) and angles of 118 B.000 engine valve seats on head.

SCARICO = EXHAUST - ASPIRAZIONE = INTAKE

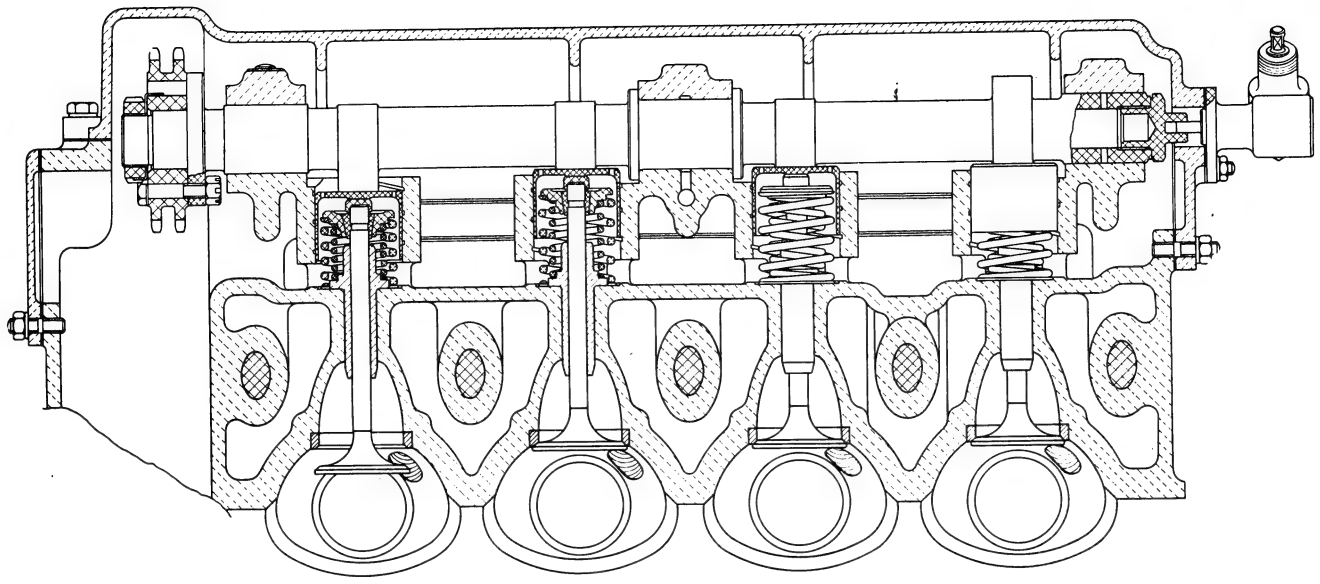


Fig. 53. - Sectional view of 118 B.000 engine head across intake valve camshaft and tachometer drive.

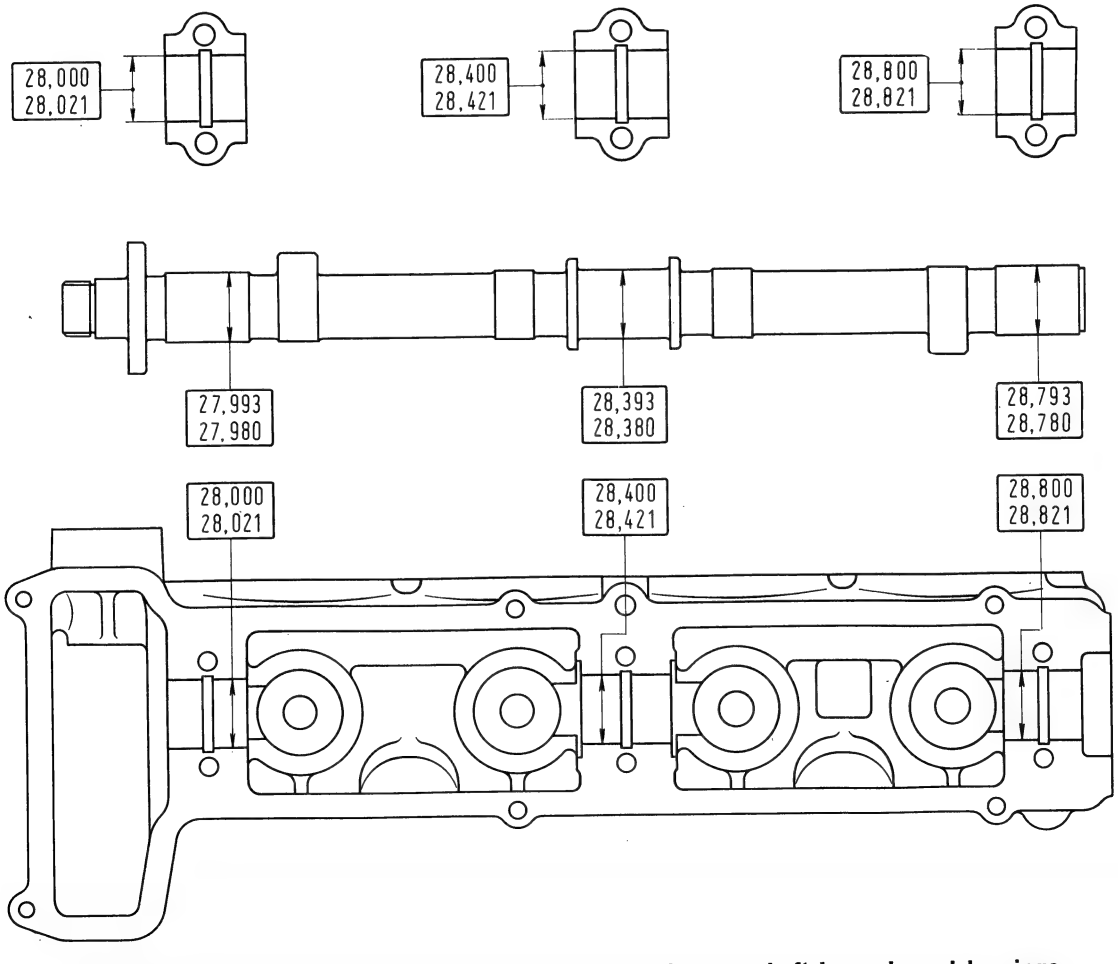


Fig. 54. - Critical dimensions (in mm) of 118 B.000 engine camshaft journals and bearings.

VALVE GEAR

Two overhead camshafts operate intake and exhaust valves, through tappets.

Camshafts are driven by crankshaft off twin double row chains.

Valve timing data (at a tappet clearance of .0118″ - 0.30 mm, intake and .0138″ - 0.35 mm, exhaust):

Intake:

— opens	28° B.T.D.C.
— closes	64° A.B.D.C.

Exhaust:

— opens	63° B.B.D.C.
— closes	23° A.T.D.C.

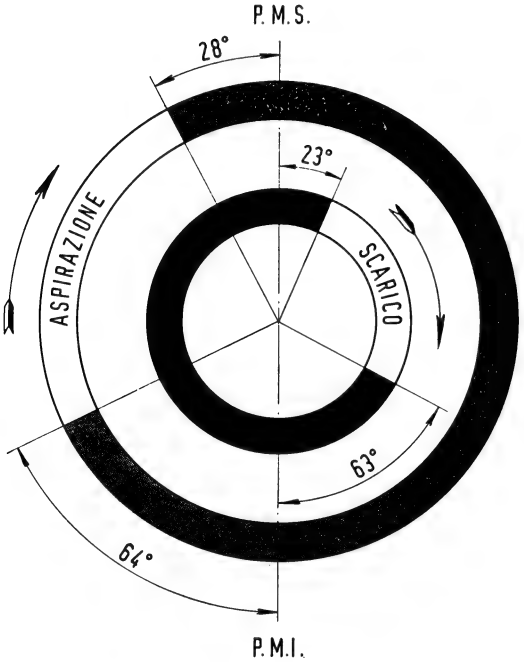


Fig. 55. - 118 B.000 engine valve timing diagram at a tappet clearance of .0118″ (0.30 mm), intake and .0138″ (0.35 mm), exhaust.

ASPIRAZIONE = INTAKE - SCARICO = EXHAUST
P.M.S. = T.D.C. - P.M.I. = B.D.C.

Valve tappet clearance for engine operation, cold:

— intake	.0118″ (0.30 mm)
— exhaust	.0138″ (0.35 mm)

Checking and Adjusting Tappet Clearance (cold engine).

The recommended clearance setting between camshafts and tappets of:

— .0118″ (0.30 mm) intake valves;

— .0138″ (0.35 mm) exhaust valves;

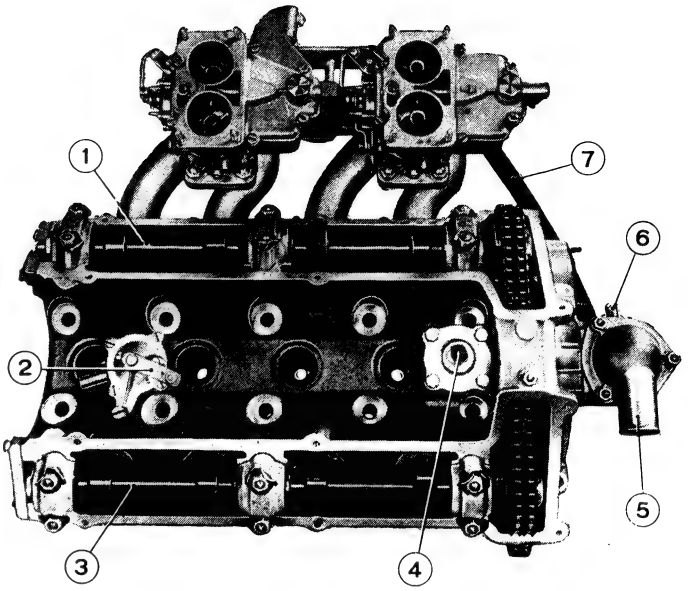


Fig. 56. - 118 B.000 engine head with valve gear covers removed.

1. Intake valves camshaft - 2. Cock, water to car heater - 3. Exhaust valves camshaft - 4. Heat indicator sending unit - 5. Cylinder head water outlet - 6. Water return line from heater - 7. Water delivery line to intake manifolds.

should be kept as constant as possible in order not to alter the correct timing and obtain optimum engine operation. In fact, if clearance is excessive, noises will develop, while if it is much less than specified, valves will keep on staying a bit open with consequent lack of compression, reduced life of valves and seats.

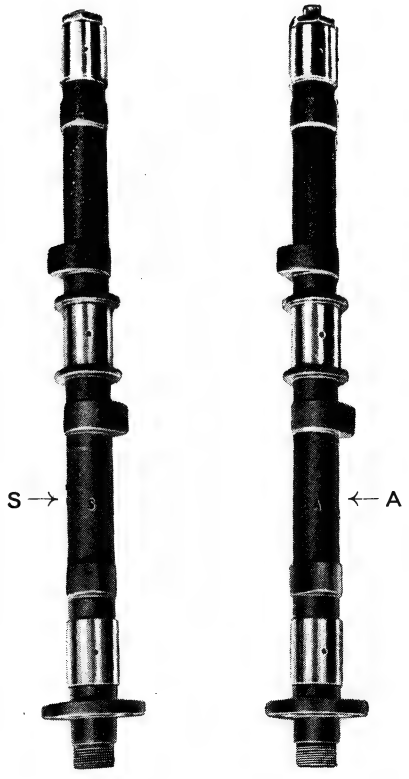


Fig. 57. - Camshafts: exhaust valve camshaft is marked S (left) and intake valve camshaft is marked A (right).

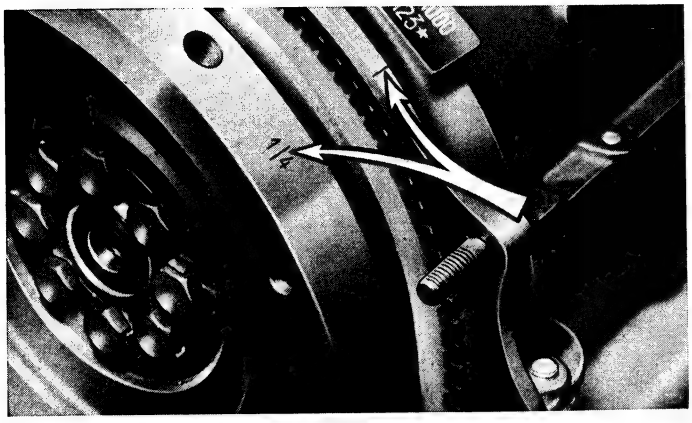


Fig. 58. - Reference marks on flywheel and crankcase for valve gear and ignition timing on engine 118 B.000.

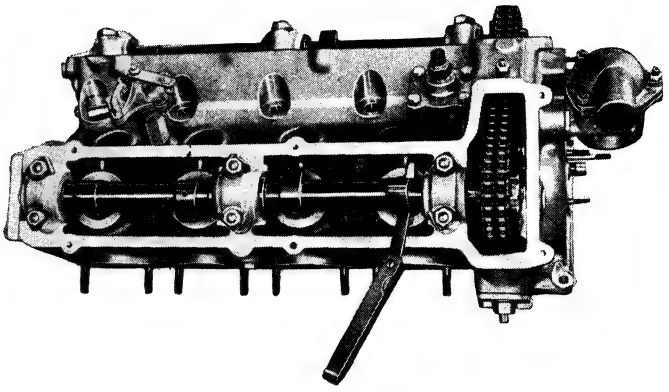


Fig. 61. - Checking tappet clearance on engine 118 B.000 by means of feeler gauge A. 95113.

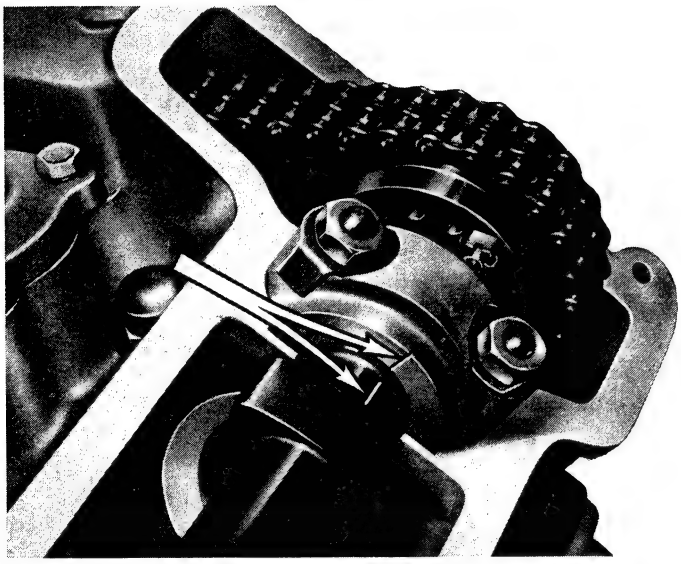


Fig. 59. - Timing marks on camshaft and bearing - engine 118 B.000.

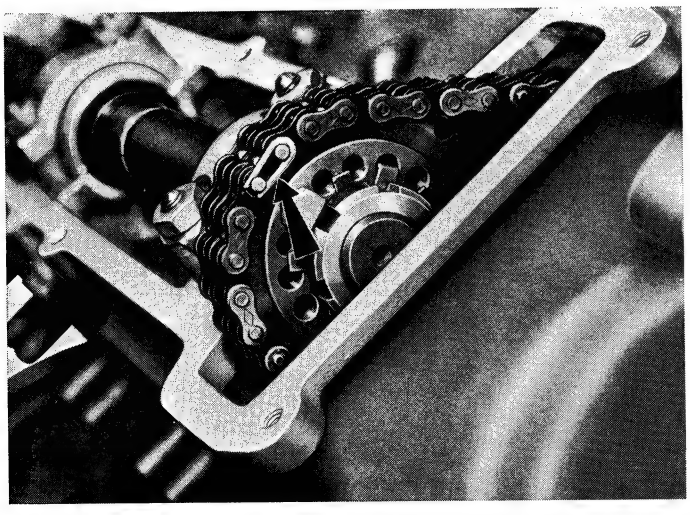


Fig. 60. - Upper timing chain link retainer - engine 118 B.000.

Arrow shows correct position of link retainer.

Before any re-adjustment is undertaken, check with feeler gauge **A. 95113** (fig. 61) the clearance between tappets and camshaft and record each reading.

This procedure makes it possible to know beforehand the thickness of each valve end cap (see fig. 62) for end caps are supplied in thicknesses ranging from .080″ (2 mm) to .126″ (3.20 mm) in progressive .002″ (0.05 mm) oversize increments.

Once the valves needing a clearance re-adjustment are singled out, proceed as follows:

— Turn flywheel until its « 1/4 » reference mark lines up with the mark on crankcase (fig. 58) and the reference marks on camshafts line up with the marks on camshaft bearings (fig. 59).

— See if the timing chain removable link is in a visible and accessible position (fig. 60); if not, turn flywheel until the alignment of reference marks and the correct location of chain removable link are obtained.

— Take off the link retainer, remove the link and secure chain free ends with two pieces of wire (fig. 63) so that chain cannot fall into the timing gear case.

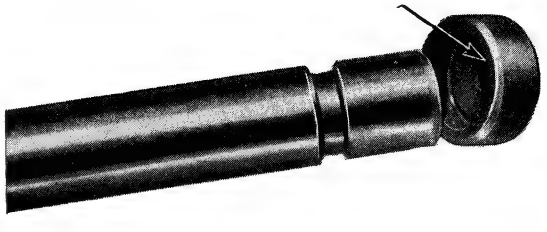


Fig. 62. - Detail of a valve stem and differential thickness cap for tappet clearance adjustment on engine 118 B.000.

Remove camshafts and proceed with the replacement of the end caps between valves and tappets (fig. 62) in accordance with the previously recorded clearances.

Next to adjustment, re-install all parts by reversing the removal operations, making sure that reference marks are indexed correctly.

Carry out a final check to ensure that clearances are all as specified.

NOTE - With chain open, do not vary the position of crankshaft.

On removal of camshaft bearings take care to slacken centre member screws first, then the front and rear ones, working as uniformly as possible to prevent distortion of camshafts from the upward pressure of valve springs.

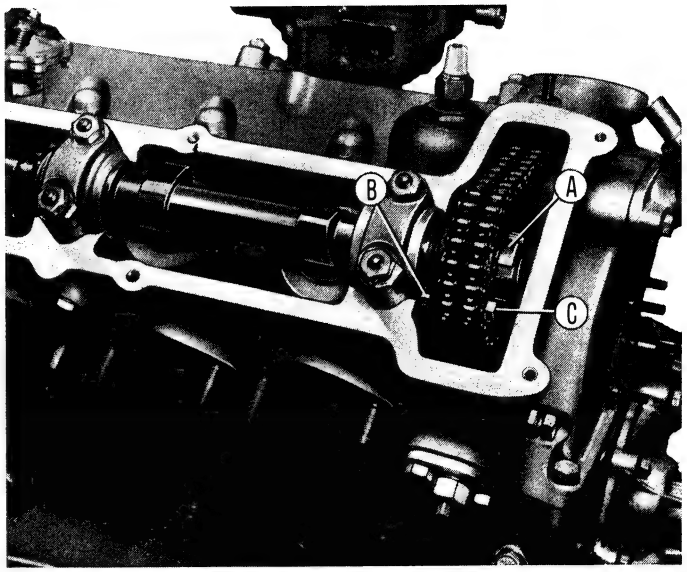


Fig. 64. - Detail of camshaft drive sprocket mounting on engine 118 B.000.

A. Camshaft drive sprocket lock nut - B-C. Camshaft locating screw and nut.

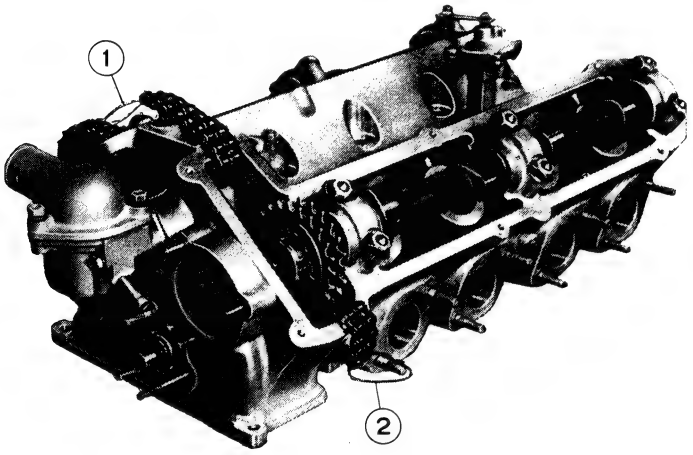


Fig. 63. - Timing chain opened for tappet clearance adjustment (engine 118 B.000).

1-2. Chain ends secured by lock wire.

VALVE TIMING

Proceed as follows:

— Turn flywheel until its « 1/4 » reference mark lines up with the mark on crankcase (fig. 58) and see to it that the reference marks on camshafts line up with the marks on camshaft bearings (fig. 59).

— Install the upper chain, locating the removable link retainer in the position shown in fig. 60, and stretch the chain as instructed on next page. Using a sector scale, and turning the flywheel, check that the advance and retard angles, respectively at opening and closing of intake and exhaust strokes, correspond to those specified on the timing diagram against the .0118″ (0.30 mm) and .0138″ (0.35 mm) clearances, respectively for the intake and exhaust valves.

In case a re-adjustment is required, timing may be corrected to the specified values by relocating the holes (14 in all) in the flange of camshafts relative to the holes (15 in all) in sprocket (see fig. 65).

The difference in the number of holes allows a correction of 1° 42′ 51″, plus or minus, by shifting the location

Fig. 65. - Flanged camshaft with sprocket, location screw, nut, cotter pin, adjuster ring and lockplate (engine 118 B.000).

The sprocket has 15 drilled holes, the camshaft flange 14. By varying the mounting position of sprocket on camshaft of 1 hole, an angular displacement of 1° 42′ 51″ — plus or minus depending on the direction of rotation — is obtained, to reset engine timing in conformity with the specified data (see timing diagram).

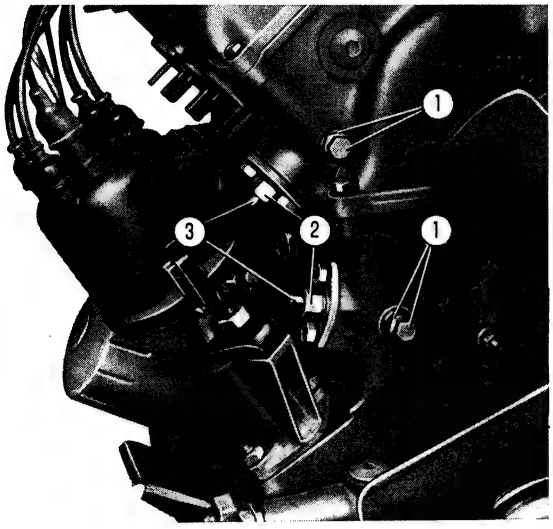


Fig. 66. - Adjusting tension of timing chains on engine 118 B.000.
1. Screws (with nuts) locking the upper double-row chain for camshafts and the double-row chain for dual idler sprocket - 2. Lock nuts - 3. Chain setting screws (loosen to stretch chain).

screw to the hole immediately following or preceding, as required.

For this operation, proceed as follows: back out the adjuster rings, remove sprocket-to-camshaft location screws; while holding fast the sprocket, relocate the camshaft so to obtain the correct setting, re-install the location screws in the newly aligned holes and fully tighten adjuster rings (fig. 64).

Adjusting Tension of Timing Chains.

Timing chains tension is adjusted by means of the stretchers shown in fig. 67.

Chains must not be excessively stretched (sag under hand pressure: .039″ to .079″ (1-2 mm).

Turn stretcher square shank counterclockwise to increase and clockwise to reduce chain tension. Care must be taken that the nuts and bolts fixing the stretcher flanges to cylinder head and crankcase are well taut.

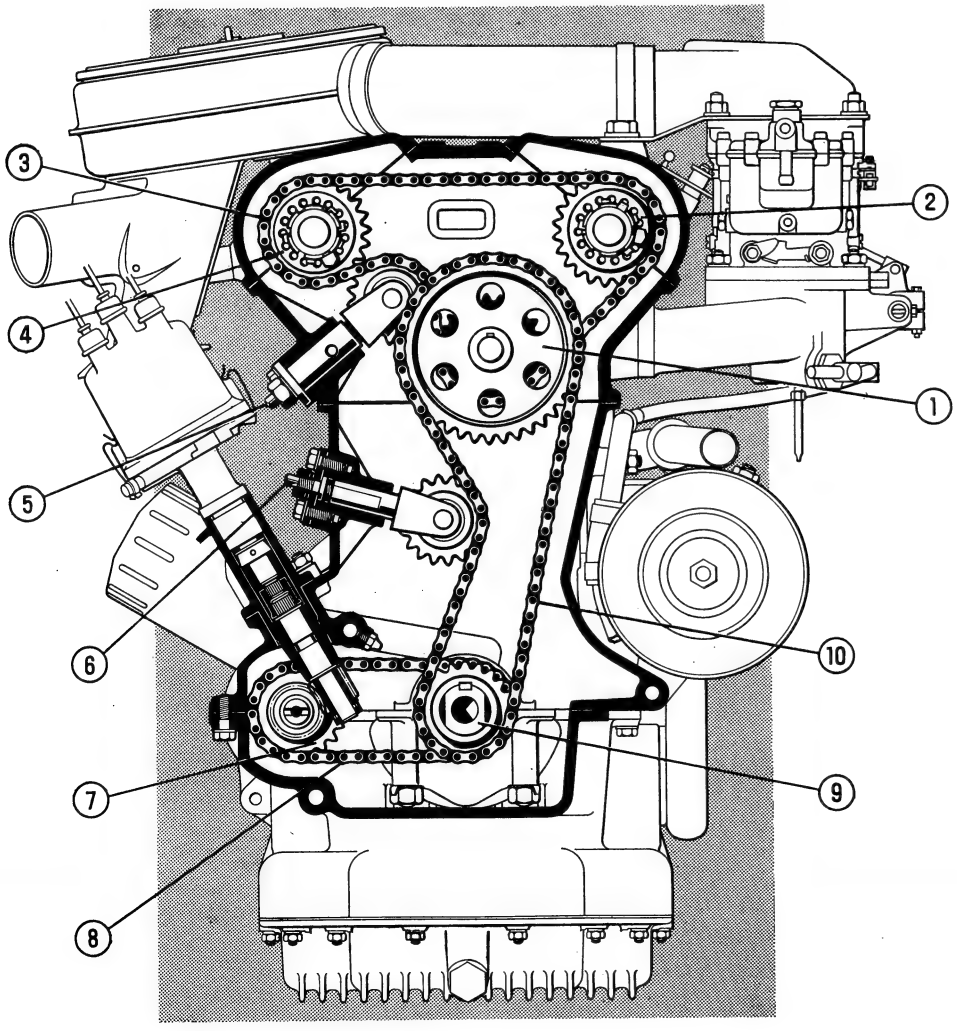


Fig. 67.

Valve drive diagram - engine 118 B.000.

1. Dual idler sprocket - 2. Intake valve camshaft sprocket - 3. Chain, double row, camshaft drive - 4. Exhaust valve camshaft sprocket - 5. Stretcher, chain (3) - 6. Stretcher, chain (10) - 7. Sprocket, ignition distributor and oil pump drive - 8. Chain, single, sprocket (7) drive - 9. Crankshaft - 10. Chain, double row, idler sprocket drive.

SPECIFICATIONS - FITS OF NEW PARTS TIGHTENING REFERENCE

CYLINDER BLOCK AND CRANKCASE

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Cylinder bore diameter	Size group A	3.0315″ to 3.0319″ (77.000 to 77.010 mm)	3.1496″ to 3.1500″ (80.000 to 80.010 mm)
	Size group B	3.0319″ to 3.0323″ (77.010 to 77.020 mm)	3.1500″ to 3.1504″ (80.010 to 80.020 mm)
	Size group C	3.0323″ to 3.0327″ (77.020 to 77.030 mm)	3.1504″ to 3.1508″ (80.020 to 80.030 mm)
	Size group D	—	3.1508″ to 3.1512″ (80.030 to 80.040 mm)
Cylinder bore line diam.		3.1862″ to 3.1870″ (80.93 to 80.95 mm)	— —
Cylinder liner O.D.		3.1890″ to 3.1898″ (81.00 to 81.02 mm)	— —
Cylinder liner I.D.		3.0118″ to 3.0193″ (76.50 to 76.69 mm)	— —
Cylinder bore-to-liner pinch fit		.0019″ to .0035″ (0.05 to 0.09 mm)	— —

CONNECTING RODS - BEARINGS - BUSHINGS

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Connecting rod big end bore		2.2330″ to 2.2334″ (56.718 to 56.730 mm)	2.0210″ to 2.0215″ (51.333 to 51.346 mm)
Connecting rod small end bore		.9425″ to .9438″ (23.939 to 23.972 mm)	.8637″ to .8650″ (21.939 to 21.972 mm)
Standard con rod bearing insert thickness		.0721″ to .0723″ (1.831 to 1.837 mm)	.0715″ to .0717″ (1.816 to 1.822 mm)
Replacement con rod bearing insert undersize range		.0108″ - .0208″ - .0308″ - .0408″ (0.274 - 0.528 - 0.782 - 1.036 mm)	.01″ - .02″ - .03″ - .04″ (0.254 - 0.508 0.762 - 1.016 mm)
Small end bushing O.D.		.9440″ to .9449″ (23.979 to 24.000 mm)	.8653″ to .8661″ (21.979 to 22.000 mm)
Seated bushing ream diameter	Size group 1	.8661″ to .8662″ (21.998 to 22.001 mm)	.7873″ to .7874″ (19.998 to 20.001 mm)
	Size group 2	.8662″ to .8663″ (22.001 to 22.004 mm)	.7874″ to .7875″ (20.001 to 20.004 mm)
Piston pin-to-small end bushing: — clearance of new parts		.0002″ to .0004″ (0.004 to 0.010 mm)	.0002″ to .0004″ (0.004 to 0.010 mm)
Small end bushing-to-bore	pinch fit	.0003″ to .0024″ (0.007 to 0.061 mm)	.0003″ to .0024″ (0.007 to 0.061 mm)
Connecting rod bearing-to-journal: — clearance of new parts		.0012″ to .0030″ (0.031 to 0.076 mm)	.0012″ to .0030″ (0.031 to 0.076 mm)
Maximum misalignment of connecting rod axes: — $4\ ^{59}/_{64}$″ (125 mm) apart from rod stem		± .0020″ (± 0.05 mm)	± .0020″ (± 0.05 mm)

PISTONS - PINS - RINGS

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Standard diameter of steel belted unsplit pistons, at right angle to piston pin: — .709″ (18 mm) apart from pin axis (fig. 15)	Size group A	3.0299″ to 3.0303″ (76.960 to 76.970 mm)	—
	Size group B	3.0303″ to 3.0307″ (76.970 to 76.980 mm)	—
	Size group C	3.0307″ to 3.0310″ (76.980 to 76.990 mm)	—
Standard diameter of pistons, at right angle to piston pin: — 9/32″ (7 mm) apart from skirt top (fig. 40)	Size group A	—	3.1437″ to 3.1441″ (79.850 to 79.860 mm)
	Size group B	—	3.1441″ to 3.1445″ (79.860 to 79.870 mm)
	Size group C	—	3.1445″ to 3.1449″ (79.870 to 79.880 mm)
	Size group D	—	3.1449″ to 3.1453″ (79.880 to 79.890 mm)
— 1 9/16″ (40 mm) apart from skirt top (fig. 40)	Size group A	—	3.1455″ to 3.1459″ (79.895 to 79.905 mm)
	Size group B	—	3.1459″ to 3.1463″ (79.905 to 79.915 mm)
	Size group C	—	3.1463″ to 3.1467″ (79.915 to 79.925 mm)
	Size group D	—	3.1467″ to 3.1471″ (79.925 to 79.935 mm)
Replacement piston oversize range		.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)	.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)
Piston pin hole diameter	Size group 1	.8661″ to .8662″ (21.998 to 22.001 mm)	.7873″ to .7874″ (19.996 to 19.999 mm)
	Size group 2	.8662″ to .8663″ (22.001 to 22.004 mm)	.7874″ to .7875″ (19.999 to 20.002 mm)
Piston ring groove height	Top groove	.0801″ to 0.807″ (2.035 to 2.050 mm)	.0683″ to .0701″ (1.760 to 1.780 mm)
	Second groove	.0793″ to .0799″ (2.015 to 2.030 mm)	.0791″ to .0799″ (2.010 to 2.030 mm)
	Bottom groove	.1558″ to .1564″ (3.957 to 3.972 mm)	.1558″ to .1564″ (3.957 to 3.972 mm)
Standard piston pin diameter	Size group 1	.8658″ to .8659″ (21.991 to 21.994 mm)	.7871″ to .7872″ (*) (19.991 to 19.994 mm)
	Size group 2	.8659″ to .8660″ (21.994 to 21.997 mm)	.7872″ to .7873″ (*) (19.994 to 19.997 mm)
Replacement piston pin oversize range		.0079″ (0.2 mm)	(*)
Piston ring thickness	first compression ring	.0779″ to .0783″ (1.978 to 1.990 mm)	.0680″ to .0685″ (1.728 to 1.740 mm)
	second oil ring	.0779″ to .0783″ (1.978 to 1.990 mm)	.0779″ to .0783″ (1.978 to 1.990 mm)
	third radial-cut oil ring	.1535″ to .1547″ (3.900 to 3.930 mm)	—
	third slotted oil ring	—	.1535″ to .1547″ (3.900 to 3.930 mm)

(*) Piston pin comes in a matched set with the piston.

(Cont.)

Cont.: **PISTONS - PINS - RINGS**

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Piston skirt-to-cylinder barrel, at right angle to piston pin: — .709″ (18 mm) apart from pin axis: clearance of new parts		.0012″ to .0020″ (0.030 to 0.50 mm)	— —
Piston skirt-to-cylinder barrel, at right angle to piston pin: — 9/32″ (7 mm) apart from skirt top		—	.0055″ to .0063″ (0.140 to 0.160 mm)
— $1\ ^{9}/_{16}$″ (40 mm) apart from skirt top		—	.0374″ to .0453″ (0.095 to 0.115 mm)
Piston pin-to-piston hole: clearance of new parts		.0002″ to .0004″ (0.004 to 0.010 mm)	.0001″ to .0003″ (*) (0.002 to 0.008 mm)
Piston ring-to-groove land (vertically)	first compression ring: clearance of new parts	.0018″ to .0028″ (0.045 to 0.072 mm)	.0008″ to .0020″ (0.020 to 0.052 mm)
	second oil ring: clearance of new parts	.0010″ to .0020″ (0.025 to 0.052 mm)	.0008″ to .0020″ (0.020 to 0.052 mm)
	third radial-cut oil ring: clearance of new parts	.0011″ to .0028″ (0.027 to 0.072 mm)	—
	third slotted oil ring: clear. of new parts	—	—
Ring end gap in cylinder bore	first compression ring: clearance of new parts	—	.0011″ to .0028″ (0.027 to 0.072 mm)
	second oil ring: clearance of new parts	.0118″ to .0177″ (0.30 to 0.45 mm)	.0118″ to .0177″ (0.30 to 0.45 mm)
	third radial-cut oil ring (compressed)	.0079″ to .0138″ (0.20 to 0.35 mm)	.0079″ to .0138″ (0.20 to 0.35 mm)
	third slotted oil ring: clear. of new parts	touch fit	—
Replacement piston ring oversize range	compression and oil ring	—	.0098″ to .0138″ (0.25 to 0.35 mm)
	radial-cut oil ring	—	—
	slotted oil ring	.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)	.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)
		.0157″ (0.4 mm)	—
		—	.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)
		—	

(*) Piston pin comes in a matched set with the piston.

CRANKSHAFT AND MAIN BEARINGS

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Main bearing journal standard diameter	2.4788″ to 2.4796″ (62.962 to 62.982 mm)	2.2470″ to 2.2475″ (57.073 to 57.086 mm)
Main bearing bore diameter	2.6250″ to 2.6255″ (66.675 to 66.687 mm)	2.3950″ to 2.3955″ (60.833 to 60.845 mm)
Standard main bearing insert thickness	.0716″ to .0718″ (1.818 to 1.824 mm)	.0726″ to .0728″ (1.845 to 1.851 mm)
Replacement main bearing insert undersize range	.0108″ - .0208″ - .0308″ - .0408″ (0.274 - 0.528 - 0.782 - 1.036 mm)	.01″ - .02″ - .03″ - .04″ (0.254 - 0.508 - 0.762 - 1.016 mm)
Connecting rod journal standard diameter	2.0863″ to 2.0871″ (52.992 to 53.013 mm)	1.8755″ to 1.8763″ (47.638 to 47.658 mm)
Main bearing-to-journal: — clearance of new parts	.0018″ to .0035″ (0.045 to 0.089 mm)	.0022″ to .0032″ (0.057 to 0.082 mm)
Length of intermediate main bearing journal, shoulder-to-shoulder	1.3772″ to 1.3787″ (34.98 to 35.02 mm)	— —

(Cont.)

Cont.: CRANKSHAFT AND MAIN BEARINGS

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Width of intermediate main bearing bore and cap, between thrust ring seats	1.1866″ to 1.1890″ (30.14 to 30.20 mm)	— —
Intermediate main bearing thrust ring thickness	.0909″ to .0929″ (2.31 to 2.36 mm)	— —
Oversize thrust ring thickness	.0949″ to .0969″ (2.41 to 2.46 mm)	— —
Length of rear main bearing journal, shoulder-to-shoulder	— —	1.2917″ to 1.2933″ (32.81 to 32.85 mm)
Width of rear main bearing bore and cap, between thrust ring seats	— —	1.1004″ to 1.1024″ (27.95 to 28.00 mm)
Rear main bearing thrust ring thickness	— —	.0909″ to .0929″ (2.31 to 2.36 mm)
Oversize thrust ring thickness	— —	.0949″ to .0969″ (2.41 to 2.46 mm)
Crankshaft end fit, thrust rings installed: — clearance of new parts	.0024″ to .0102″ (0.06 to 0.26 mm)	.0035″ to .0110″ (0.09 to 0.28 mm)
Maximum misalignment of main bearing journals	.0020″ (*) (0.05 mm)	.0020″ (*) (0.05 mm)
Maximum misalignment of crankpins to main bearing journals	± .0197″ (± 0.5 mm)	± .0100″ (± 0.25 mm)
Maximum out-of-round of crankpins and main bearing journals, after grinding	.0002″ (0.005 mm)	.0002″ (0.005 mm)
Maximum taper of crankpins and main bearing journals, after grinding	.0002″ (0.005 mm)	.0002″ (0.005 mm)
Flywheel: — parallel relationship of clutch disk face to crankshaft mounting face: max. out-of-true, not above — squareness of above faces to rotation axis: max. out-of-true, not above	.0039″ (0.1 mm) .0039″ (0.1 mm)	.0039″ (0.1 mm) .0039″ (0.1 mm)
Squareness of flywheel resting face to crankshaft centerline: — max. out-of-true with indicator plunger set laterally some 1 1/2″ (38 mm) apart from crankshaft rotation axis, not above	.0010″ (0.025 mm)	.0008″ (0.020 mm)

(*) Total indicator reading.

CYLINDER HEAD - VALVES - GUIDES - SPRINGS

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Valve guide head seat diameter	.5886″ to .5896″ (14.950 to 14.977 mm)	.5118″ to .5125″ (13.000 to 13.018 mm)
Valve guide O. D.	.5905″ to .5912″ (14.998 to 15.016 mm)	.5139″ to .5143″ (13.052 to 13.062 mm)
I.D. of valve guides installed in head	.3161″ to .3168″ (8.029 to 8.047 mm)	.3150″ to .3156″ (8.000 to 8.015 mm)
Valve guide-to-seat: pinch fit of new parts	.0008″ to .0026″ (0.021 to 0.066 mm)	.0013″ to .0024″ (0.034 to 0.062 mm)
Valve stem diameter	.3144″ to .3150″ (7.985 to 8.000 mm)	.3140″ to .3146″ (7.975 to 7.990 mm)

(Cont.)

Cont.: CYLINDER HEAD - VALVES - GUIDES - SPRINGS

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Valve stem-to-guide fit: — clearance of new parts	.0011″ to .0024″ (0.029 to 0.062 mm)	.0004″ to .0016″ (0.010 to 0.040 mm)
Valve seat angle	45° ± 5′	55° ± 5′
Valve face angle	45° 30′ ± 5′	55° 30′ $^{+15'}_{0'}$
Valve head diameter — intake	1.3780″ (35 mm)	1.5945″ (40.5 mm)
Valve head diameter — exhaust	1.2402″ (31.5 mm)	1.4370″ (36.5 mm)
Maximum run-out of valve rotating on stem a full turn, with dial plunger set on center of outside face	.0008″ (0.02 mm)	.0008″ (0.02 mm)
Valve seat I. D. — intake	1.2598″ (32 mm)	1.3976″ to 1.4055″ (35.5 to 35.7 mm)
Valve seat I. D. — exhaust	1.1220″ (28.5 mm)	1.2205″ to 1.2283″ (31 to 31.2 mm)
Valve spring I. D. — inner spring	.6829″ (17.6 mm)	.6693″ (17 mm)
Valve spring I. D. — outer spring	1.0039″ (25.5 mm)	.9449″ (24 mm)
Free length — inner spring	1.5433″ (39.2 mm)	1.4370″ (36.5 mm)
Free length — outer spring	1.9685″ (50 mm)	1.7126″ (43.5 mm)
Length and load, spring check: **engine 115 C.005**		
— inner spring under 34 lbs (15.4 kg) of load	1.1299″ (28.7 mm)	—
— inner spring under 63.7 lbs (28.9 kg) of load	.7677″ (19.5 mm)	—
— outer spring under 67.7 lbs (30.7 kg) of load	1.2874″ (32.7 mm)	—
— outer spring under 103.6 lbs (47 kg) of load	.9252″ (23.5 mm)	—
engine 118 B.000		
— inner spring under 18.6 lbs (8.45 kg) of load	—	1.2205″ (31 mm)
— inner spring under 49.2 lbs (22.3 kg) of load	—	.8661″ (22 mm)
— outer spring under 33 lbs (15 kg) of load	—	1.4173″ (36 mm)
— outer spring under 72.8 lbs (33 kg) of load	—	1.0630″ (27 mm)
Minimum permissible load on springs: — inner spring length 1.1299″ (28.7 mm)	29.8 lbs (13 $^1/_2$ kg)	—
— inner spring length 1.2205″ (31 mm)	—	15 lbs (6.8 kg)
— outer spring length 1.2874″ (32.7 mm)	60.6 lbs (27 $^1/_2$ kg)	—
— outer spring length 1.4173″ (36 mm)	—	26 $^1/_2$ lbs (12 kg)
Theoretical valve lift (touch fit) — intake	.3409″ (8.65 mm)	.3409″ (8.65 mm)
Theoretical valve lift (touch fit) — exhaust	.3386″ (8.60 mm)	.3386″ (8.60 mm)

CAMSHAFT AND BUSHINGS

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Bushing seat bore in crankcase:			
— front		2.0670″ to 2.0680″ (52.502 to 52.527 mm)	
— center		2.0050″ to 2.0060″ (50.927 to 50.952 mm)	—
— rear		1.9425″ to 1.9435″ (49.340 to 49.365 mm)	
Bushing O. D.:			
— front		2.0656″ to 2.0662″ (52.467 to 52.482 mm)	
— center (1)		2.0090″ to 2.0110″ (51.028 to 51.079 mm)	—
— rear (1)		1.9460″ to 1.9480″ (49.428 to 49.479 mm)	
	seated	reamed	—
Bushing bore:			
— front	1.4183″ to 1.4198″ (2) (36.025 to 36.064 mm) (2)	1.4183″ to 1.4198″ (2) (36.025 to 36.064 mm) (2)	
— center	1.8640″ to 1.8680″ (47.346 to 47.447 mm)	1.8780″ to 1.8788″ (47.701 to 47.721 mm)	—
— rear	1.8090″ to 1.8130″ (45.949 to 46.050 mm)	1.8230″ to 1.8238″ (46.304 to 46.324 mm)	
Bushing-to-crankcase bore fit:			
— front: clearance of new parts		.0008″ to .0024″ (0.02 to 0.06 mm)	
— center: pinch fit of new parts		.0030″ to .0060″ (0.076 to 0.152 mm)	—
— rear: pinch fit of new parts		.0025″ to .0055″ (0.063 to 0.139 mm)	
Camshaft journal diameter:			
— front		1.4163″ to 1.4173″ (35.975 to 36.000 mm)	1.1016″ to 1.1021″ (27.980 to 27.993 mm)
— center		1.8760″ to 1.8770″ (47.650 to 47.675 mm)	1.1173″ to 1.1178″ (28.380 to 28.393 mm)
— rear		1.8210″ to 1.8220″ (46.253 to 46.278 mm)	1.1331″ to 1.1336″ (28.780 to 28.793 mm)

(1) Figure refers to the ring gauge bore (hand fitted bushing).

(2) This bushing, which comes precision finished in the bore, is secured by two screws.

(Cont.)

Cont.: **CAMSHAFT AND BUSHINGS**

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Camshaft bearing bore:		
— front	—	1.1024″ to 1.1032″ (28.000 to 28.021 mm)
— center		1.1181″ to 1.1189″ (28.400 to 28.421 mm)
— rear		1.1339″ to 1.1347″ (28.800 to 28.821 mm)
Camshaft bushing-to-journal fit:		
— clearance of new parts: front	.0010″ to .0035″ (0.025 to 0.089 mm)	—
— clearance of new parts: center	.0010″ to .0028″ (0.026 to 0.071 mm)	
— clearance of new parts: rear	.0010″ to .0028″ (0.026 to 0.071 mm)	
Camshaft bearing-to-journal fit:		
— clearance of new parts: front	—	.0003″ to .0016″ (0.007 to 0.041 mm)
— clearance of new parts: center		.0003″ to .0016″ (0.007 to 0.041 mm)
— clearance of new parts: rear		.0003″ to .0016″ (0.007 to 0.041 mm)

TAPPETS - ROCKERS - SHAFTS - SUPPORTS

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Standard tappet seat bore in crankcase	.8663″ to .8670″ (22.003 to 22.021 mm)	1.3779″ to 1.3789″ (35.000 to 35.025 mm)
Standard tappet O. D.	.8653″ to .8660″ (21.978 to 21.996 mm)	1.3773″ to 1.3778″ (34.984 to 34.995 mm)
Replacement tappet oversize range	.0020″ - .0039″ (0.05 - 0.10 mm)	— —
Tappet-to-seat fit: — clearance of new parts	.0003″ to .0017″ (0.007 to 0.043 mm)	.0002″ to .0016″ (0.005 to 0.041 mm)
Rocker shaft support bore diam.	.7076″ to .7083″ (17.974 to 17.992 mm)	— —
Rocker shaft diameter	.7069″ to .7076″ (17.956 to 17.974 mm)	— —
Rocker shaft support-to-rocker shaft fit: — clearance of new parts	.0000″ to .0014″ (0 to 0.036 mm)	— —
Rocker arm bore diameter	.7089″ to .7096″ (18.006 to 18.024 mm)	— —

(Cont.)

Cont.: **TAPPETS - ROCKERS - SHAFTS - SUPPORTS**

DESCRIPTION	Engine 115 C.005	Engine 115 B.000
Rocker arm-to-shaft fit: — clearance of new parts	.0013″ to .0027″ (0.032 to 0.068 mm)	— —
Rocker arm spring: — I. D.	.7283″ (18.5 mm)	
— free height	2.7480″ (69.8 mm)	—
— spring height under 5.5 ± .4 lbs (2.5 ± 0.2 kg) of load	1.2205″ (31 mm)	

115 C.005 ENGINE TIGHTENING REFERENCE

ITEMS	Part Number	Thread Diam. and Pitch	Material	Torque
Main bearing cap screw	4025557	M 12 x 1.5	R 100	76 ft.lbs (10.5 kgm)
Con rod bearing cap screw	4119148	M 11 x 1	R 100	47.7 ft.lbs (7 kgm)
Cylinder head hold-down screw	1/59747/30	M 12 x 1.5	R 100	50.6 ft.lbs (9 kgm)
Flywheel-to-crankshaft screw	1/42334/30	M 10 x 1.25	R 100	57.9 ft.lbs (8 kgm)

(Cont.)

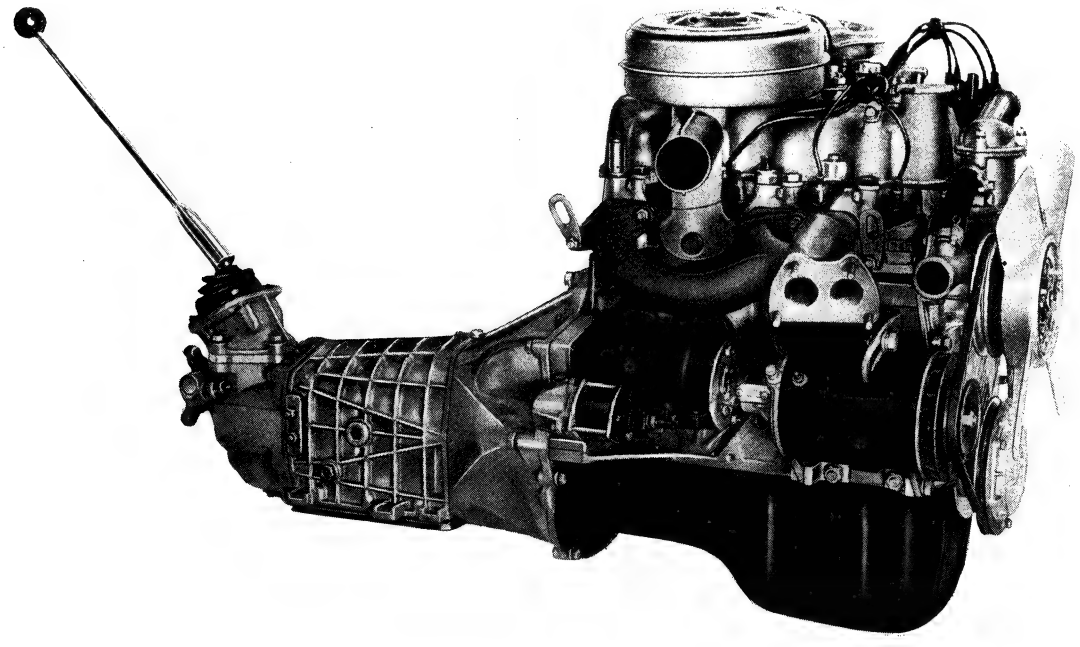


Fig. 68. - Right-hand side view of 1500 Cabriolet power plant.

Cont.: **115 C.005 ENGINE TIGHTENING REFERENCE**

ITEMS	Part Number	Thread Diam. and Pitch	Material	Torque
Driven sprocket-to-camshaft screw	1/59707/20	M 10 x 1.25	R 80	36.2 ft.lbs (5 kgm)
Rocker shaft support-to-cylinder head stud nut	1/61008/11	M 8 x 1.25	R 50 Cdt (stud R 80)	13.7 ft.lbs (1.9 kgm)
Fan and generator drive pulley hub screw . . .	4089697	M 20 x 1	R 100	101.3 ft.lbs (14 kgm)
Spark plug	4079728	M 14 x 1.25	—	18.1 to 21.7 ft.lbs (2.5 to 3 kgm)
Fan solenoid thermal switch	4078479	M 22 x 1.5	OT 58	36.2 to 43.4 ft.lbs (5 to 6 kgm)

118 B.000 ENGINE TIGHTENING REFERENCE

ITEMS	Part Number	Thread Diam. and Pitch	Material	Torque
Flywheel-to-crankshaft screw	4104765	M 9 x 1	R 100	32 1/2 ft.lbs (4.5 kgm)
Connecting rod bearing cap screw self-locking nut	4045971	M 9 x 1	R 80 (screw R 100)	28.9 ft.lbs (4 kgm)
Cylinder head hold-down screw	1/59749/30	M 12 x 1.5	R 100	65.1 ft.lbs (9 kgm)
Main bearing cap screw	4025557	M 12 x 1.5	R 100	76 ft.lbs (10.5 kgm)
Camshaft bearing cap stud	1/61008/21	M 8 x 1.25	R 80 Znt (stud R 100)	18.1 ft.lbs (2.5 kgm)
Centrifugal oil filter housing screw	4104168	M 18 x 1	R 100	101.3 ft.lbs (14 kgm)
Fan solenoid thermal switch	4111819	M 22 x 1.5	OT 58	36.2 to 43.4 ft.lbs (5 to 6 kgm)
Spark plug	4079728	M 14 x 1.25	—	18.1 to 21.7 ft.lbs (2.5 to 3 kgm)

Lubrication

Engine 115 C.005.

Metered pressure, gear-pump controlled engine lubrication.

The lubrication system includes, besides the gear pump:

— a suction intake horn with filter screen;

— a centrifugal delivery oil filter (6, fig. 71);

— a by-pass, supplementary oil filter (17), mounted on engine left side;

— an oil pressure relief valve (10) on pump cover;

— a low pressure indicator sending unit (14).

Standard oil pressure: 57 to 64 p.s.i. (4 to 4.5 kg/cm²).

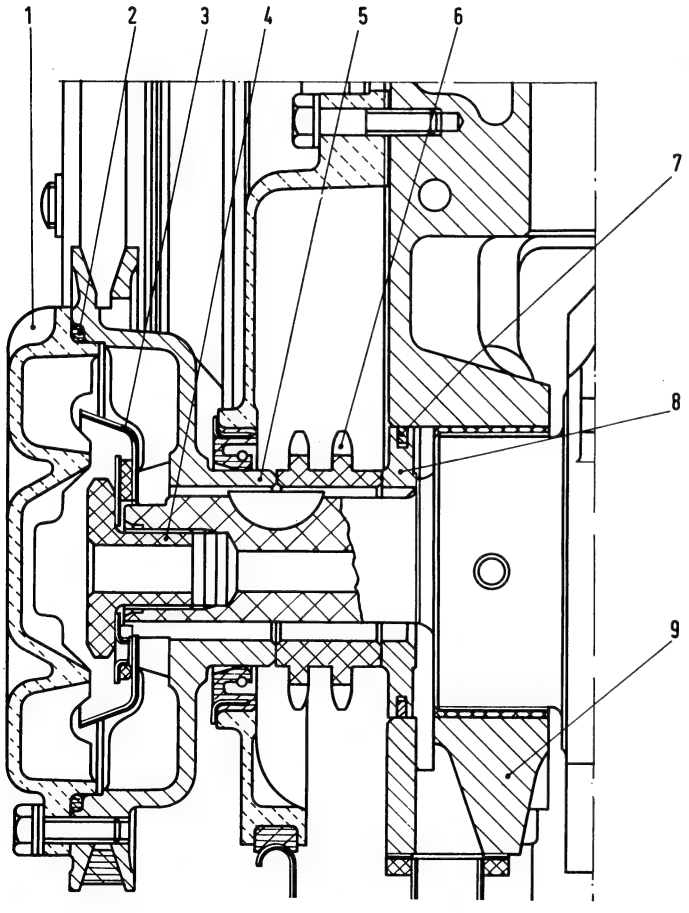


Fig. 69. - Detail of 115 C.005 engine side section view across centrifugal oil filter.

1. Centrifugal filter cover - 2. Seal ring - 3. Baffle ring - 4. Pulley hub-to-crankshaft hollow screw - 5. Centrifugal oil filter pulley hub - 6. Timing gear drive sprocket - 7. Oil shield disk ring - 8. Oil shield disk - 9. Front main bearing cap.

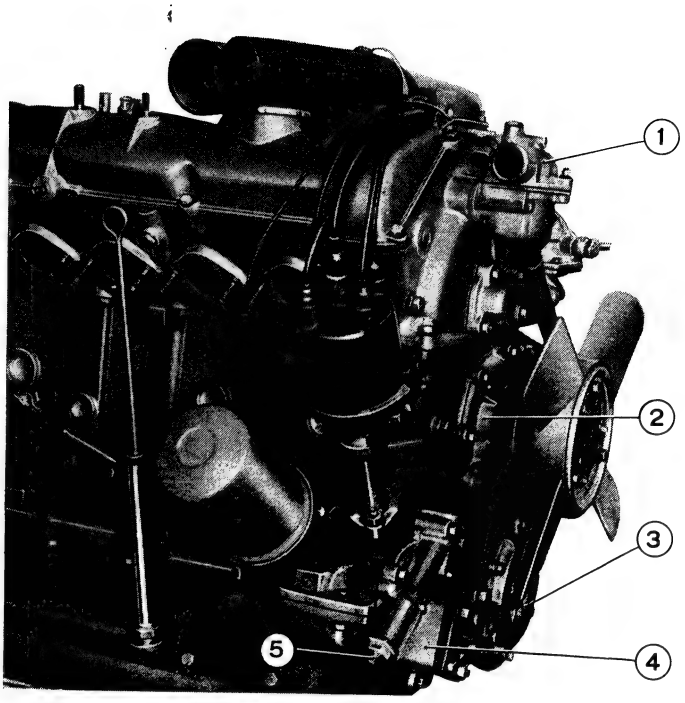


Fig. 70. - Scrap view of engine 118 B.000.

1. Water outlet tube from cylinder head - 2. Water pump - 3. Centrifugal oil filter - 4. Oil pump - 5. Oil pressure relief valve.

Engine 118 B.000.

The lubrication system includes, besides the gear pump:

— an oil suction line (9, fig. 76) from sump;

— a centrifugal delivery oil filter (15);

— a by pass, supplementary oil filter (7), mounted on engine right side;

— an oil pressure relief valve (13) on pump housing;

— an oil delivery line to pressure gauge.

Standard oil pressure: 85.3 p.s.i. (6 kg/cm²).

CENTRIFUGAL OIL FILTER

The centrifugal oil filter consists basically of a cover (1, fig. 69), a pulley hub (5) and a baffle ring (3).

The lower diameter of the baffle ring is lesser than that of the cover and cover hub, because the baffle ring has been designed to create a radial oil strain toward an area where centrifugal force is such as to segregate foreign matter.

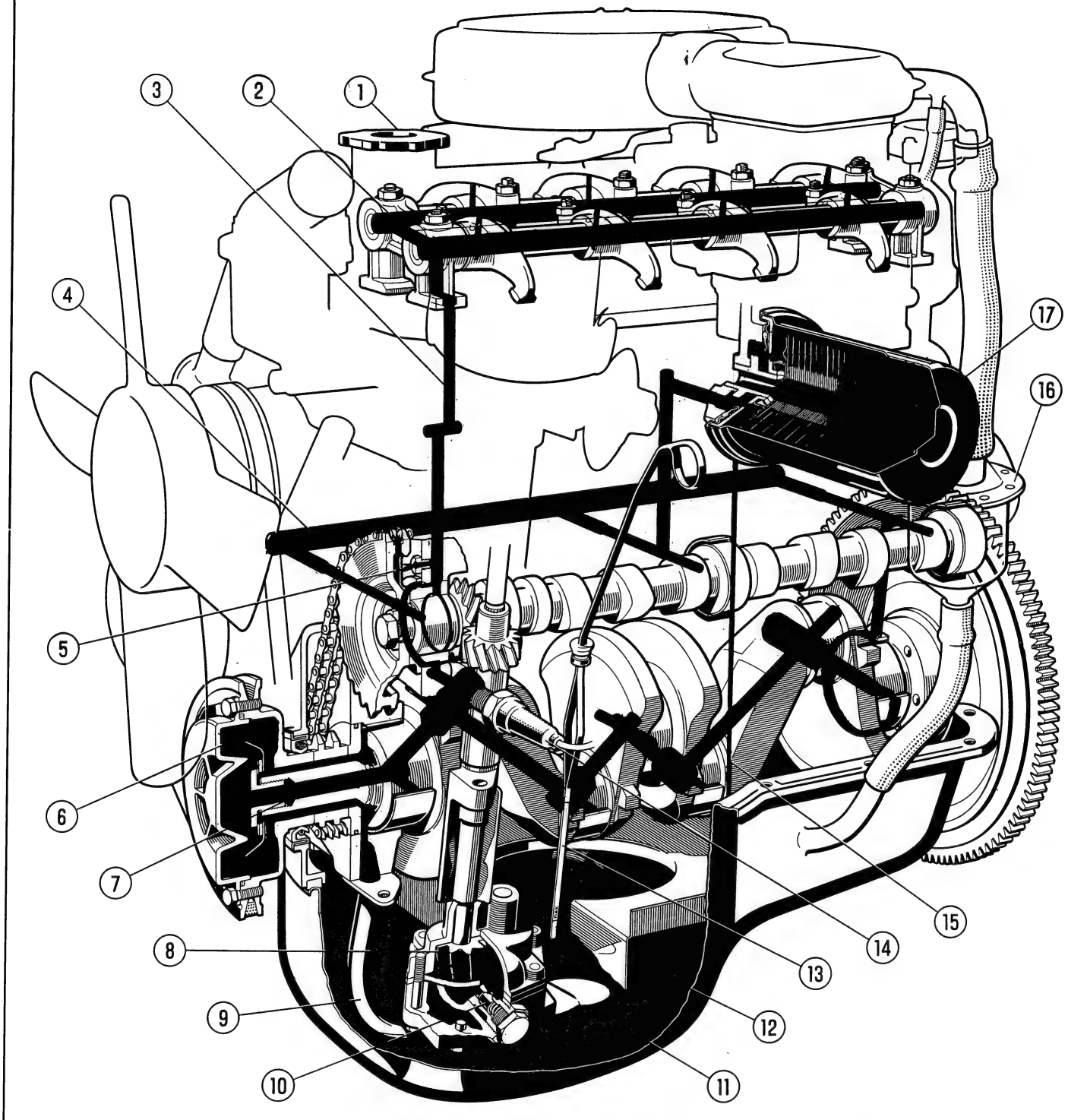


Fig. 71. - Cut-away and phantom view of 115 C.005 engine lubrication system.

1. Oil filler cap - 2. Rocker shafts - 3. Rocker shaft oil delivery passage - 4. Main oil delivery passage - 5. Timing chain oil connection - 6. Centrifugal oil filter - 7. Crankshaft with cut-away of inner oil passage - 8. Gear oil pump - 9. Pump-to-centrifugal filter oil delivery pipe - 10. Oil pressure relief valve - 11. Oil pump suction filter - 12. Oil pan drain plug - 13. Oil dip stick - 14. Low pressure indicator sending unit - 15. Supplementary filter oil return to pan - 16. Blow-by device of gases and oil vapours, circuited with the oil pan and carburetor air intake - 17. By-pass, supplementary oil filter.

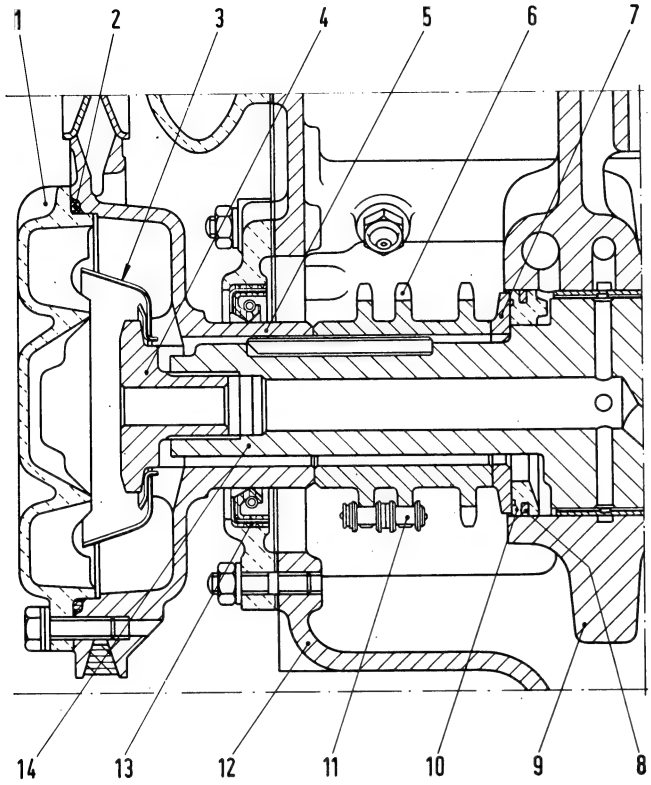


Fig. 72. - Detail of 118 B.000 engine side section view across centrifugal oil filter.

1. Centrifugal filter cover - 2. Seal ring - 3. Baffle ring - 4. Pulley hub-to-crankshaft hollow screw - 5. Centrifugal oil filter pulley hub - 6. Timing gear, oil pump and ignition distributor drive drive sprocket - 7. Thrust ring - 8. Seal ring - 9. Front main bearing cap - 10. Oil shield disk - 11. Timing gear idler sprocket drive chain - 12. Oil pan - 13. Front gasket - 14. Crankshaft.

Radial ribs on pulley inner face are to trap foreign matter and convey oil to center filter.

The oil from both sides of front crankshaft end

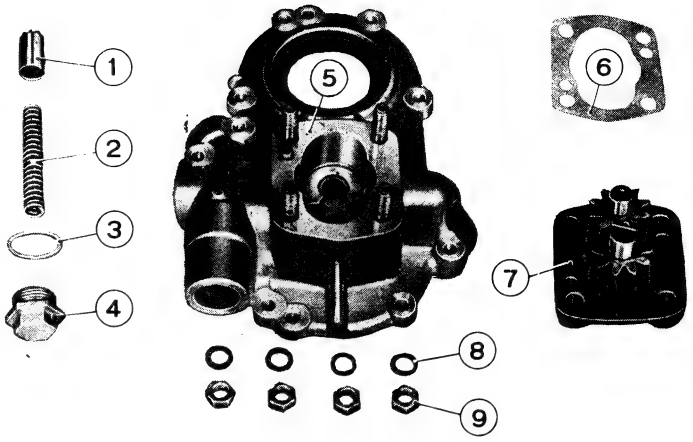


Fig. 74. - 118 B.000 engine oil pump components.

1. Oil pressure relief valve - 2. Relief valve spring - 3. Seal - 4. Relief valve plug - 5. Oil pump housing - 6. Gasket - 7. Drive gears and cover - 8. Spring washers - 9. Pump-to-crankcase mounting nuts.

(which bears two longitudinal machine grooves) is forced to filter outskirts by the baffle ring. Oil is so cleaned and returns to filter center whence it flows inside the crankshaft through a hollow screw (4) securing the hub and the baffle ring to the crankshaft.

The hub edge is grooved to fit a « V » belt which transmits drive to the generator and fan.

The hollow screw securing the hub to the crankshaft should be drawn up with 101.3 ft.lbs (14 kgm) of torque, using a torque wrench.

By-pass Oil Filter.

The by-pass oil filter is a self-contained unit which comes as such for spare.

The routine replacement of this filter is recommended to be effected every 6,000 miles (10,000 km).

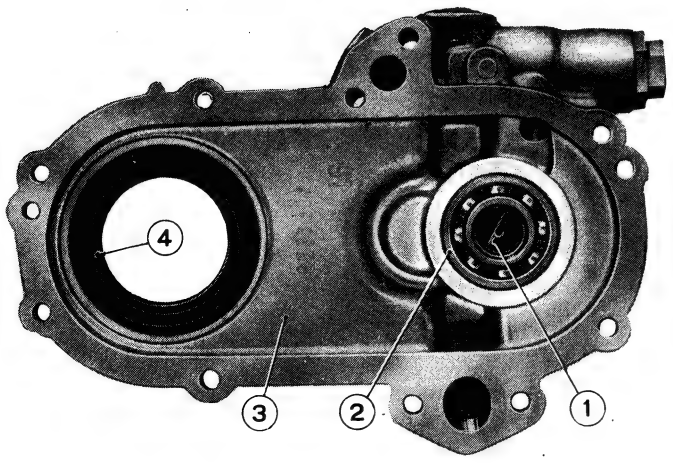


Fig. 73. - 118 B.000 engine oil pump - Interior view.

1. Pump shaft drive tang - 2. Ball bearing - 3. Pump housing - 4. Crankshaft seal.

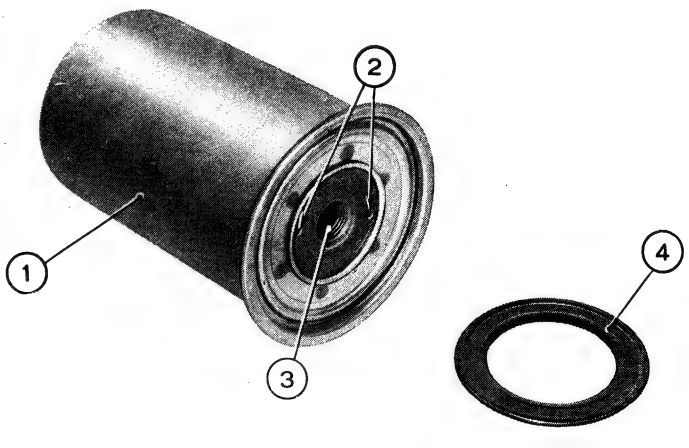


Fig. 75. - By-pass oil filter.

1. Filter element - 2. Oil inlet holes to filter - 3. Oil return hole to pan - 4. Filter-to-crankcase seal.

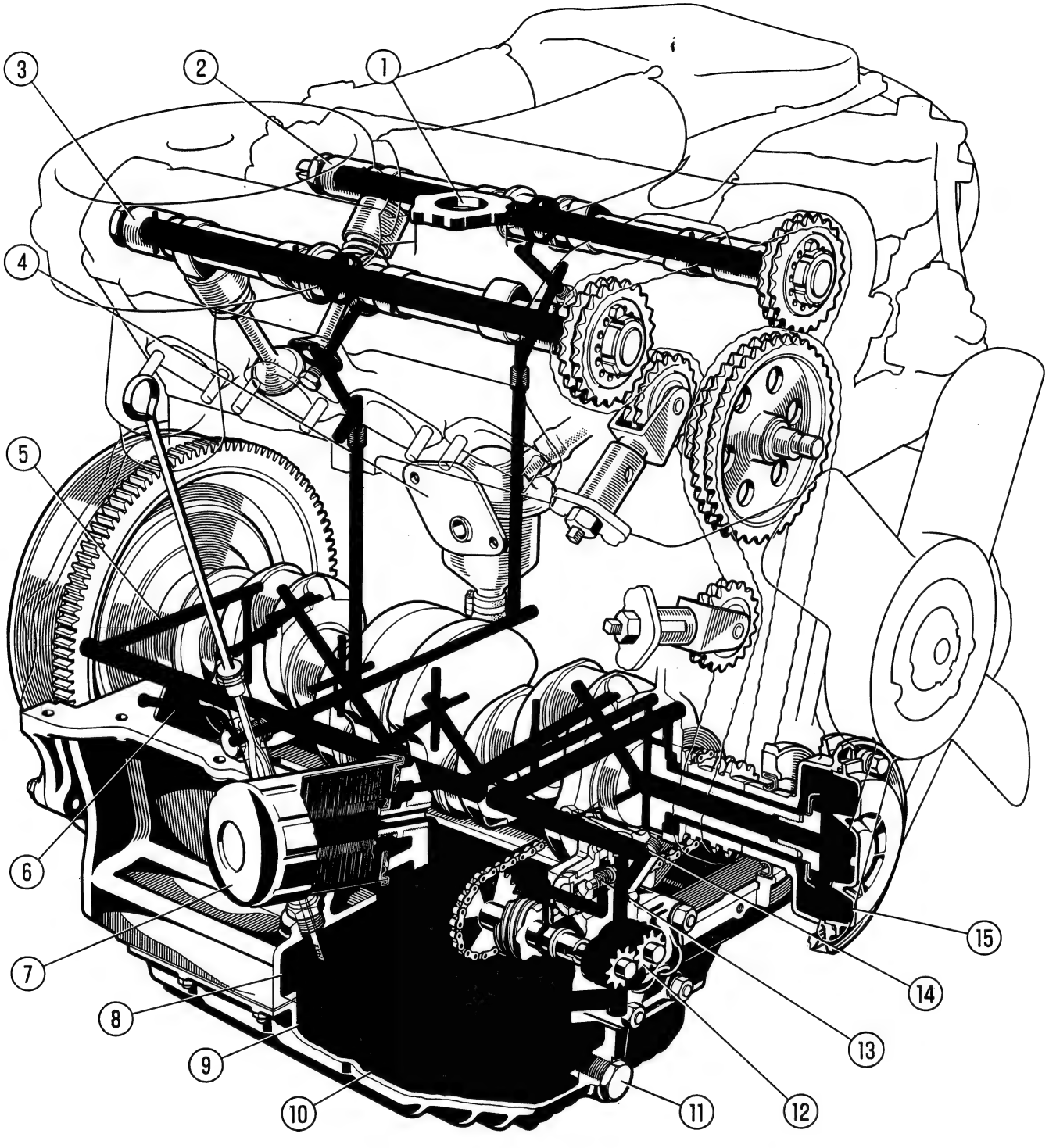


Fig. 76. - Cut-away and phantom view of 118 B.000 engine lubrication system.

1. Oil filler cap - 2. Intake valves camshaft - 3. Exhaust valves camshaft - 4. Crankcase oil vent line, with filter - 5. Duct, oil to pressure gauge, camshafts and by-pass filter - 6. Line, oil to pressure gauge - 7. By-pass oil filter - 8. Oil dipstick - 9. Oil suction line in sump - 10. Oil intake filter - 11. Drain plug - 12. Oil gear pump - 13. Oil pressure relief valve - 14. Connection, ignition distributor and oil pump drive chain lubrication - 15. Centrifugal oil filter.

To replace the filter, proceed as follows:

— Using tool **A. 60260**, unscrew the filter from crankcase connection, check the filter seating and clean it thoroughly. Coat the seating face with a film of oil and install a new filter unit. Again with tool **A. 60260**, tighten the filter home using care that the rubber seal between filter and crankcase seating is positioned correctly.

— Run the engine for some minutes and check for oil leaks or incorrect operation.

Oil Pump Drive Shaft (Engine 118 B.000).

ADJUSTING END PLAY

Oil pump and ignition distributor are driven off the crankshaft via a chain (figs. 76 and 67).

To take up end play, a thrust washer is fitted between the abutment face of ignition distributor/oil pump drive shaft and the oil pump ball bearing in pump housing (see figs. 78 and 79).

Thrust washers are available for service in .0039″ (0.10 mm) oversize thickness increments, from .0669″ (1.70 mm) to .1181″ (3.00 mm).

Adjustment procedure is as follows:

Make sure the shaft ball bearings are tightly fitted, at both crankcase and pump housing ends, and insert the drive shaft into the crankcase bearing.

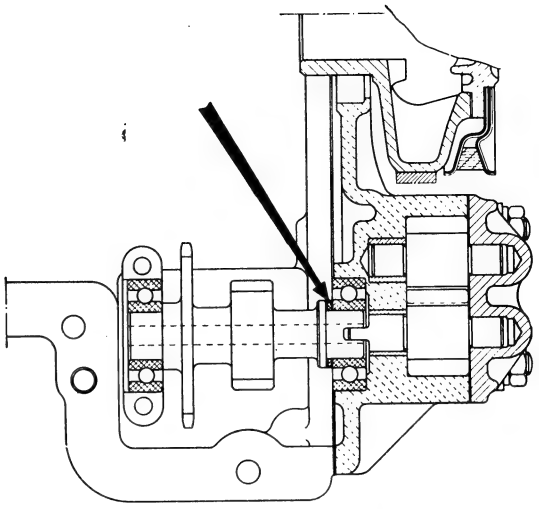


Fig. 78. - Sectional view of 118 B.000 engine oil pump.

Arrow points to the thrust washer which comes for service in different thicknesses.

Holding a straightedge on crankcase machined surface, select a thrust washer having a thickness equivalent to the gap between shaft abutment face and straightedge; make sure that the mounting face of the ball bearing in pump housing is flush with pump housing mounting flange: differences, if any, must be kept in due account to increase or decrease the washer thickness.

On shaft, insert the washer of the proper thickness and fit the oil pump after setting a paper gasket in between. The drive shaft end play is determined by the thickness of this paper gasket.

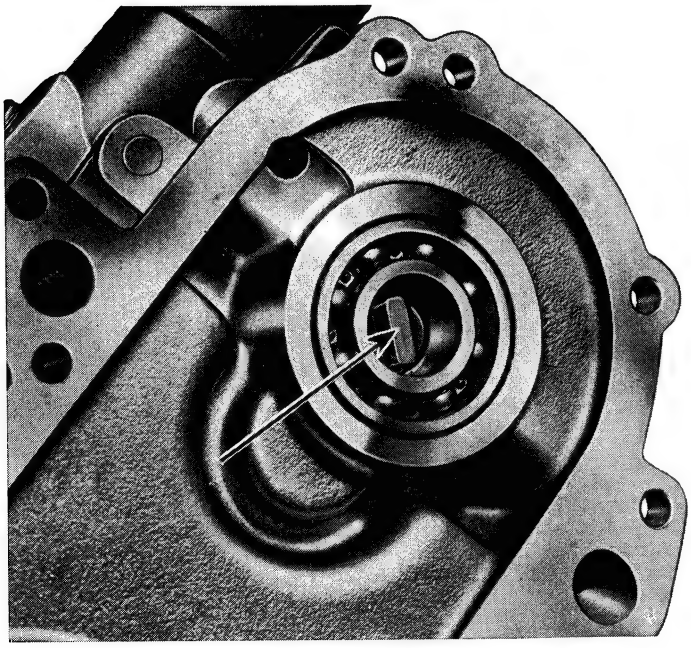


Fig. 77. - Detail of the 118 B.000 engine oil pump housing with bearing. Arrow points to the shaft drive tang.

Fig. 79. - 118 B.000 engine ignition distributor-oil pump drive gear set and shaft, with thrust washer.

Cooling

Engine is cooled through a forced water circulation promoted by a centrifugal pump.

The cooling system includes the following parts:

— a water pump, mounted on the crankcase;

— a vertical-tube radiator for water cooling, in front of engine;

— a thermostat, located in the cylinder head-to-radiator funnel.

Thermostat setting at atmospheric pressure:

— opening begins . . . . . 181° ± 4° F (83° ± 2° C)

— minimum valve trip (at 205° F - 96° C, max) . . . . . .295″ (7.5 mm)

— maximum valve trip . . . . . .433″ (11 mm)

— an automatic in-and-out fan operating through a solenoid controlled by a thermal switch which is located on down side of radiator to contact of coolant;

— a temperature gauge sending unit, wired with the temperature gauge on dashboard.

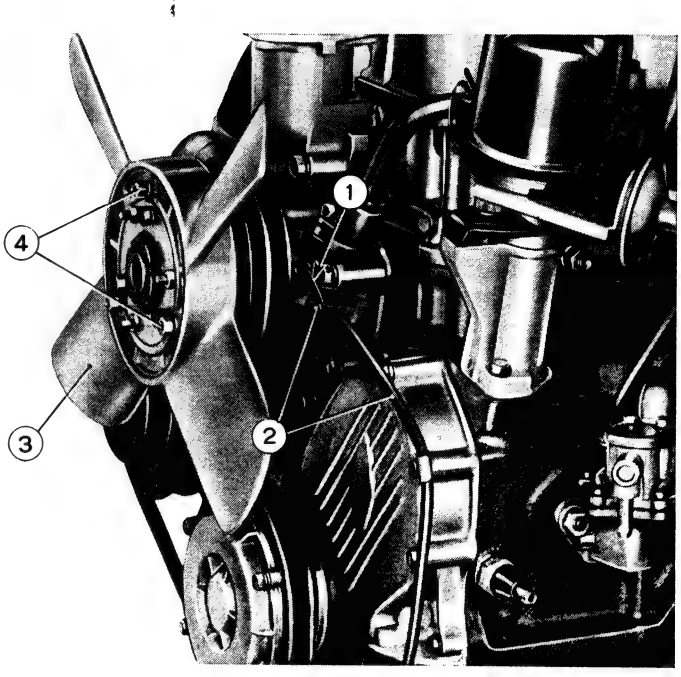


Fig. 80. - Scrap view of engine 115 C.005.
1. Brush holder spring - 2. Brush and lead to temperature gauge sending unit - 3. Fan - 4. Fan-to-hub nuts.

WATER PUMP

The water pump bearing is integral with the impeller shaft and is metal boxed at ends.

The bearing pocket is packed with Jota 3 grease in production and therefore no further lubrication is required during car service. A retaining screw secures the bearing to the pump housing.

If the bearing needs replacement for any reason, the bearing-shaft assembly must be replaced. Recall that the impeller, impeller bushing and fan driven pulley hub are forced on to the shaft using a press (in engine 115 C.005). For removal of the pulley and solenoid assembly, see covering paragraph on page 61.

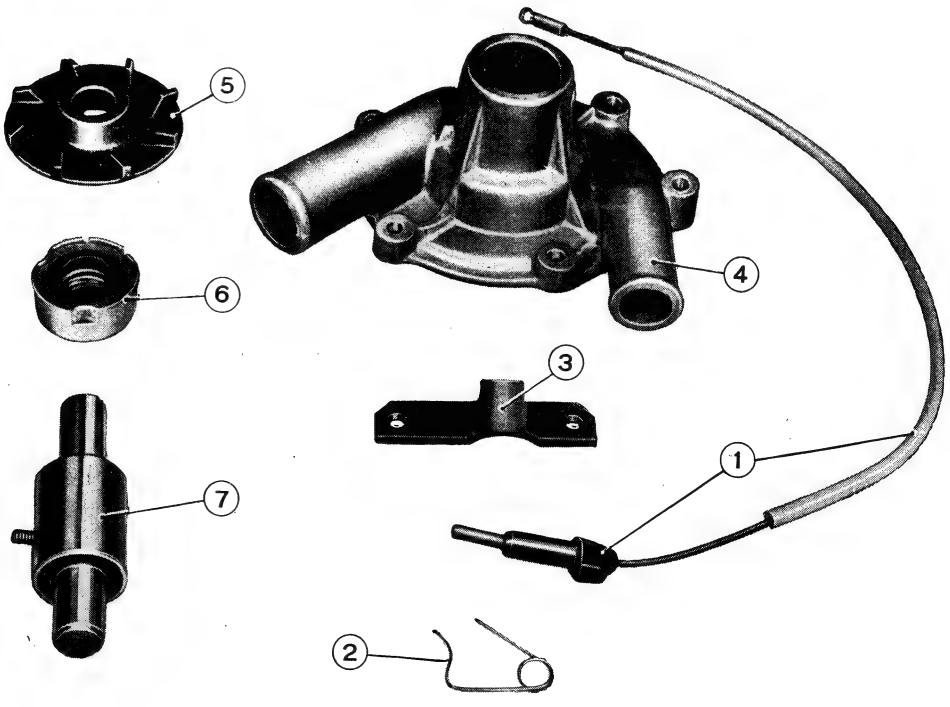


Fig. 81. - Components of water pump and fan wiring - engine 118 B.000.

1. Brush and wire, slip ring to switch - 2. Brush holder spring fastener - 3. Brush holder - 4. Water pump housing - 5. Impeller - 6. Bearing seal - 7. Shaft with bearing and stop screw.

FAN

The automatic, solenoid-controlled in-and-out fan consists basically of two units, namely:

1) **Pulley unit,** including the pulley (1, fig. 84) complete with hub (2) for pulley attachment to the water pump shaft, and with recesses to locate the solenoid winding (3) and the slip ring (6) in the water pump.

   The solenoid housing (3) contains a ring-shaped hollow seat (4) for the winding (5). The brass slip ring (6) is insulated from the pulley.

   An armoured wire (7) passing through a hole drilled in the pulley and the solenoid housing, provides the circuit between slip ring and winding.

   With engine running the pulley unit is driven into rotation by the « V » belt operated off the crankshaft.

2) **Hub-fan unit** including the hub (8, figs. 84 and 86) on which the fan (16) and the solenoid armature (9) are fixed. This unit can rotate freely in respect of the pulley unit thanks to a ball bearing (10) being placed between either unit.

   During engine operation, even though the solenoid is not attracted, the pulley unit is driven by the belt, whereas in this condition the hub-fan unit keeps free, being just apt to undergo a negligible rotational force as a result of bearing friction and air action on fan blades.

   The energizing of the solenoid draws the armature (9) toward the solenoid housing (3) and there is enough friction between these parts to obtain a dragging force stronger than the fan reaction, so that the hub-fan unit will rotate rigidly with the pulley unit.

   The armature (9) is linked resiliently with the hub by means of three lamina springs (11) being arranged as shown in fig. 84, which have been designed to take the armature away from the solenoid housing when current is turned off.

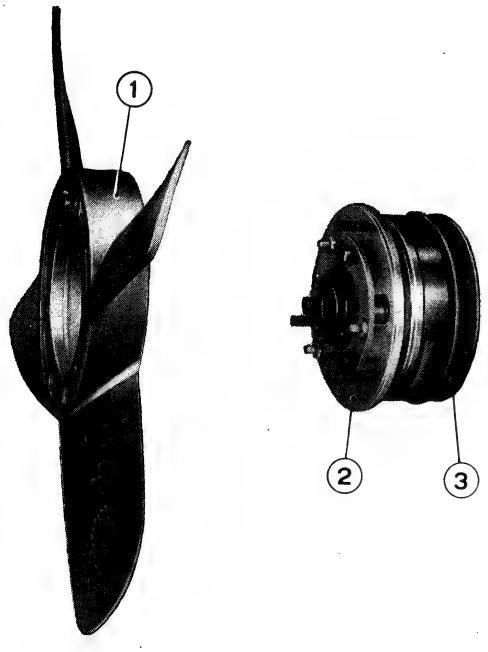


Fig. 82. - Fan and hub - engine 118 B.000.

1. Fan - 2. Electromagnetic hub - 3. Fan pulley with solenoid.

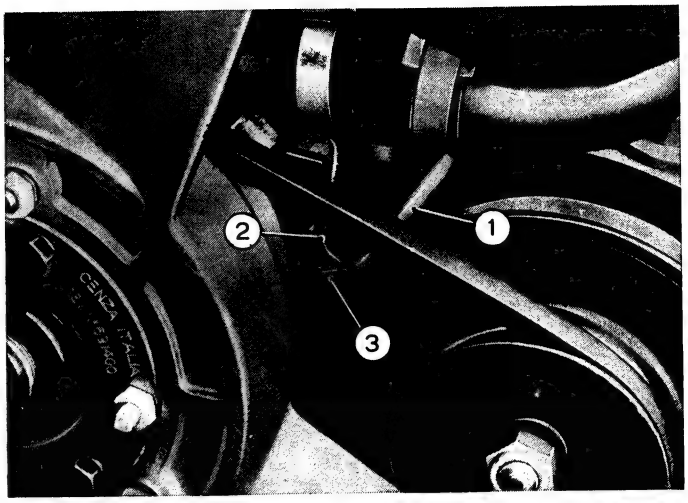


Fig. 83. - Detail of electrical connection between thermal switch, carbon contact and slip ring (engine 118 B.000).

1. Armoured wire - 2. Spring fastener - 3. Carbon contact on slip ring.

For regular solenoid operation, the air gap between the armature (9) and the solenoid housing (3) should be .0098″ to .0138″ (0.25 to 0.35 mm); for any air gap adjustment, use three screws (12) with nuts (13).

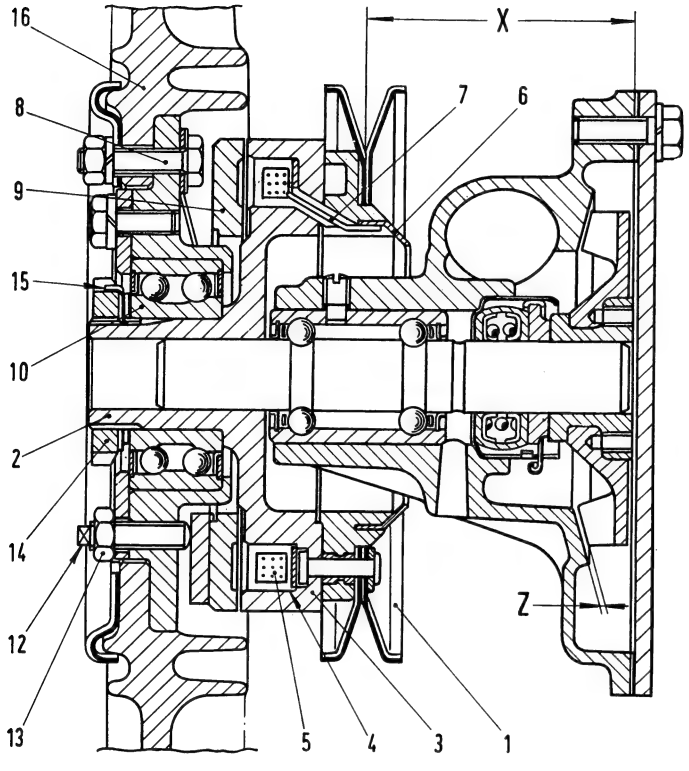
Linear attachment of pulley unit to hub-fan unit is assured by nut (14) with lock washer (15).

Current feed from main circuit to slip ring (6) is given by a sliding carbon brush (17); engagement and disengagement of fan are controlled by a thermal switch on down side of water radiator to contact of coolant (fig. 85).

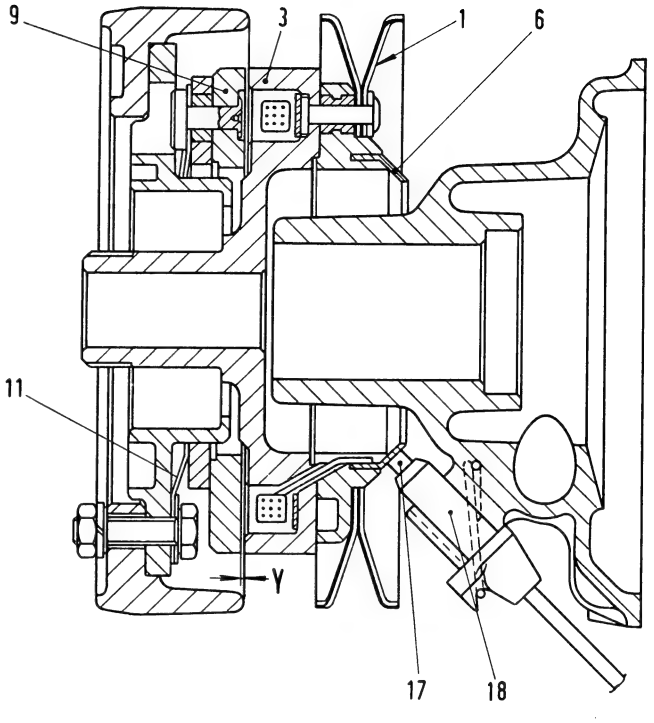
As water temperature reaches 181°±4° F (83°±2° C), the sending unit closes the electric circuit and the solenoid is energized, throwing in the radiator fan.

115C.005 ENGINE WATER PUMP-FAN ASSEMBLY

SECTION A-A



SECTION B-B



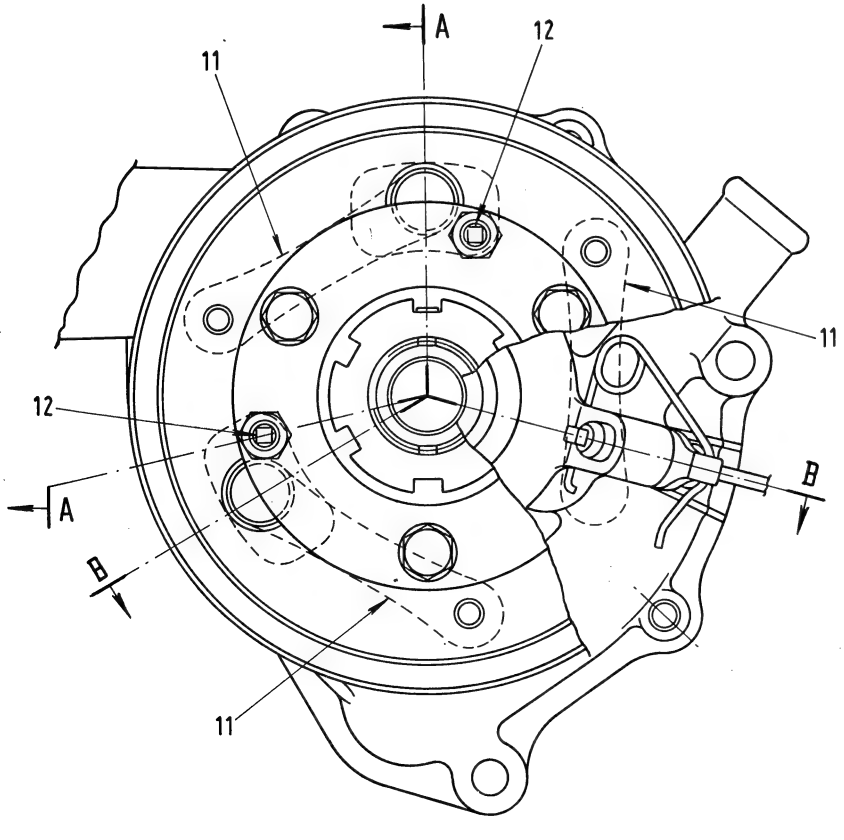


Fig. 84. - Sectional views of water pump and automatic in-and-out fan (engine 115 C.005).

1. Pulley - 2. Pulley hub - 3. Solenoid housing - 4. Solenoid seat - 5. Solenoid winding - 6. Slip ring - 7. Slip ring-to-solenoid wire - 8. Fan hub - 9. Solenoid armature - 10. Fan bearing - 11. Solenoid armature return lamina springs - 12. Solenoid air gap adjusting screws - 13. Screw nut - 14. Bearing retainer nut - 15. Nut lock washer - 16. Fan - 17. Brush - 18. Brush holder.

X = $2\,^3/_8''$ (60.5 mm)

Y = .0098″ to .0138″ (0.25 to 0.35 mm)

Z = .0197″ to .0394″ (0.5 to 1 mm)

When water temperature drops below 154° ± 4° F (68° ± 2° C), the thermal switch cuts out the electric circuit and the radiator fan is disengaged. In out position the fan will go on spinning at reduced speed as a result of ball bearing friction and the air stream activated by the riding vehicle.

Inspection and Adjustment.

After an initial stretch of 900 to 1,200 miles (1,500 to 2,000 km), check the solenoid housing-to-armature air gap for **.0098″ to .0138″ (0.25 to 0.35 mm);** if not so, adjust air gap as follows:

— loosen the lock nuts (1, fig. 85) of adjusting screws (2);

— turn the screws (2) in or out, each time measuring the air gap by means of a feeler gauge at the affected screw;

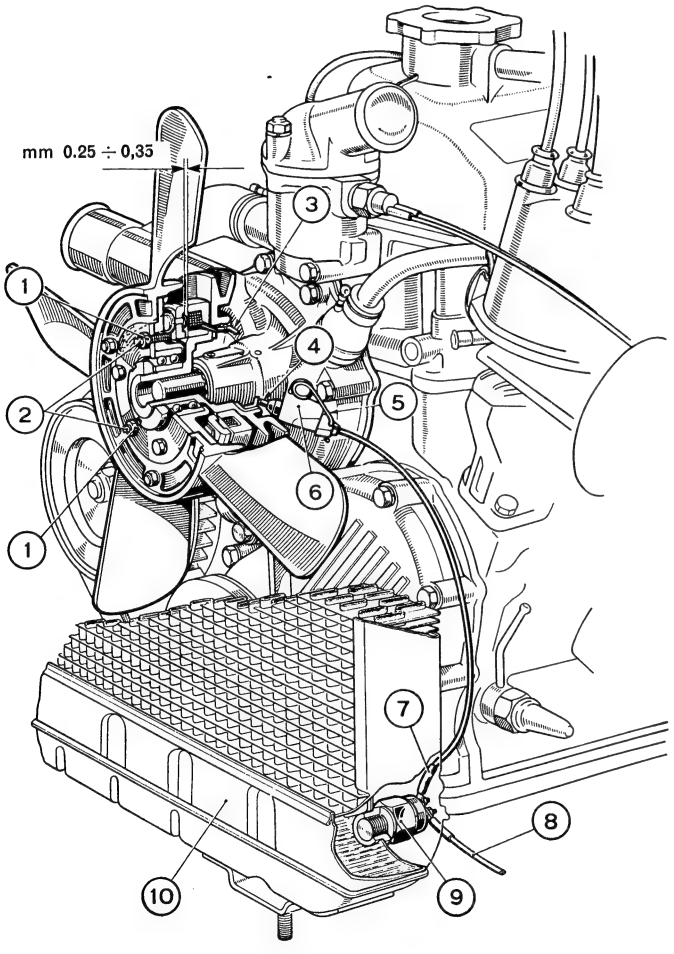


Fig. 85. - Automatic in-and-out fan (engine 115 C.005).

1. Solenoid air gap adjusting screw nuts - 2. Air gap adjusting screws - 3. Slip ring - 4. Brush - 5. Brush holder spring - 6. Brush holder seat - 7. Sending unit-to-brush lead - 8. Feeding line to fan thermal switch - 9. Fan thermal switch - 10. Radiator.

mm 0,25 ÷ 0,35 = .0098″ to .0138″.

NOTE - Pulley, fan hub and solenoid housing shown here are the early type. For the late design of these parts see figures 84 and 86.

— when air gap is correct, lock the screw nuts (1).

Every 12,000 miles (20,000 km):

— thoroughly wipe the slip ring (3, fig. 85) with a dry cloth;

— unfasten the retaining spring (5, fig. 85), slide off the brush holder from its seat (6) and inspect the wear condition and contact ability of the brush (4) and brush pressure spring, making sure that the brush can slide freely in its seat; replace worn parts, if any;

— on reassembly, see that the spring (5) grasps the brush holder firmly.

Trouble Diagnosis and Corrections.

1) **Faulty Thermal Switch.**

If the temperature gauge on dashboard registers water temperature in excess of 185° F (85° C) and the radiator fan fails to throw in, the thermal switch may be at fault. If so, **temporarily** tie wires 7 and 8 (fig. 85) on the same terminal so that the fan will be operating all the time. Replace the thermal switch, as soon as possible.

2) **Open Solenoid Winding** (exceptional occurrence).

If the fan fails to thrown in even though the wires (7-8, fig. 85) have been tied together, which must be traced to an open solenoid winding (5, fig. 84), it will be also possible to have the fan operate all the same, **as a temporary measure**, by the **extended drag** method, as follows:

— loosen the three nuts (1, fig. 85) which secure the air gap adjusting screws (2);

— turn the three adjusting screws (2, fig. 85) **part way in**, so that the armature adheres to the solenoid housing;

— lock the screws with the three nuts (1, fig. 85); in this way the fan will be put into uninterrupted operation. As a definite remedy of trouble, arrange to replace the pulley-solenoid-slip ring assembly.

3) **Open Slip Ring-Solenoid Wire.**

If the fan fails to throw in even though the wires (7-8, fig. 85) have been tied together, this may be due to the commutator-to-solenoid wire (7, fig. 84) being open; if so, to have the fan operate, proceed as outlined at 2), **for temporary correction.**

To remove the trouble, replace the pulley-solenoid-slip ring assembly.

Replacing Pulley and Solenoid Assembly.

To replace the pulley (1, figs. 84 and 86) with solenoid (3) as an assembly, proceed as follows:

— Drain the water radiator and cylinder block.

— Loosen and lift out the fan belt.

— Loosen clamp collars, disconnect water outlet and inlet pipe hoses at water pump.

— Unfasten the brush holder pressure spring and slide off the brush holder (18) from its seat.

— Remove retaining screws and withdraw the water pump and fan assembly.

With the water pump on work bench, proceed as follows:

— Pry up the lock washer (15) and remove the bearing nut (14) using wrench **A. 50099**.

— Slide off the fan (16) assembly, inclusive of hub (8), solenoid armature (9) and bearing (10).

— Use a puller and drive the pulley-solenoid assembly (1, 2 and 3) from the water pump bearing shaft.

To assemble, proceed as follows:

— Remove the water pump cover to gain access to the opposite end of the bearing shaft, which will work as a resting face on subsequent pulley pressing operation.

— Using a press, insert the pulley and solenoid assembly on to the water pump bearing shaft, caring for the perfect alignment between these parts and recalling that there must be a constant pinch fit of **.00047″** to **.00236″ (0.012** to **0.06 mm).** The pressing job should be made so that **the centerline of the pulley is 2 3/8″ (60.5 mm)** (fig. 84) (engine 115 C.005) or **1 7/8″ (47.5 mm)** (fig. 86) (engine 118 B.000) **apart from the water pump cover mounting face.**

— Temporarily fit the brush holder (18, fig. 84) in seat and, whilst turning the pulley, check the brush (17) for a perfect touch all along the outside of slip ring

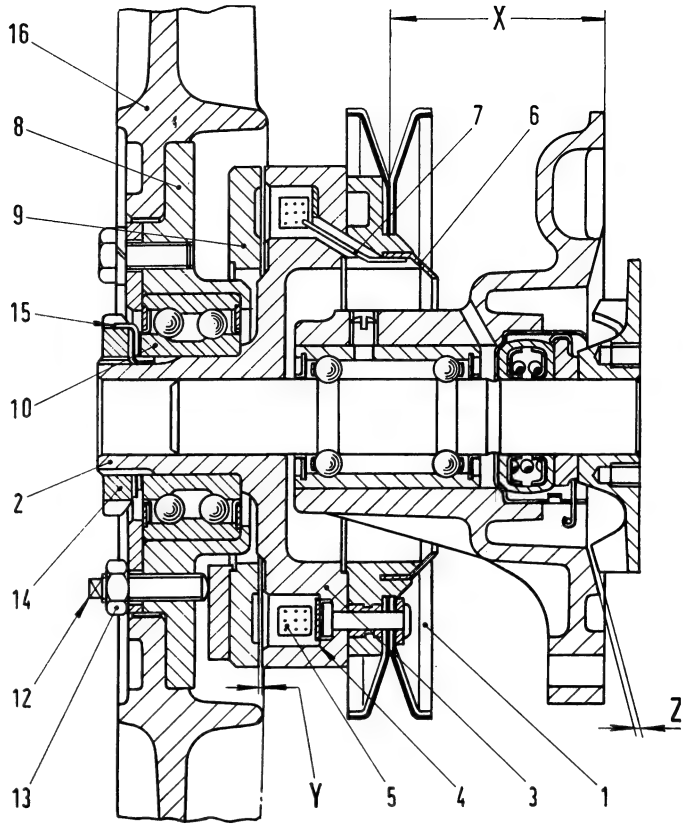


Fig. 86. - Sectional view of water pump and automatic in-and-out fan assembly (engine 118 C.000).

1. Pulley - 2. Pulley hub - 3. Solenoid housing - 4. Solenoid seat - 5. Solenoid winding - 6. Slip ring - 7. Lead, slip ring to winding - 8. Fan hub - 9. Armature - 10. Fan bearing - 12. Air gap adjustment screws - 13. Locknut - 14. Slotted ring, fan mounting - 15. Lock plate for ring - 16. Fan.

X = 1 7/8″ (47.5 mm)

Y = .0098″ to .0138″ (0.25 to 0.35 mm)

Z = .0197″ to .0394″ (0.5 to 1 mm)

(6). Any insulating material dripping between brush and commutator should be thoroughly removed.

— Install, on the pulley hub (2, fig. 86), the fan (16) assembly, inclusive of hub (8), solenoid armature (9) and bearing (10), slide in the lock washer (15) and then lock the bearing with the nut (14) using wrench **A. 50099**; bend down the lock washer.

— Adjust the air gap at **.0098″** to **.0138″ (0.25** to **0.35 mm)** as outlined on page 60.

Next install the water pump and fan assembly on cylinder block, fit the water pump drive belt and adjust belt tension. Thread the brush holder (18, fig. 84) into seat and hook up the brush holder spring fastener.

Fuel System

CARBURETORS

The following carburetor types are fitted:

— Weber 34 DCHD 4 on engine 115 C.005;

— Weber 34 DCS 2 and 34 DCS 4 on engine 118 B.000.

WEBER 34 DCHD 4 CARBURETOR SETTING DATA

ITEM	Primary Throat	Secondary Throat
Bore	1.339″ (34 mm)	1.339″ (34 mm)
Venturi	.984″ (25 mm)	.984″ (25 mm)
Main jet	.051″ (1.30 mm)	.055″ (1.40 mm)
Idling jet	.020″ (0.50 mm)	.027″ (0.70 mm)
Air correction jet	.088″ (2.25 mm)	.090″ (2.30 mm)
Starting jet	.059″ (1.50 mm)	
Starting air jet	.197″ (5 mm)	
Accelerator pump jet	.027″ (0.70 mm)	
Accelerator pump recirculation jet	shut off	
Idling air jet	.075″ (1.90 mm)	
Needle valve housing	.069″ (1.75 mm)	
Float	.63 oz (18 gr)	
Float level: — distance of float from the face of cover (vertical, without gasket)	.197″ to .216″ (5 to 5.5 mm)	
— float travel	.335″ (8.5 mm)	

SETTING DATA OF WEBER 34 DCS 2 AND 34 DCS 4 CARBURETORS

ITEM	Primary Throat	Secondary Throat
Bore	1.339″ (34 mm)	1.339″ (34 mm)
Venturi	.866″ (22 mm)	.866″ (22 mm)
Main jet	.041″ (1.05 mm)	.041″ (1.05 mm)
Air correction jet	.079″ (2 mm)	.079″ (2 mm)
Idling jet	.016″ (0.40 mm)	.016″ (0.40 mm)
Idling air jet	.031″ (0.80 mm)	.031″ (0.80 mm)
Accelerator pump jet	.016″ (0.40 mm)	.016″ (0.40 mm)
Starting jet	.031″ (0.80 mm)	
Starting air jet	.059″ (1.50 mm)	
Needle valve housing	.069″ (1.75 mm)	
Float	.63 oz (18 gr)	
Float level: — distance of two float halves from the face of cover (vertical, without gasket)	.256″ (6.5 mm)	
— float travel	.335″ (8.5 mm)	

WEBER CARBURETOR TYPE 34 DCHD 4

Description (Figs. 88 and 89).

The Weber 34 DCHD 4 carburetor is of the dowdraft, dual-barrel, compound design.

The first carburetor stage is directly under the mechanical control of the accelerator which operates the primary throttle valve (12) via a system of links and levers.

The second throat, instead, will turn in automatically, beyond the driver's control, thanks to a device consisting of a vacuum chamber (19) which contains a diaphragm (44) being connected to the secondary throat throttle (37) via a system of links and levers.

The secondary throttle (37) begins opening as soon as vacuum in the first throat is such as to overcome, through the passage (38), the force of the spring opposing the diaphragm (44) which, in turn, causes the lever on the secondary throttle (37) spindle to rotate via a rod.

As the secondary throttle is opening, vacuum in the second throat affects also the port at the primary Venturi restriction, thus ensuring the full opening of the secondary throttle whenever the engine may so require.

Provision is made for the secondary throat throttle to close through a mechanical device in spindles of the primary and secondary throttles (fig. 87).

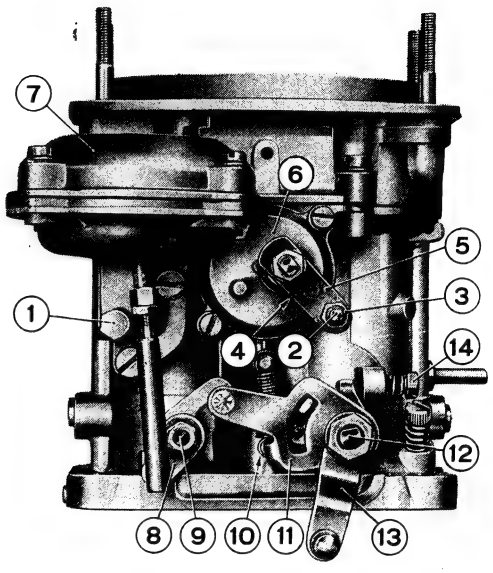


Fig. 87. - Weber 34 DCHD 4 carburetor to suit engine 115C.005.

1. Cable sheath retaining screw - 2-3. Choke control cable retaining screw and nut - 4. Lever return spring - 5. Choke control lever - 6. Vacuum device cover - 7. Vacuum device - 8. Secondary throat throttle control lever - 9. Secondary throat throttle spindle - 10. Sector return spring - 11. Sector for release and return of lever (8) - 12. Primary throat throttle spindle - 13. Primary throat throttle control lever - 14. Screw for idle adjustment of primary throat throttle.

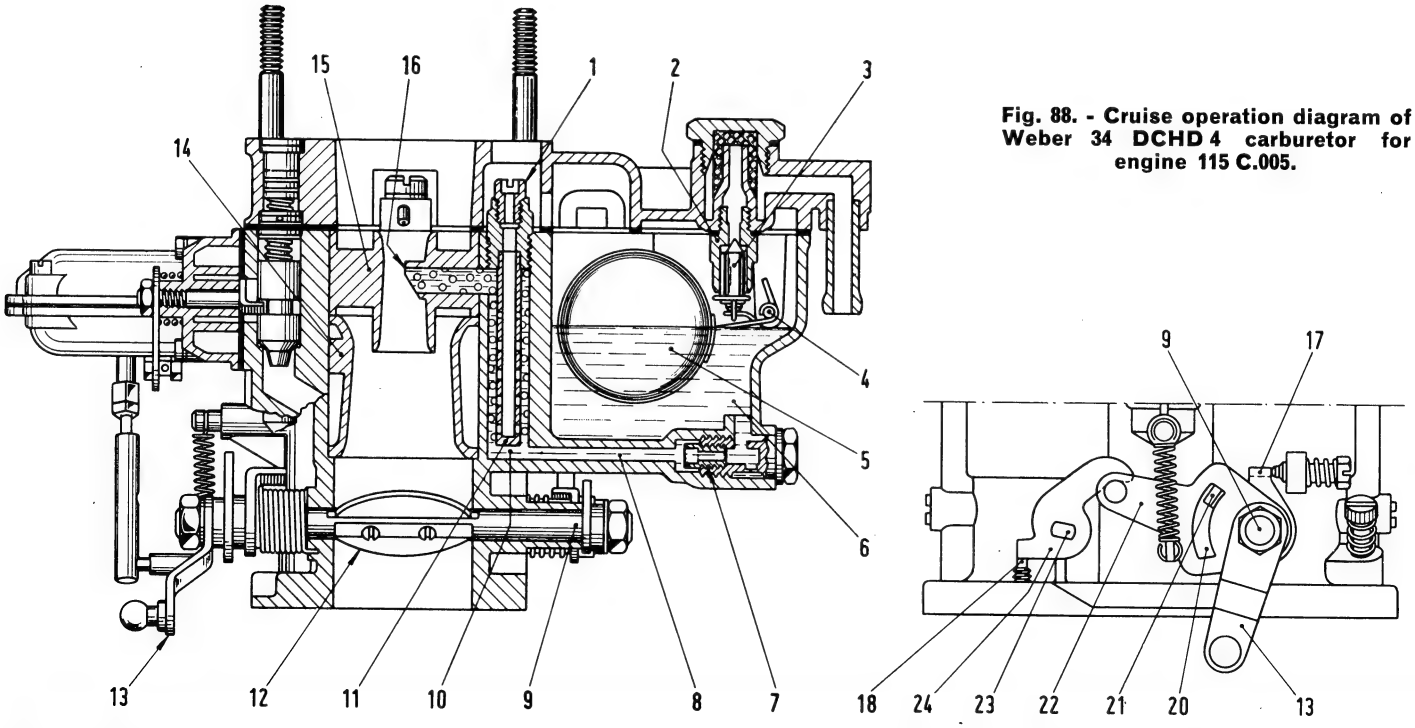


Fig. 88. - Cruise operation diagram of Weber 34 DCHD 4 carburetor for engine 115 C.005.

1. Air correction jet - 2. Needle valve - 3. Valve needle - 4. Pivot pin - 5. Float - 6. Bowl - 7. Main jet - 8. Main jet-to-emulsion well passage - 9. Primary throttle spindle - 10. Emulsion well - 11. Emulsion tube - 12. Primary throttle - 13. Primary throttle control lever - 14. Primary Venturi - 15. Auxiliary Venturi - 16. Discharge tube - 17. Lever stop sector - 18. Secondary throttle stop adjusting screw - 20. Slot for lug (21) - 21. Drag lug for sector (22) - 22. Sector for release and return of lever (24) - 23. Secondary throttle spindle - 24. Secondary throttle return lever.

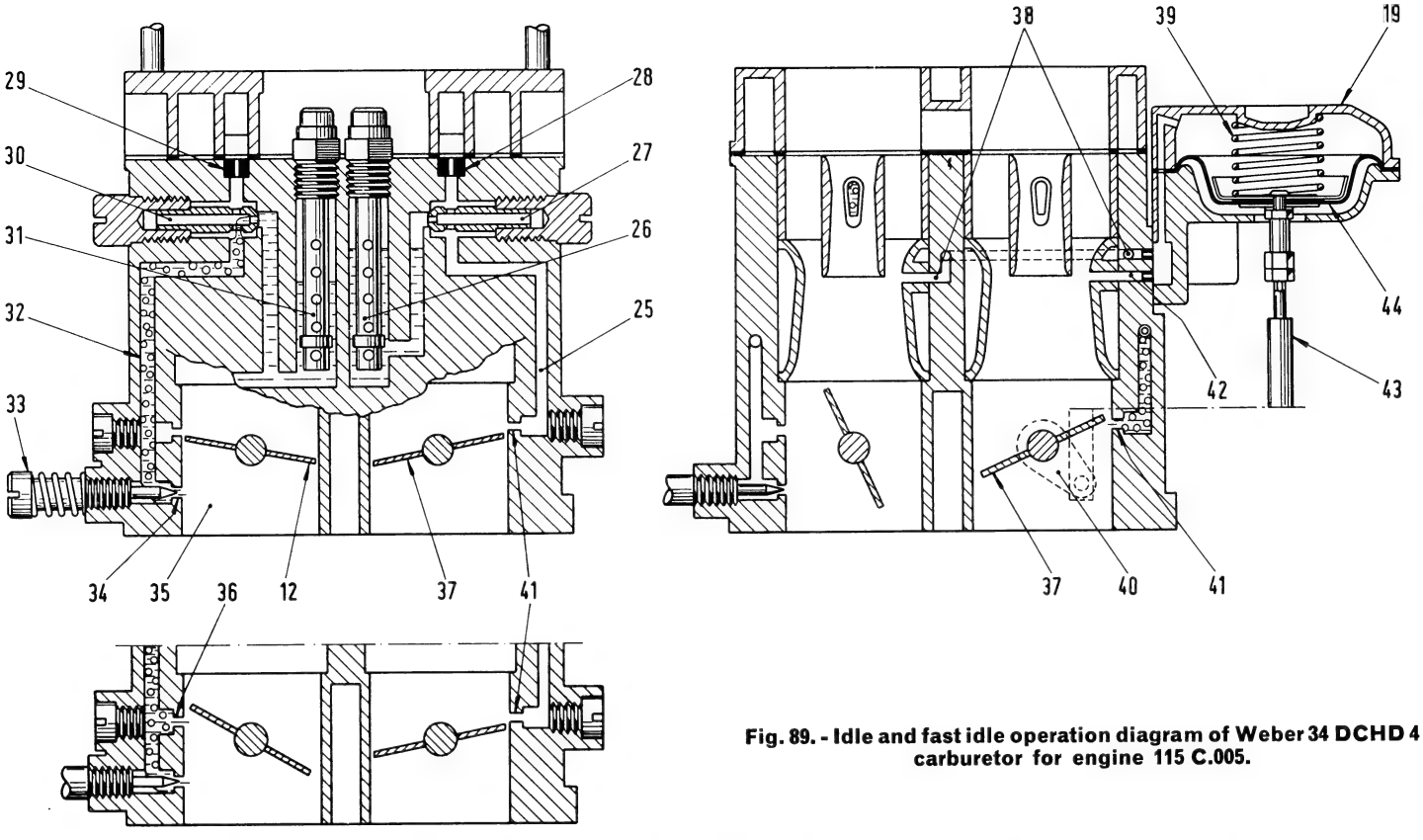


Fig. 89. - Idle and fast idle operation diagram of Weber 34 DCHD 4 carburetor for engine 115 C.005.

12. Primary throttle valve - 19. Vacuum chamber - 25. Secondary throat idle transfer port passage - 26. Secondary emulsion tube - 27. Secondary idle jet - 28. Secondary idling air calibrated bushing - 29. Primary idling air calibrated bushing - 30. Primary idle jet - 31. Primary emulsion tube - 32. Idle passage - 33. Idle adjusting screw - 34. Idling feed orifice - 35. Primary throat - 36. Primary throat idle transfer port - 37. Secondary throttle valve - 38. Vacuum device port and passage at primary throat - 39. Spring - 40. Secondary throttle control lever - 41. Secondary throat idle transfer port - 42. Vacuum device port at secondary throat - 43. Secondary throttle control rod - 44. Vacuum device diaphragm.

Accelerator Pump (fig. 90).

This pump is of the plunger type.

When the primary throttle is closed, the lever (52) raises the rod (51) and thus the plunger (49) causing fuel to be drawn from the bowl (6) through the ball valve (47) into the pump cylinder.

When the primary throttle (12) is opened, the lever (53) depresses the lever (52) working idle on the secondary spindle (23). As a result, the rod is released

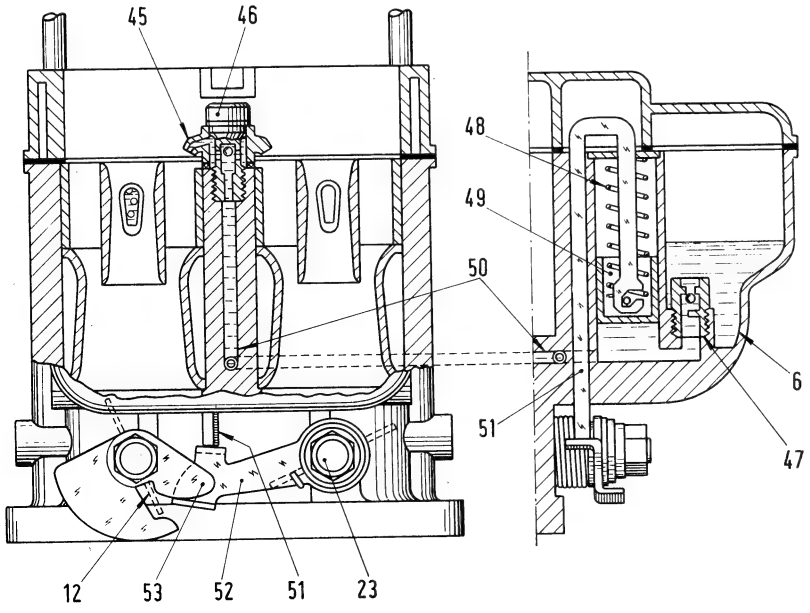


Fig. 90. - Power operation diagram of Weber 34 DCHD 4 carburetor for engine 115 C.005.

6. Bowl - 12. Primary throttle valve - 23. Secondary throttle spindle - 45. Accelerator pump jet - 46. Delivery valve - 47. Suction valve - 48. Spring - 49. Accelerator pump plunger - 50. Delivery passage - 51. Plunger rod - 52. Rod control lever, idler - 53. Pump control lever, primary.

and the plunger (49) moves downward under pressure from the spring (48), forcing fuel into the passage (50), and via the valve (46) to the pump jet (45) where it is injected into the primary throat.

Easy Starting Device (fig. 91).

The fuel control starting device is intended to ensure easy starting from cold, regular engine operation at idle and car set-out in a cold condition.

The starting device (choke) is used until the engine has reached its normal running temperature.

The mixture rate (rich or weak) changes after the position of the choke control on the dashboard.

With the choke control knob all the way out the fuel mixture is very rich ensuring easy starting even of a coldest engine.

The choke is of the gradual acting type.

INSTRUCTIONS FOR USING THE EASY STARTING DEVICE

Starting Engine.

— From cold: pull the control knob out to its fullest extent and return it slightly once the engine has started.

— Engine slightly warm: pull the control knob only half way out.

Warming up Engine.

During this period, whether the engine is stationary or moving, the knob should be returned gradually and with short pauses to the midway position, thus ensuring that the starting mixture supplied to the cylinders is never in excess of the engine's actual requirements.

Engine Running Normally.

As soon as the normal engine temperature is reached, the control knob should be fully returned to the closed position (diagram C).

OPERATION NOTES

Once the engine has started, with the choke fully on, the engine will rev up suddenly causing substantial vacuum increase downstream throttle valve. Vacuum in the passage (63) opens the valve (62) so that air is drawn past the bushing (61) orifice to weaken the mixture in the passage (54) from the starting jet (59).

So the mixture rate and amount supplied by the easy starting device will be always such as to ensure the regular running of a cold engine (diagram B).

Idling Adjustment (fig. 93).

For idle adjustment, work on the primary throat only by means of the throttle stop screw (5) and the volume control screw (4).

Screw (5) controls the degree of opening of the primary throttle, whilst the tapered screw (4) regulates the volume of mixture delivered by the idling mixture passage and further mixed with the air drawn in by the engine suction, thus enabling the appropriate degree of idling richness to be obtained.

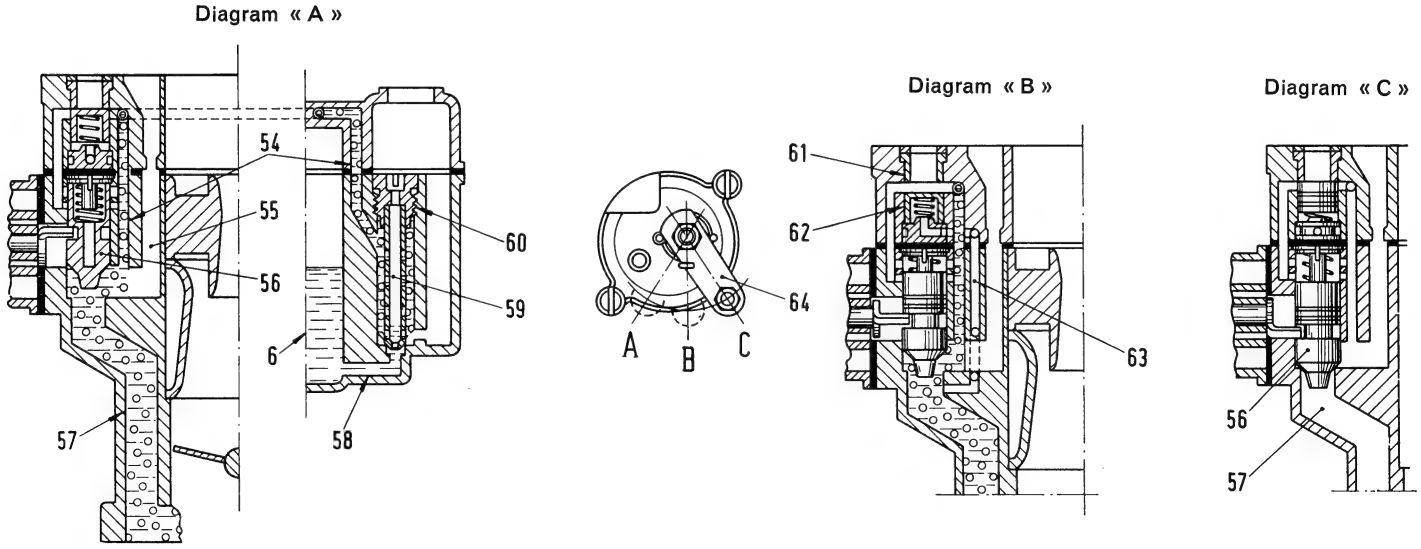


Fig. 91. - Operation diagram of Weber 34 DCHD 4 carburetor easy starting device (choke) (engine 115 C.005).

Diagram « A »: easy starting device all the way in.

Diagram « B »: easy starting device part way in.

Diagram « C »: easy starting device out.

6. Bowl - 54. Starting mixture passage to choke - 55. Air passage - 56. Plunger - 57. Starting mixture passage to primary throat - 58. Fuel passage from bowl to starting jet - 59. Starting jet - 60. Starting air jet - 61. Leaning air bushing - 62. Leaning air metering valve - 63. Vacuum passage controlling valve (62) - 64. Choke control lever.

A. Position of lever 64 with easy starting device all the way in - B. Lever position with easy starting device part way in - C. Lever position with easy starting device all the way out.

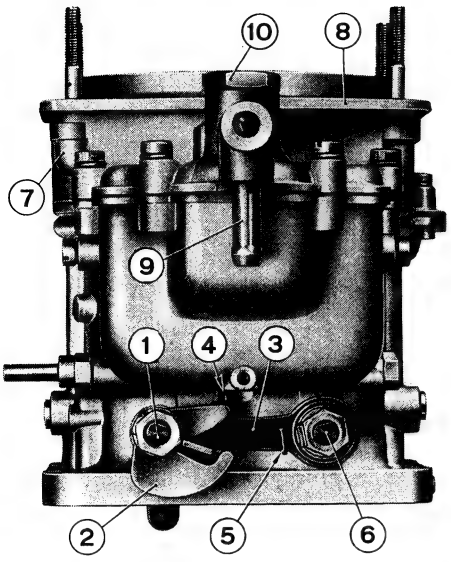


Fig. 92. - Weber 34 DCHD 4 carburetor for engine 115 C.005.
1. Primary throat throttle spindle - 2. Accelerator pump control lever, primary - 3. Rod control lever, idler - 4. Plunger rod - 5. Return spring for lever (3) - 6. Secondary throat throttle spindle - 7. Body side cover - 8. Air cleaner mounting flange - 9. Fuel delivery line connector - 10. Filter inspection cover.

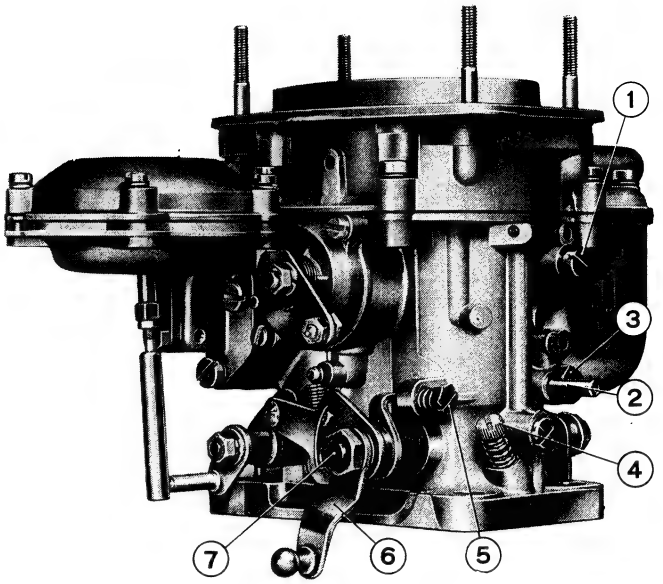


Fig. 93. - Weber 34 DCHD 4 carburetor for engine 115 C.005.
1. Idling jet - 2. Vacuum advance line connector - 3. Main jet - 4. Volume control screw - 5. Throttle stop screw - 6. Primary throat throttle control lever - 7. Primary throat throttle spindle.

Idling adjustment should be carried out with the engine warm and running by first of all adjusting the throttle stop screw (5) to a point where the engine does not falter.

Then adjust the volume control screw (4) to obtain the mixture which gives the highest regular engine speed at the selected degree of throttle restriction. Finally, unscrew very slowly the stop screw (5) to reduce engine speed to the minimum without irregular running.

WEBER CARBURETORS TYPE 34 DCS 2 AND 34 DCS 4

These carburetors (34 DCS 2, front and 34 DCS 4, rear), to suit Model 1600 S, are of the dual barrel type with synchronous opening of throttle valves, choke and accelerator pump.

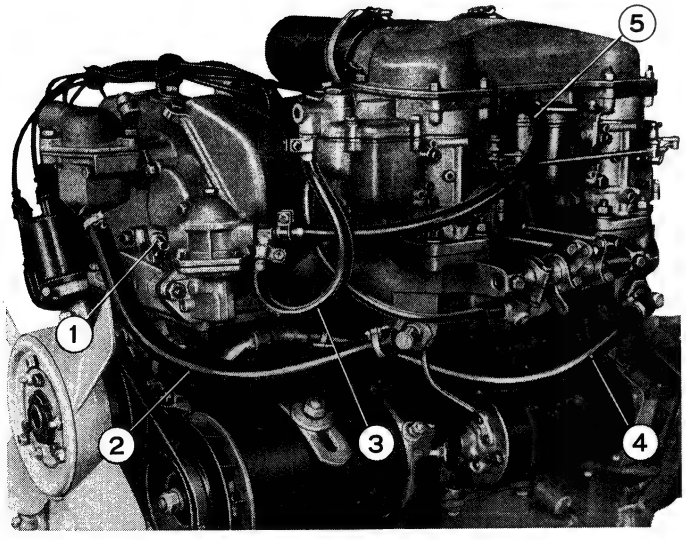


Fig. 94. - Weber 34 DCS 2 and 34 DCS 4 carburetors in place on engine 118 B.000.
1. Fuel inlet connector - 2. Water hose, head funnel to intake manifold - 3. Front carburetor feed line - 4. Water hose, intake manifold to heater return pipe - 5. Rear carburetor feed line.

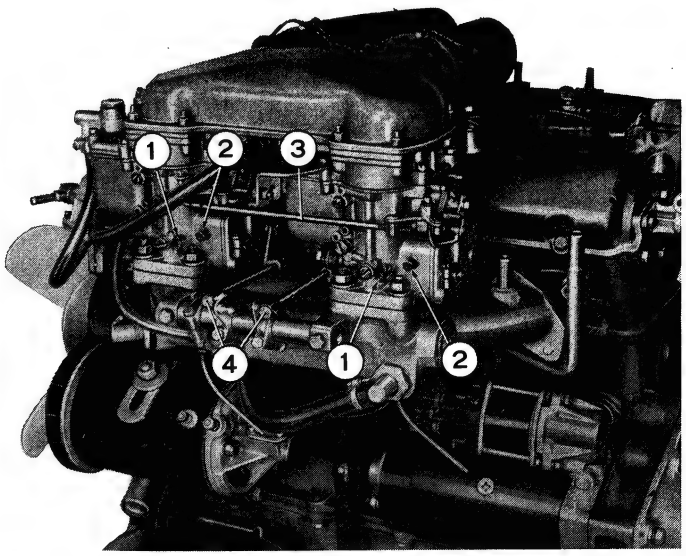


Fig. 95. - Weber 34 DCS 2 and 34 DCS 4 carburetors in place on engine 118 B.000.
1. Idle mixture adjusting screw - 2. Throttle adjusting screw - 3. Choke control lever link - 4. Throttles control lever rod.

Normal Operation (fig. 98).

The fuel, through needle valve (2) flows to bowl (6) where float (5), articulated on pivot pin (4), regulates the opening of needle (3) in order to keep the level of the liquid constant.

From bowl (6), through main jets (7) and passages (8), the fuel reaches wells (10).

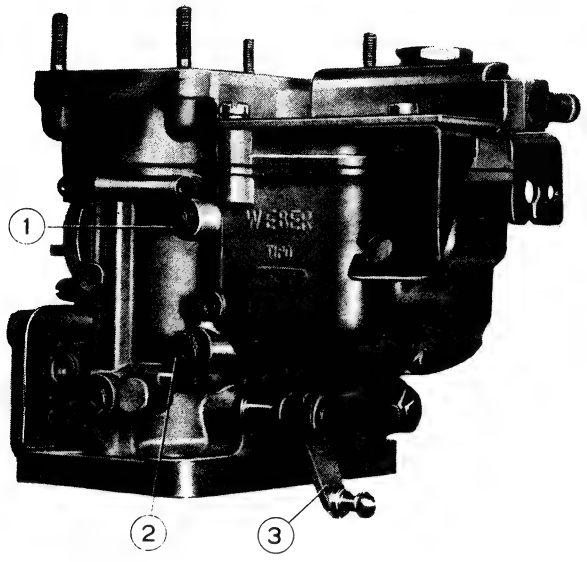


Fig. 96. - Rear Weber 34 DCS 4 carburetor to suit engine 118 B.000.

1. Idle jet - 2. Main jet - 3. Throttles control lever.

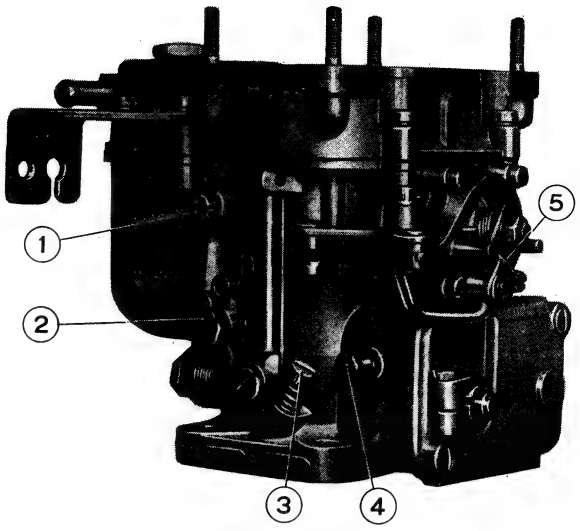


Fig. 97. - Rear Weber 34 DCS 4 carburetor to suit engine 118 B.000.

1. Idle jet - 2. Main jet - 3. Idle mixture adjusting screw - 4. Throttle adjusting screw. - 5. Choke control lever.

Mixed with the air from the orifices of emulsion tubes (11) and from air corrector jets (1), through nozzles (16), fuel reaches the carburetion area, consisting of auxiliary Venturis (15) and primary Venturis (14).

In fig. 98 is also shown the device for synchronous opening of throttle valves. From lever (13), throttles (12) are controlled synchronously through toothed sectors (17) and (18) fixed to spindles (19) and (9). So throttles are opening in opposite direction each other, which ensures an equal degree of feeding to intake manifolds.

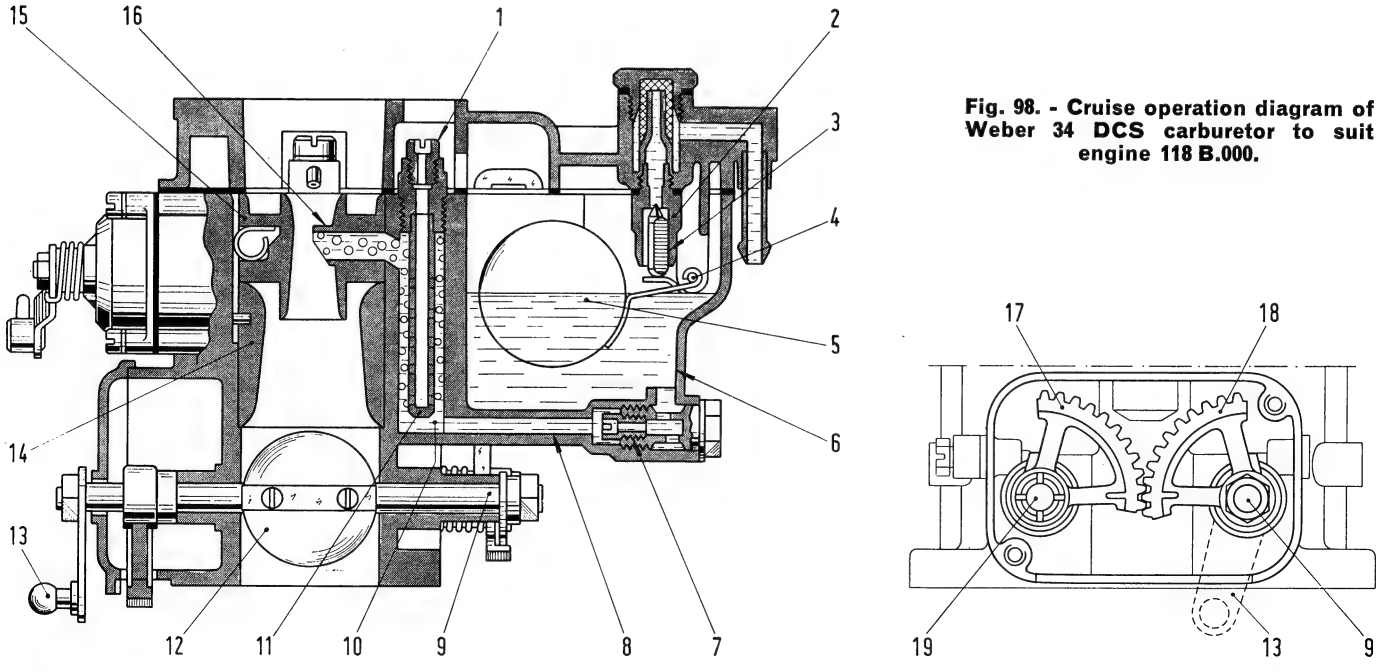


Fig. 98. - Cruise operation diagram of Weber 34 DCS carburetor to suit engine 118 B.000.

1. Air correction jet - 2. Needle valve - 3. Valve needle - 4. Pivot pin - 5. Float - 6. Bowl - 7. Main jet - 8. Passage, main jet to well - 9. Throttle spindle - 10. Well - 11. Emulsion tube - 12. Throttle valve - 13. Throttle control lever - 14. Primary Venturi - 15. Auxiliary Venturis - 16. Nozzle - 17-18. Toothed sectors controlling synchronous opening of throttle valves - 19. Throttle spindle.

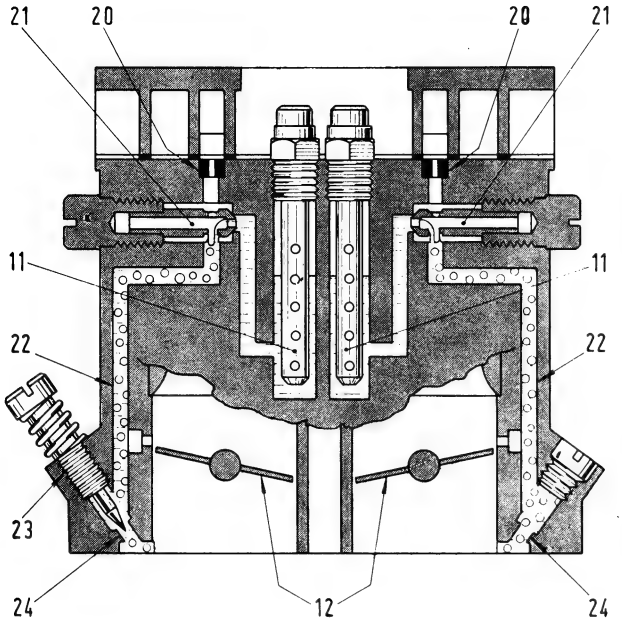
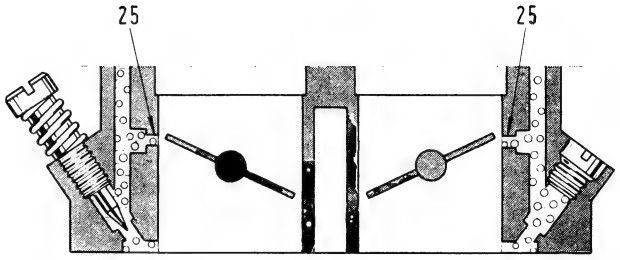


Fig. 99. - Idle and fast idle operation diagram of Weber 34 DCS carburetor to suit engine 118 B.000.

11. Emulsion tubes - 12. Throttle valves - 20. Idle air calibrated bushings - 21. Idle jets - 22-24. Idle feed passages and orifices - 23. Cone tipped screw for fuel feed orifice adjustment at one carburetor throat. - 25. Idle transfer orifices.



Idle Speed and Transfer (fig. 99).

Fuel streams from emulsion wells (11) to idle jets (21), where it blends with air from calibrated hushings (20), and then is ported through passages (22) and idle feed orifices (24) to carburetor throats dowstream of throttles (12).

The fuel feed orifice can be adjusted through a cone tipped screw at one throat, whereas at the other there is a fixed adjustment. For the setting of the idle speed on both carburetors, adhere to the directions covering the 34 DCHD 4 carburetor on page 65.

Mixture also reaches carburetor throats through idle transfer orifices (25) at throttle valves, thus ensuring a regular increase in angular velocity of engine off idle speed.

Power Operation (fig. 100).

When throttles are closed, lever (33) raises rod (31) and plunger (29). Fuel is drawn from bowl (6) into pump cylinder past inlet ball valve (32).

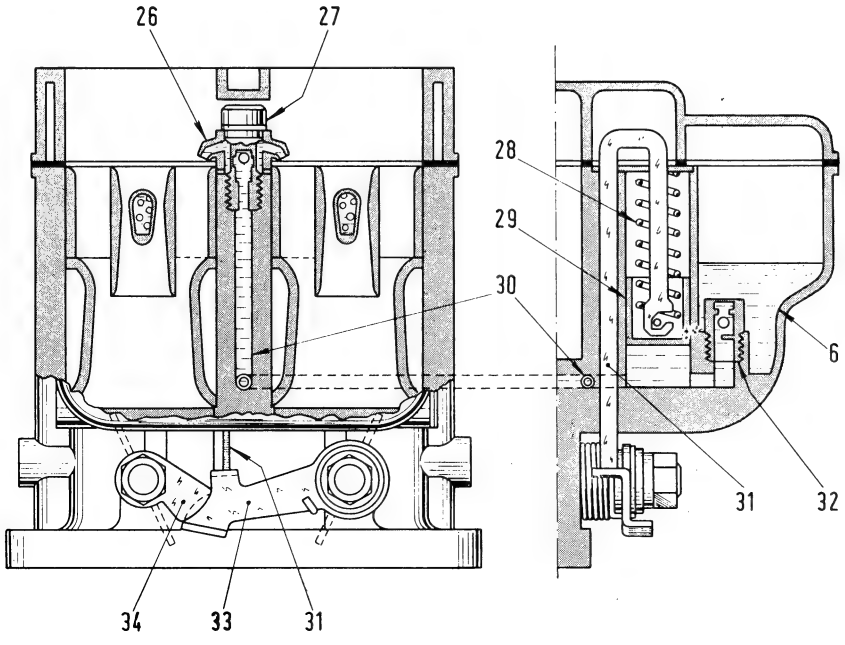


Fig. 100. - Power operation diagram of Weber 34 DCS carburetor to suit engine 118 B.000.

6. Bowl - 26. Accelerator pump jet - 27. Accelerator pump jet valve - 28. Spring - 29. Pump plunger - 30. Pump jet passage - 31. Rod - 32. Inlet valve - 33-34. Plunger rod levers.

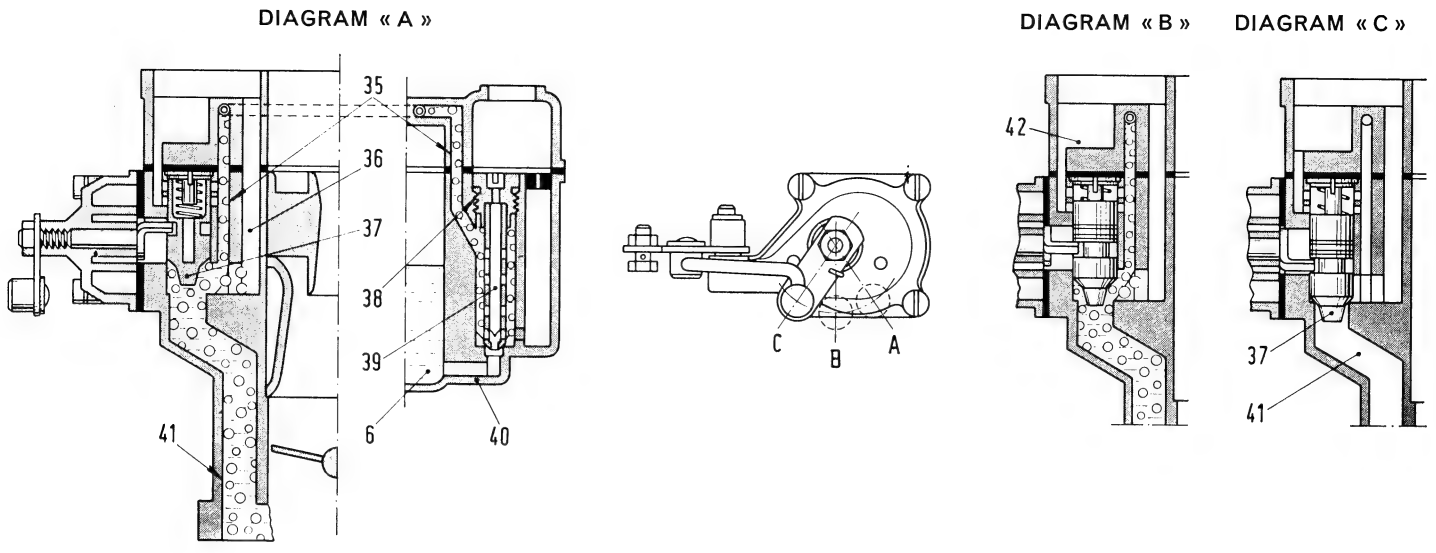


Fig. 101. - Operation diagram of Weber 34 DCS carburetor easy starting device (choke) (engine 118 B.000).

Diagram « A »: easy starting device all the way in - Diagram « B »: easy starting device part way in - Diagram « C »: easy starting device out.

6. Bowl - 35. Starting mixture passage to choke - 36. Air passage - 37. Plunger - 38. Starting air jet - 39. Starting jet - 40. Fuel passage from bowl to starting jet - 41. Starting mixture passage to primary throat - 42. Leaning air inlet.

A. - Lever position corresponding to choke all the way in - B. Lever position with choke part way in - C. Lever position with choke all the way out.

When throttles are opened, lever (34) lowers lever (33), releasing the rod (31). Plunger (29) moves downward under pressure from the spring (28) and fuel is forced past passage (30) and into throttle chambers through the delivery valve (27) and calibrated pump jets.

Suction valve (32) may come with a calibrated orifice on side face for excess fuel recirculation to bowl.

Easy Starting Device (fig. 101).

Fuel from bowl (6) is advanced to the choke through passage (40) and starting jet (39). After blending with air from carburetor air intake metered at the starting air jet (38), fuel flows past passage (35) to the plunger (37) recess, where it mixes with air from passage (36). This mixture will be drawn up through passage (41) to ensure prompt starting of engine (diagram A).

Once the engine has started, turn the choke part way out (diagram B).

In this step, a further amount of air from passage (42) leans out the choke mixture for regular operation of the cold engine.

However, when the engine has been heated, such mixture will still be too rich and in excessive supply, so the starting device must be gradually cut out as the temperature of engine rises.

With the choke in off position, the plunger (37) shuts the passage (41) preventing any flow of mixture (diagram C).

INSTRUCTIONS FOR USING THE EASY STARTING DEVICE

The following instructions should be observed in order to obtain maximum benefit from the device:

Starting Engine.

— From cold: pull the control knob out to its fullest extent and return it slightly once the engine has started.

— Engine slightly warm: pull the control knob only half way out.

Warming up Engine.

During this period, whether the vehicle is stationary or moving, the knob should be returned gradually and with short pauses to the midway position, thus ensuring that the starting mixture supplied to the cylinders is never in excess of the engine's actual requirements.

Engine Running Normally.

As soon as the normal engine temperature is reached the control knob should be fully returned to the closed position.

ELECTRIC FUEL PUMP

(ENGINE 118B.000)

Description.

The electric fuel pump is mounted underneath car floor (fig. 103) outside the battery housing. This pump is serially connected with the mechanical pump and needing no linkage with engine it can be installed far away from engine heat.

Pump capacity is independent of engine R.P.M. rate, and the pump is automatically started as ignition is turned on, so as to fill the carburetor before engine is started, with a saving in battery current.

Operation (fig. 102).

The plunger (6) is magnetically and electrically driven up and down the tube (1) at a very high speed. When the plunger (6) is pushed up by the spring (7) load its upper end enters the field of the permanent magnet (2) (movable contact). The pulling force between magnet (2) and plunger (6) causes the magnet (with pole bent at 90°) to come in contact with the brass tube (1) in which the plunger slides. Because of the movement of breaker arm (10) whose articulation is pivoted on its fulcrum, the ground contact is pressed against the stationary contact (18), thus closing the electric circuit.

At this instant the current from battery (or from generator) flows through the coil (3) winding inducing a strong magnetic field around it, which attracts and pulls down the plunger (6).

When, following the downward movement the plunger leaves the permanent magnet (2) field, the attraction force decreases and the permanent magnet returns to rest position under the magnetic pull of the opposite pole. As a consequence, breaker contacts (5) part and cut off the current to the coil whose magnetic field collapses.

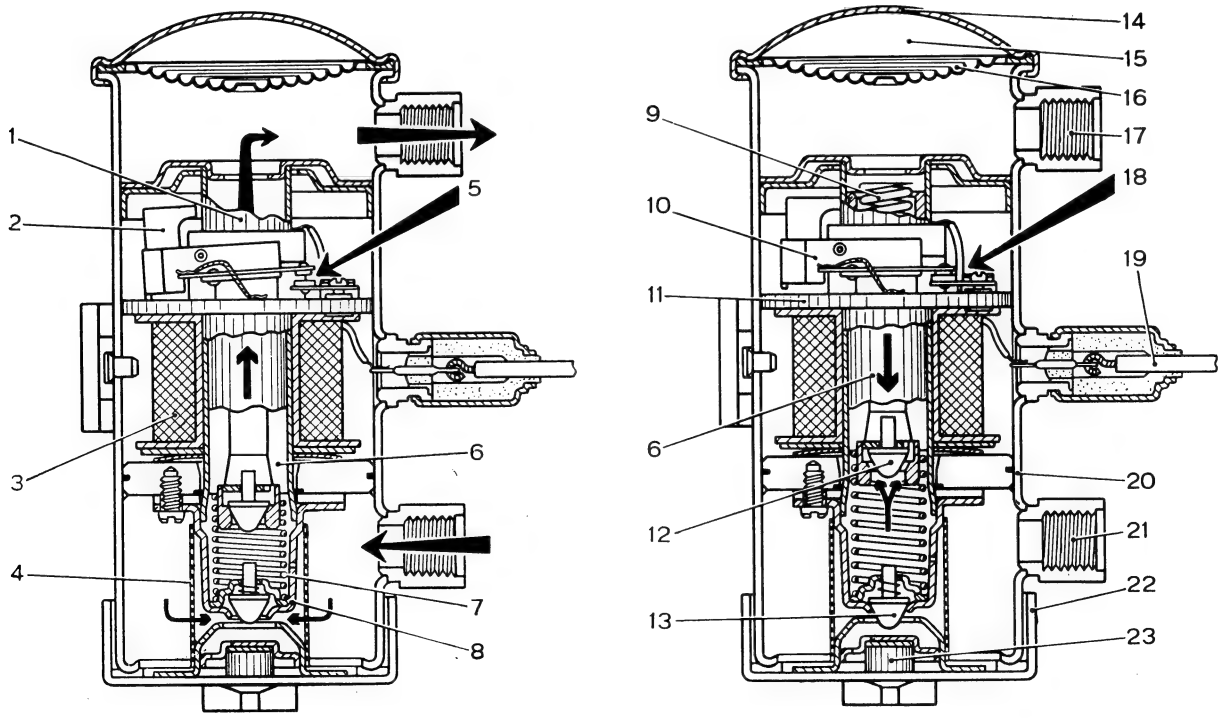


Fig. 102. - Electric fuel pump diagram.

1. Tube - 2. Magnet - 3. Coil - 4. Strainer - 5. Contacts (open) - 6. Plunger - 7. Plunger spring - 8. Valve carrier casing - 9. Damper spring - 10. Breaker arm - 11. Breaker base - 12. Fuel lift valve - 13. Fuel inlet valve - 14. Cover - 15. Air chamber - 16. Diaphragm - 17. Delivery connection - 18. Contacts (closed) - 19. Current lead - 20. Pump body - 21. Inlet connection - 22. Cover - 23. Magnet.

At this point the load of the spring (7) takes over, pushes the plunger upwards and the cycle is repeated.

The reciprocating stroke of the plunger as described above causes a pumping action on fuel as follows:

When plunger is pushed upwards by the spring (7) it exerts both a compression and a suction action. In the upstroke the **lift valve** (12) in plunger (6) is closed while, instead, the inlet valve (13) in the casing (8) is open so that the fuel above the lift valve is forced up and sent to carburetor through the pump pressure chamber. At the same time fuel is sucked into the chamber (8) below plunger through an open inlet valve (13).

In its downstroke the plunger (6) compresses the fuel below it but being the inlet valve (13) closed the fluid passes into the chamber (8) above plunger through the lift valve (12).

In other words:

— in the upward stroke of plunger (6) the pump draws and lifts fuel (fig. 102 - left illustration);

— in the downward stroke, the plunger (6) just displaces fuel inside the cylinder (fig. 102 - right illustration).

During its flow through the pump the fuel is filtered twice since it passes first through a plastic gauze strainer (4), arranged in the suction space between valve carrier casing (8) and magnet (23) seat and then in a gapped passage between magnet (23) seat and inlet valve (13) where the magnet field traps any ferrous particles still present in fuel.

The « air chamber » diaphragm (16) located in pump upper space forms, with the air contained in the space, a kind of air cushion which contributes to regularity and steadiness of fuel delivery.

Should the generator current rise to dangerous levels, the coil winding is protected by the jumper resistor connected across terminal and ground.

Pump Installation.

The pump must be mounted vertically with fixed cover uppermost, and must be securely grounded.

The pump is provided with a welded bracket with holes for the mounting screws.

Maintenance.

Maintenance is limited to the mechanical parts of the pump involving cleaning, delivery and suction of fuel.

For this purpose, the pump bottom can be removed using a 17 mm opening wrench. During this operation care must be taken not to damage the seal gasket between bottom and body. The gauze strainer is accessible after removal of pump bottom.

The latter and the strainer must be washed in gasoline. Also the magnet support must be cleaned to remove any metal particles stuck thereon.

To disassemble the mechanical components undo the three valve carrier casing mounting screws and remove the casing, the inlet valve with cup, the plunger spring and the plunger.

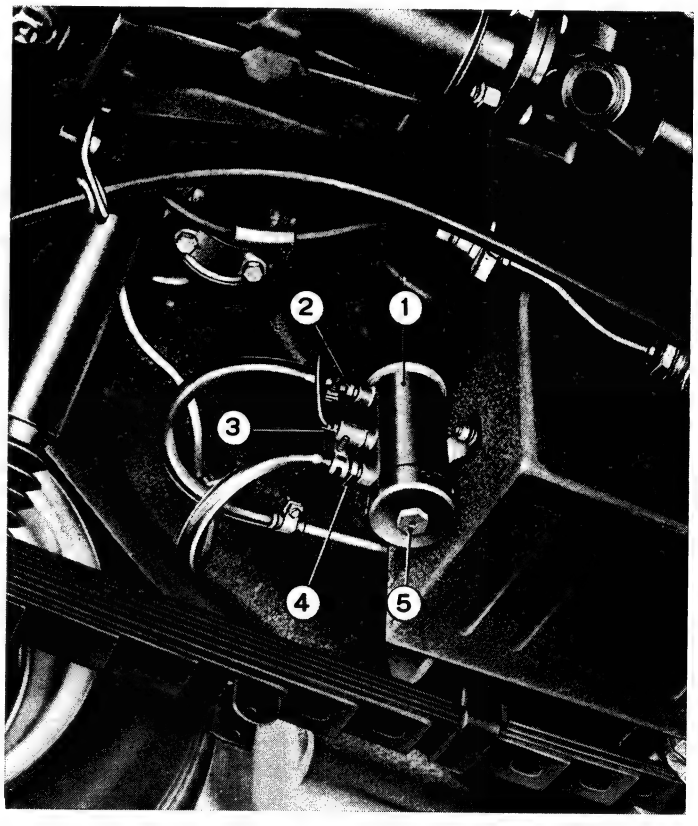


Fig. 103. - Electric fuel pump.

1. Pump assembly - 2. Fuel delivery connection - 3. Electric connection - 4. Fuel inlet connection - 5. Bottom cover nut.

The plunger components (lift valve and damper spring) cannot be disassembled.

The parts that can be disassembled are supplied as spares for service.

Bench Testing Range of Engine

A rebuilt engine should be submitted to an appropriate testing range on bench rig. When doing so, comply with data tabulated hereafter:

BENCH TESTING RANGE OF ENGINES 115 C.005 AND 118 B.000

Test Speed Rate r.p.m.	Time in Minutes	Brake Load
500	15	no load
2000	15	half load
2000	5	full load
Total minutes 35		

NOTE - When bench testing a rebuilt engine avoid racing it to top speed limits but strictly hold to the data given in the chart. Engine break-in will be completed by the Owner, who is bound not to drive the car beyond the speed rates specified for the initial use.

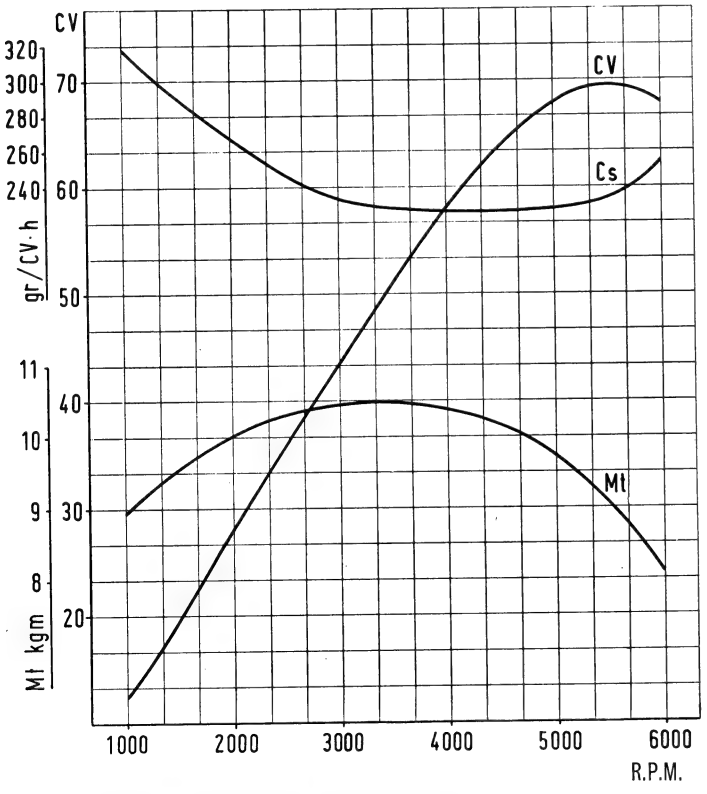


Fig. 104. - Horsepower consumption and torque curves of engine 115 C.005.

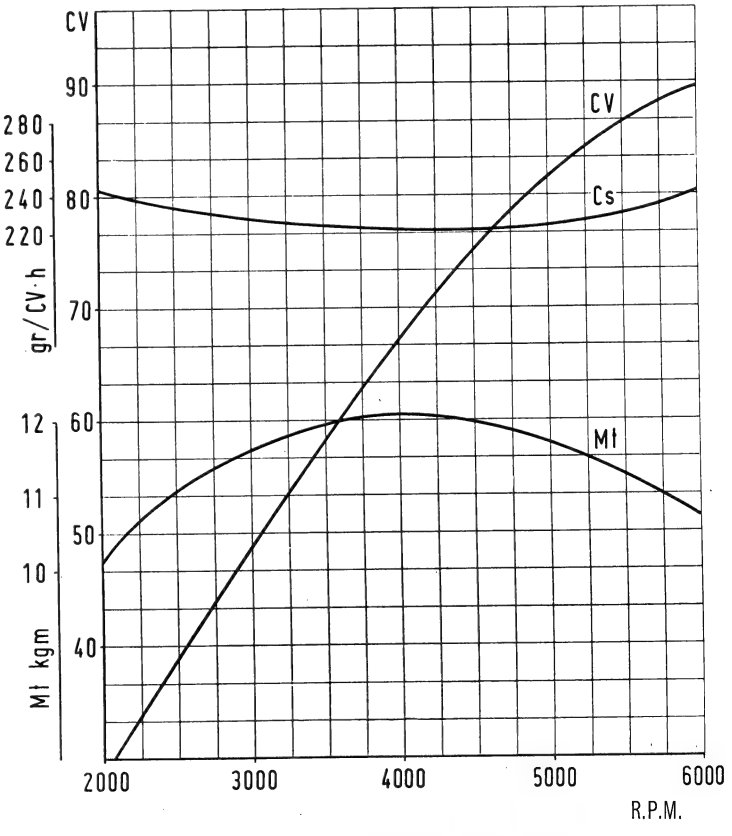


Fig. 105. - Horsepower consumption and torque curves of engine 118 B.000.

Horsepower curves are minimum specifications for a thoroughly run-in engine with air cleaner, without muffler and electromagnetic fan drive.
Mt = Torque - CV = H.P. - CS = Fuel consumption.

Clutch

The clutch is of the single plate, spring-cushioned hub type with damper rings, working dry through annular friction linings.

FIAT 1500 Cabriolet features a **mechanical** clutch control: driven plate lining O.D. $7\,^{7}/_{8}''$ (200 mm).

FIAT 1600 S Cabriolet features a **hydraulic** clutch control: driven plate lining O.D. $8\,^{1}/_{2}''$ (216 mm).

ADJUSTING CLUTCH PEDAL TRAVEL

Under normal operating conditions, the clutch pedal should develop a free travel of approximately 23/32″ to 7/8″ (18 to 22 mm) before acting on release levers.

This travel corresponds to a clearance of abt. **.0787″ (2 mm)** between thrust bearing and release lever tips (see figs. 109 and 111).

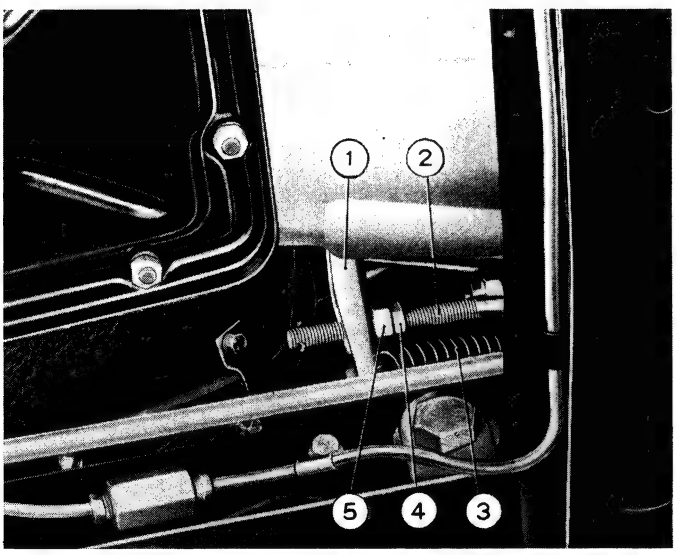


Fig. 106. - Detail of clutch throwout lever (1500 Cabriolet).

1. Yoke lever - 2. Push rod - 3. Yoke lever return spring - 4-5. Clutch pedal free travel adjusting counternut and nut.

Should this free travel be reduced or annulled on account of lining wear, the clutch would be liable to slip. If so, restore correct pedal play by working on the adjusting nut (5, fig. 106) of yoke lever push rod (2); then lock the nut (5) through the counternut (4).

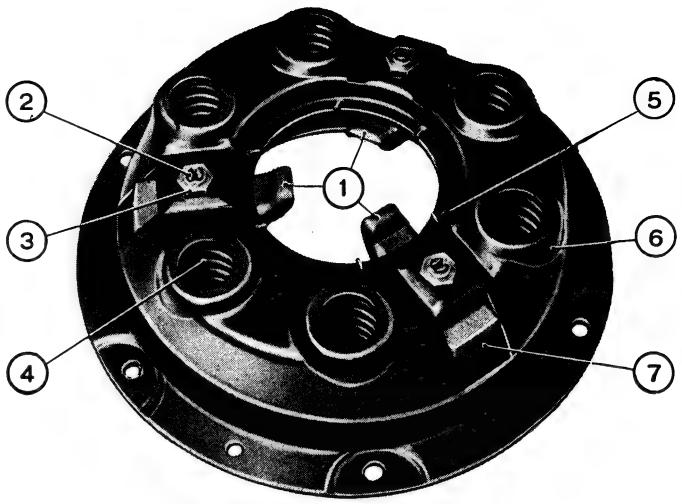


Fig. 107. - Clutch assembly.

1. Release levers - 2. Eyebolt - 3. Eyebolt nut - 4. Pressure spring - 5. Lever spring retainer - 6. Clutch cover - 7. Pressure plate.

ADJUSTING CLUTCH RELEASE LEVERS

If the clutch assembly has been dismantled and the overhaul of all parts has been made, including pressure spring test as per data tabulated on page 77, the release lever height should be adjusted, on assembly, as follows.

Secure the clutch cover to a rest face and place a dummy disk having a thickness of

.3386″ to .3406″ (8.60 to 8.65 mm) for 1500,

.3032″ to .3043″ (7.70 to 7.73 mm) for 1600 S,

between the pressure plate and the rest face. Adjust the three release levers for the lever inner edge to be

$1.7638'' \pm .0197''$ (44.8 ± 0.5 mm) for 1500,

$1.7323'' \pm .0197''$ (44 ± 0.5 mm) for 1600 S,

apart from the rest face.

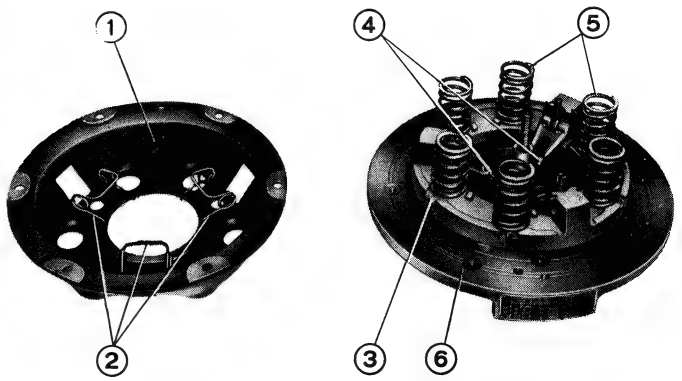


Fig. 108. - Dismantling clutch assembly.

1. Clutch cover - 2. Release lever spring retainers - 3. Pressure plate - 4. Release levers - 5. Pressure springs - 6. Tool A. 70015.

CLUTCH ASSEMBLY

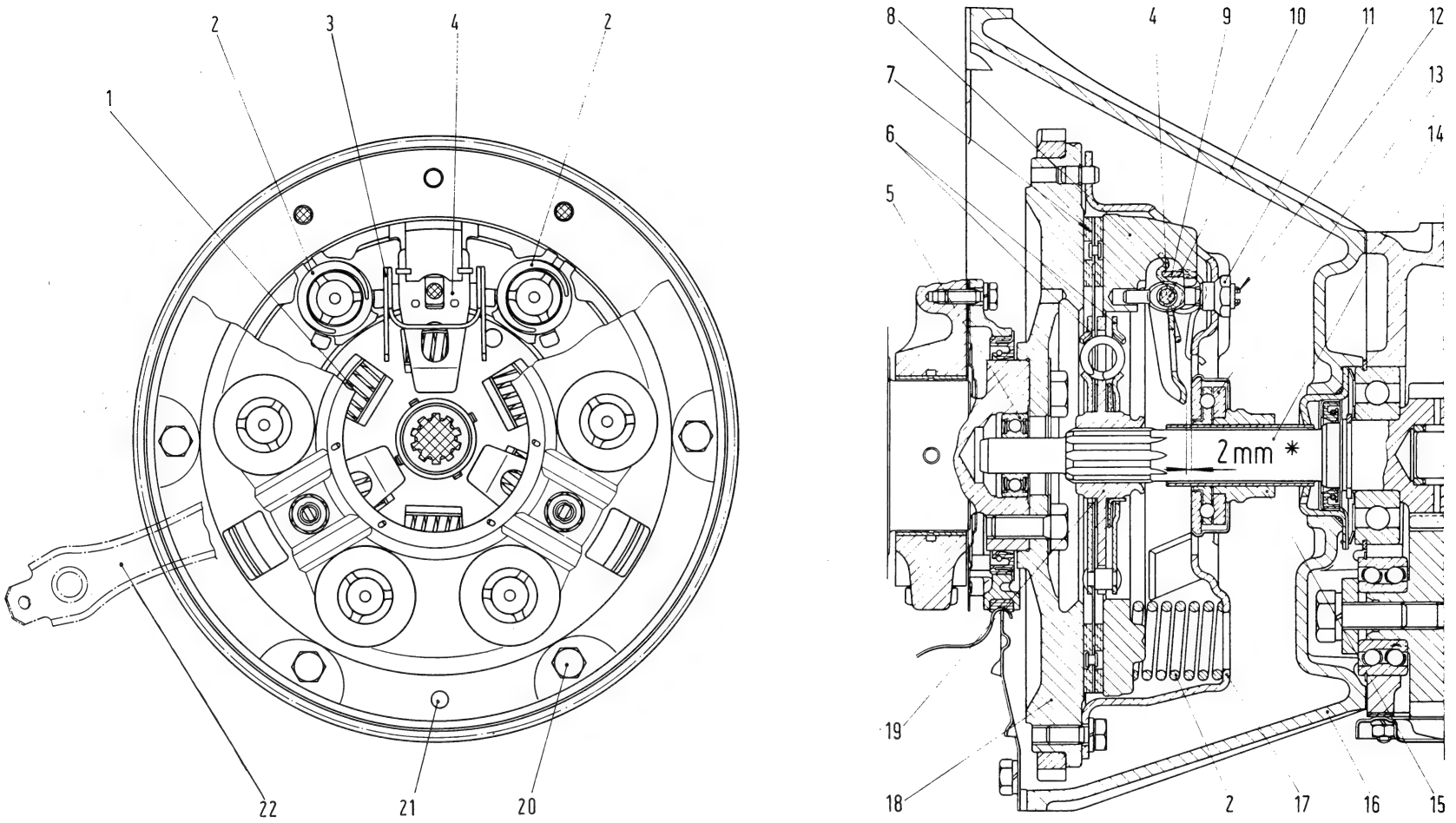


Fig. 109. - Clutch assembly: part sectional view across clutch cover and side section view.

1. Driven plate damper ring spring - 2. Pressure springs - 3. Release lever spring retainers - 4. Release levers - 5. Clutch shaft bushing - 6. Driven plate flanges - 7. Driven plate with linings - 8. Pressure plate - 9. Fulcrum - 10. Release lever pin - 11. Eyebolt nut - 12. Eyebolt - 13. Throwout bearing - 14. Clutch or direct drive shaft - 15. Slip sleeve - 16. Bell housing - 17. Clutch cover - 18. Flywheel - 19. Driven plate hub - 20. Clutch cover-to-flywheel screws - 21. Clutch cover dowel pins - 22. Throwout yoke lever.

* 2 mm = .0787″ value to be obtained through throwout yoke lever push rod setting.

The tips of three release levers should be level within .0039″ (0.1 mm) after they have reached a set-up condition.

On assembling clutch, lubricate the following parts with KG 15 grease:

— pressure plate: outer faces of release lever bosses;

— release lever fulcrums: contact face;

— release lever pin: whole length;

— clutch cover: eyebolt nut seats;

— release lever eyebolts: plain stem faces.

NOTE - Adjustment of release levers can be also made on tool A. 70015, if available (see fig. 110): clearance between lever tips and center lobes of tool should be .0039″ (0.10 mm).

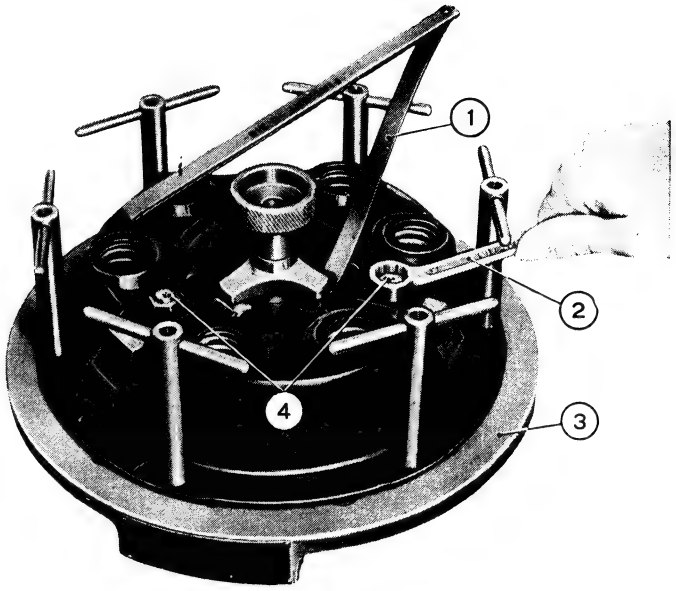


Fig. 110. - Adjusting height of clutch release levers on tool A. 70015.

1. Feeler gauge - 2. « T » wrench - 3. Tool A. 70015 - 4. Eyebolt nuts.

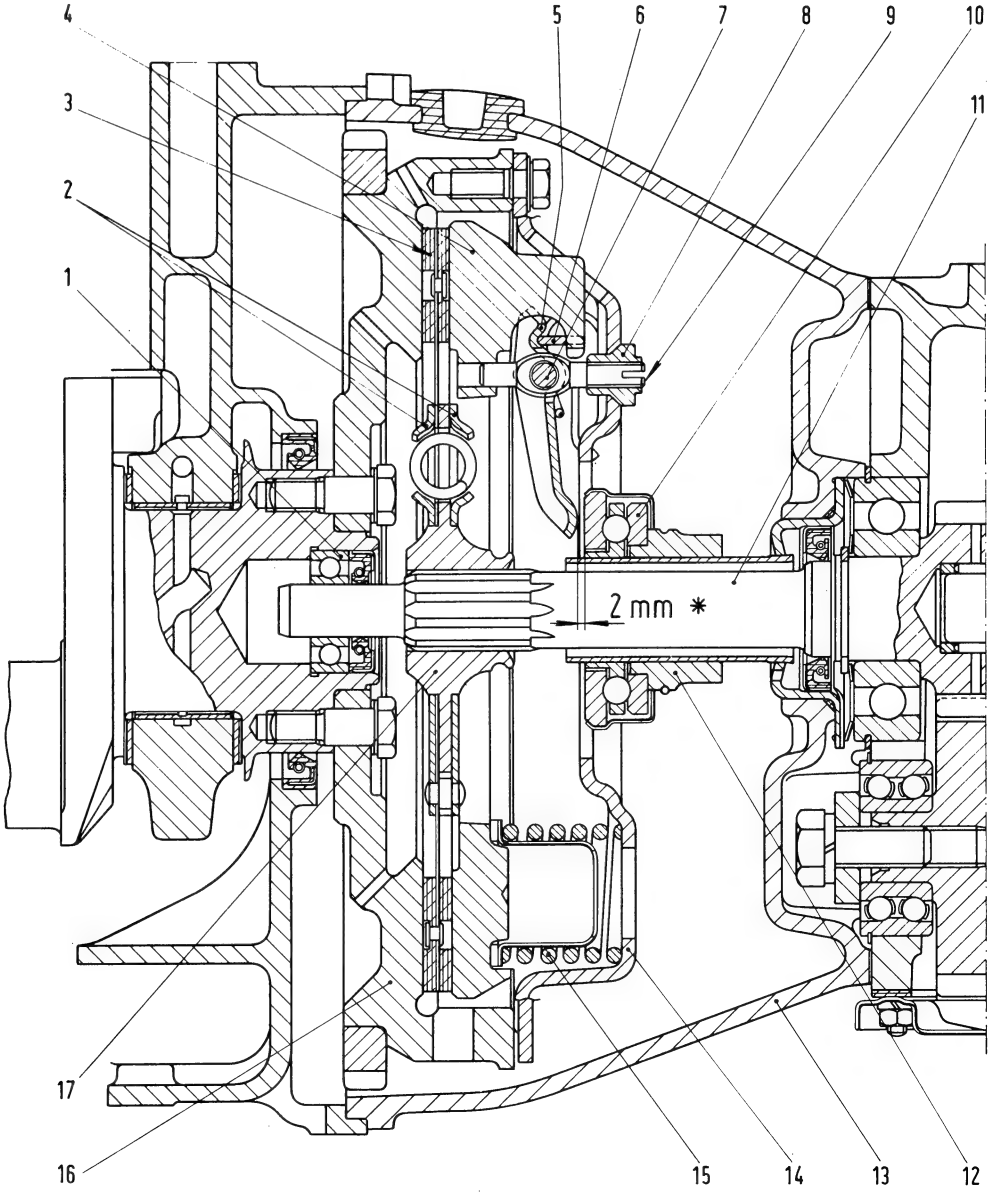


Fig. 111. - Side sectional view of 1600 S Cabriolet clutch assembly.

1. Front ball bearing, clutch shaft - 2. Driven plate flanges - 3. Driven plate linings - 4. Pressure plate - 5. Release levers - 6. Fulcrums - 7. Release lever pin - 8. Eyebolt nut - 9. Eyebolt - 10. Throwout bearing - 11. Clutch shaft - 12. Throwout sleeve - 13. Bell housing - 14. Clutch cover - 15. Pressure springs - 16. Flywheel - 17. Driven plate hub.

2 mm = .0787″

HYDRAULIC CONTROL (1600 S Cabriolet).

DESCRIPTION

The clutch hydraulic control consists of a pedal-operated master cylinder which receives fluid from a reservoir in engine compartment and forces it to an actuating cylinder on crankcase lower end.

The actuating cylinder push rod is connected directly to the clutch throwout lever. The push rod is threaded at one end and carries a nut and a lock nut screwed on, the rotation of which enables adjustment of pedal free travel.

The hydraulic clutch circuit is entirely independent of brake circuit.

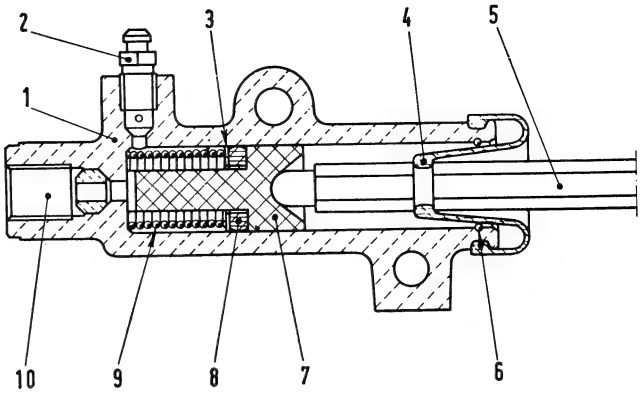


Fig. 112. - Clutch actuating cylinder (1600 S Cabriolet).

1. Cylinder body - 2. Air bleed screw - 3. Retainer - 4. Push rod and cylinder boot - 5. Threaded rod operating clutch throwout lever - 6. Snap ring - 7. Piston - 8. Seal ring - 9. Spring - 10. Fluid inlet hose connection port.

OPERATION

The hydraulic clutch circuit contains a « FIAT special brake fluid (Blue Label) » (.30 Imp. pts - .36 U.S. pts - 0.170 lt); fluid level in reservoir should always be within « MAX » and « MIN » marks.

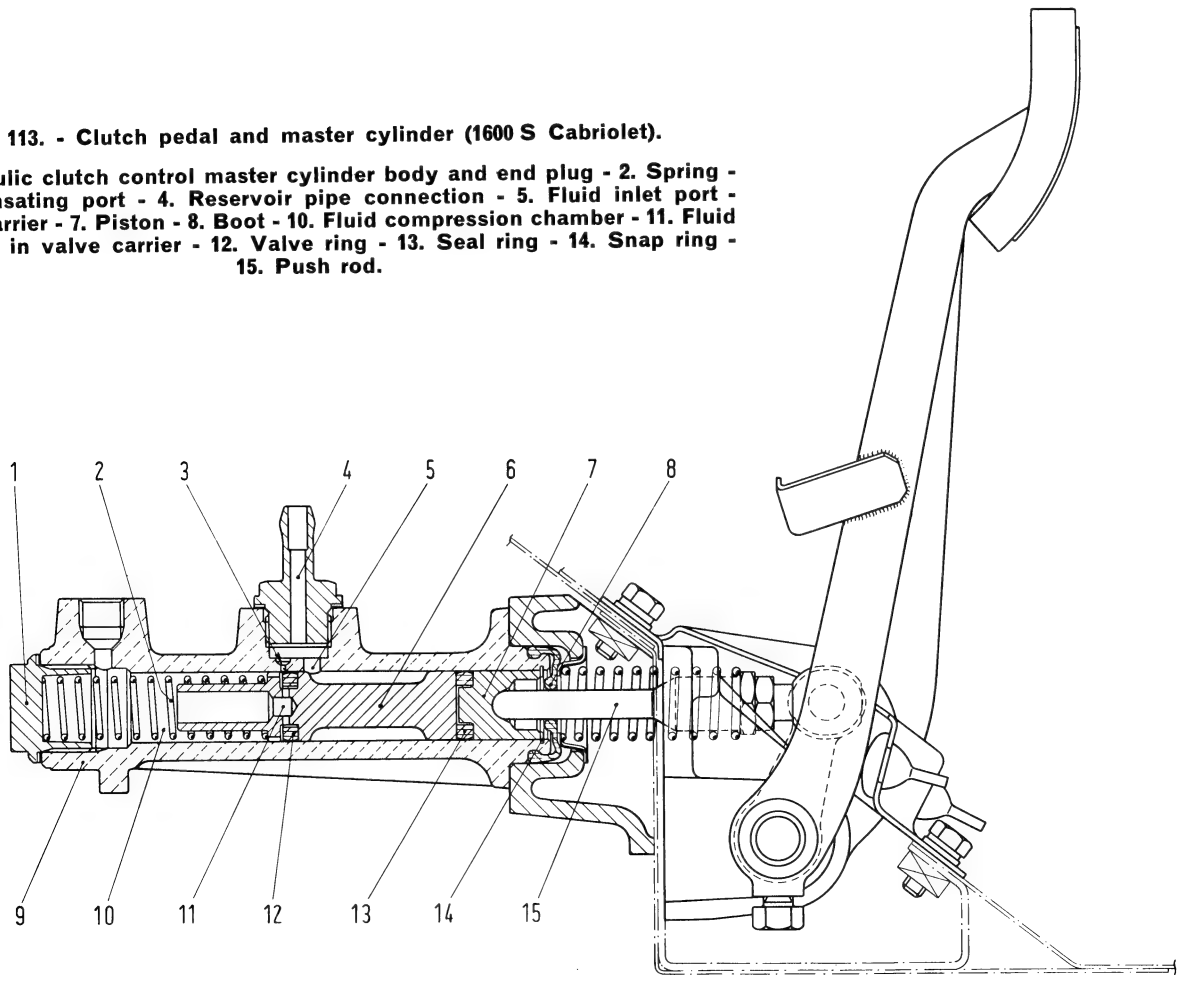
Access to the master cylinder reservoir can be gained from engine compartment.

Fluid flows from reservoir to master cylinder through hole (5, fig. 113) and seeps past the gap between valve carrier (6) and body; then it flows through holes (11) in valve carrier and fills the whole circuit.

When clutch pedal is operated, the push rod (15, fig. 113) presses piston (7) forward and, consequently,

Fig. 113. - Clutch pedal and master cylinder (1600 S Cabriolet).

1-9. Hydraulic clutch control master cylinder body and end plug - 2. Spring - 3. Compensating port - 4. Reservoir pipe connection - 5. Fluid inlet port - 6. Valve carrier - 7. Piston - 8. Boot - 10. Fluid compression chamber - 11. Fluid flow holes in valve carrier - 12. Valve ring - 13. Seal ring - 14. Snap ring - 15. Push rod.



valve carrier (6); as a result, valve ring (12) exerts its pressure against the front face of valve carrier, shutting off the passage to the annular chamber of valve carrier. Continuing in its forward movement, valve ring (12) passes over compensating port (3), and cuts off any communication with the fluid reservoir.

Compression of fluid begins from this instant. By acting on front and inner faces of valve, compression warrants perfect valve sealing even under high operation pressures.

Pressure reaching fluid in actuating cylinder (1, fig. 112) pushes piston (7) and displaces rod (5) thus actuating the clutch throwout lever.

In actuating cylinder (1, fig. 112) seal ring (8), also when at rest, is axially compressed by cup (3) under the action of spring (9). The seal ring (8) is under the radial and axial action of hydraulic pressure so that sealing ability is improved as pressure increases.

After the pedal is released, the combined action of clutch throwout lever spring and of master cylinder spring (2, fig. 113), sends the fluid back to master cylinder and all parts resume their original position. Free intercommunication between system and reservoir is thus restored.

WARNING - On assembly, make sure that there is a clearance of .0039″ to .0118″ (0.10 to 0.30 mm) between master cylinder plunger and pushrod.

CLUTCH SPECIFICATIONS

	1500 Cabriolet	1600 S Cabriolet
Type	Single plate, working dry	
Driven plate hub	spring - cushioned type	
Driven plate linings	moulded woven asbestos	
Lining O. D.	7 7/8″ (200 mm)	8 1/2″ (216 mm)
Lining I. D.	5 19/32″ (142 mm)	6″ (152 mm)
Pressure springs:		
Part No.	4111027	4097853
Wire diam.	.1811″ (4.6 mm)	.1890″ (4.8 mm)
O. D.	1.3228″ (33.6 mm)	1.5827″ (40.2 mm)
Free length	2.2834″ (58 mm)	2.3109″ (58.7 mm)
Seated length	1.4921″ (37.9 mm)	1.3583″ (34.5 mm)
Corresponding load	169.8 ± 8.8 lbs (77 ± 4 kg)	165.3 ± 8.3 lbs (75 ± 3.75 kg)
Minimum load	145 1/2 lbs (66 kg)	142.2 lbs (64 1/2 kg)
Pedal free travel	23/32″ to 7/8″ (18 to 22 mm)	23/32″ to 7/8″ (18 to 22 mm)
Inner tip height of release levers from driven plate flywheel face	1.7638″ ± .0197″ (44.8 ± 0.5 mm)	1.7323″ ± .0197″ (44 ± 0.5 mm)
Maximum runout of driven plate	.01″ (0.25 mm)	.01″ (0.25 mm)
Clutch control	mechanical	hydraulic
Master cylinder bore	—	3/4″
Actuating cylinder bore	—	3/4″
Hydraulic circuit capacity	—	.30 G.B. pts - .36 U.S. pts (0.17 lt)
Fluid quality	—	FIAT special fluid (blue label)

CLUTCH RELEASE HYDRAULIC CONTROL TROUBLE DIAGNOSIS AND CORRECTIONS

TROUBLES	CAUSES	REMEDIES
Slipping clutch.	Master cylinder overloaded because compensating port is clogged.	Overhaul master cylinder, replace seal if swollen or deteriorated, unclog compensating port; bleed the system.
Grabbing clutch.	Air in system because of imperfect bleeding.	Bleed correctly.
	Chips, filings or other foreign matter on the sealing surfaces of the ring-valve.	Clean, replace ring-valve if deteriorated, and bleed the system.
	Air in master cylinder because of inadequate piston seal ring tightness.	Fit a new seal ring and check that the piston land is lower than the seal ring. Bleed the system.
	Deteriorated ring-valve.	Replace the ring-valve checking master cylinder interior for absence of burrs, roughness, etc.; bleed the system.
	Fluid leakage from connections or lines.	Tighten connections, replace deteriorated or otherwise faulty parts and bleed the system.
	Fluid leakage from operating cylinder.	Replace the seal and the deteriorated packing; bleed the system.
	Low fluid level in reservoir.	Top up with recommended fluid and, if necessary, bleed the system.
	Misadjusted push rod.	Adjust clearance between rod and piston to .0039″ to .0118″ (0.10 to 0.30 mm).
	Clogged vent hole in reservoir cap promotes a vacuum in master cylinder, causing air infiltration through the seal.	Clean reservoir cap and unclog the vent hole; bleed the system.
Hard clutch pedal and delayed engagement against pedal return.	Inadequate grade of fluid.	Drain the system, flush clean, refill with the recommended fluid (FIAT special blue label); bleed the system.
	Deteriorated hose or kinked metal pipe.	Replace parts as required; bleed the system.

Transmission

Assembly.

Place adapter **Arr. 22206/9** on revolving stand **Arr. 22204** and clamp the transmission case to the adapter.

Work on bench and proceed in this order (figs 114 and 115):

— slide the third speed gear and synchromesh ring, the third and fourth hub and slip sleeve (with three shifting plates and two springs) and the lock washer onto the front end of the mainshaft; then use driver **A. 74079** and insert the snap ring in the shaft spline to lock the gear train firmly;

— slide the second speed gear and synchromesh ring, the first and second hub and slip sleeve (with three shifting plates and two springs), the first speed synchromesh ring, gear and bushing on to the rear end of the mainshaft.

NOTE - Shifting plate retaining springs should be fitted so that spring ends are not hooked up to the same plate.

Fit the mainshaft assembly into the transmission case, tilting it to get easy access.

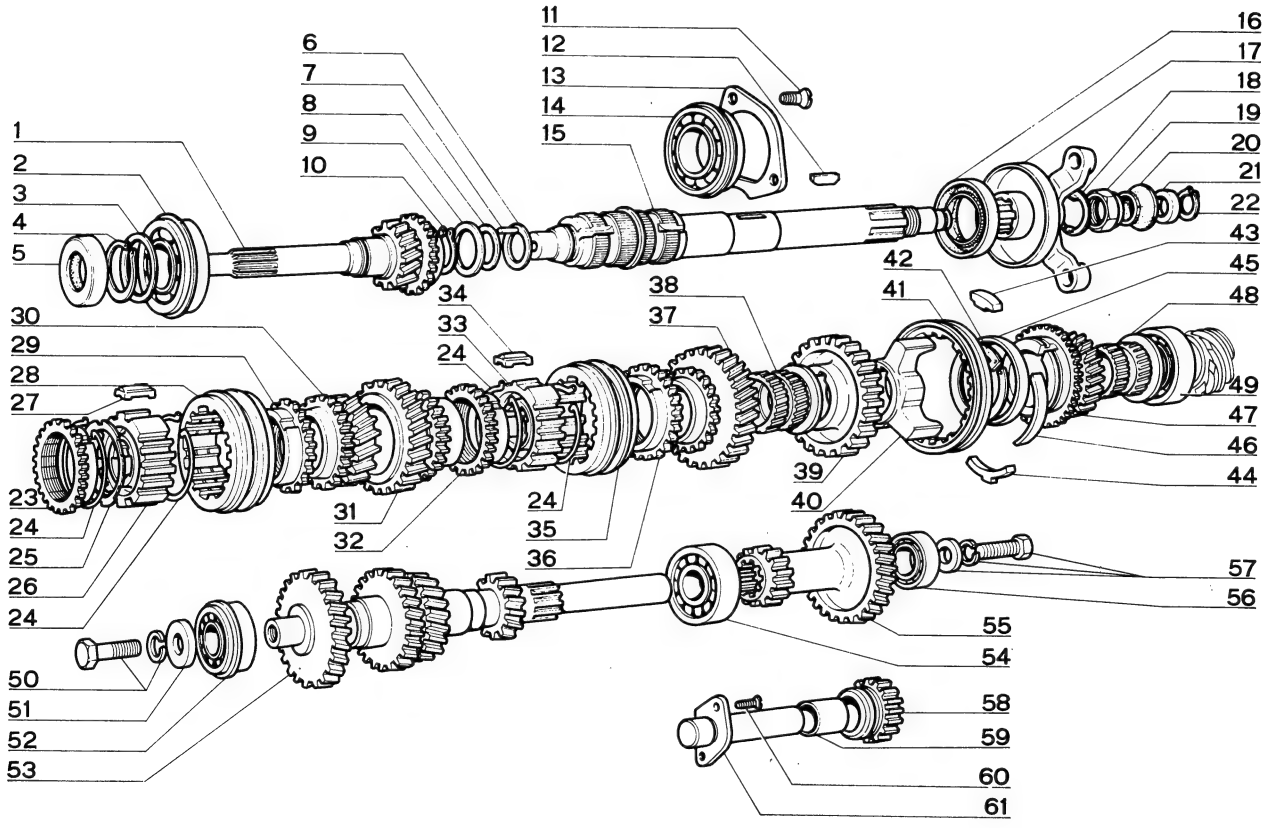


Fig. 114. - 1500 and 1600 S Cabriolet transmission components.

1. Clutch shaft - 2. Front ball bearing - 3. Lock washer - 4. Snap ring - 5. Seal - 6. Thrust ring - 7. Needle rollers - 8. Thrust ring - 9. Lock washer - 10. Snap ring - 11. Plate screws - 12. Woodruff key - 13. Bearing plate - 14. Intermediate ball bearing - 15. Mainshaft - 16. Seal - 17. Flexible joint yoke sleeve - 18. Lock washer - 19. Nut - 20. Seal ring - 21. Flexible joint dowel ring - 22. Snap ring - 23, 29, 32, 36. Third and fourth, first and second synchromesh rings - 24. Shifting plate springs - 25. Lock washer - 26. Third and fourth slip sleeve hub - 27, 34. Shifting plates - 28. Third and fourth slip sleeve - 30. Third speed gear - 31. Second speed gear - 33. First and second slip sleeve hub - 35. First and second slip sleeve - 37. First speed gear - 38. First speed gear bushing - 39. Reverse gear - 40. Overdrive slip sleeve hub - 41. Overdrive slip sleeve - 42. Snap ring - 43. Stop plate - 44. Thrust plate - 45. Overdrive synchromesh ring - 46. Spring - 47. Overdrive gear - 48. Overdrive gear bushing - 49. Rear roller bearing - 50. Bearing lock screw and washer - 51. Washer - 52. Countershaft front ball bearing - 53. Countershaft with first, second, third and constant mesh gears - 54. Center ball bearing - 55. Reverse and overdrive gear - 56. Rear ball bearing - 57. Bearing lock screw, spring washer and plain washer (*) - 58. Reverse gear - 59. Reverse gear bushing - 60. Reverse gear shaft screws - 61. Reverse gear shaft.

(*) The countershaft rear ball bearing locking design shown in figure has been adopted up to 1500 Cabriolet Chassis No. 043092 Parts serial No. 1425734, and 1600 S Cabriolet Chassis No. 042439 Parts serial No. 1427679. New locking solution is clearly illustrated in fig. 115.

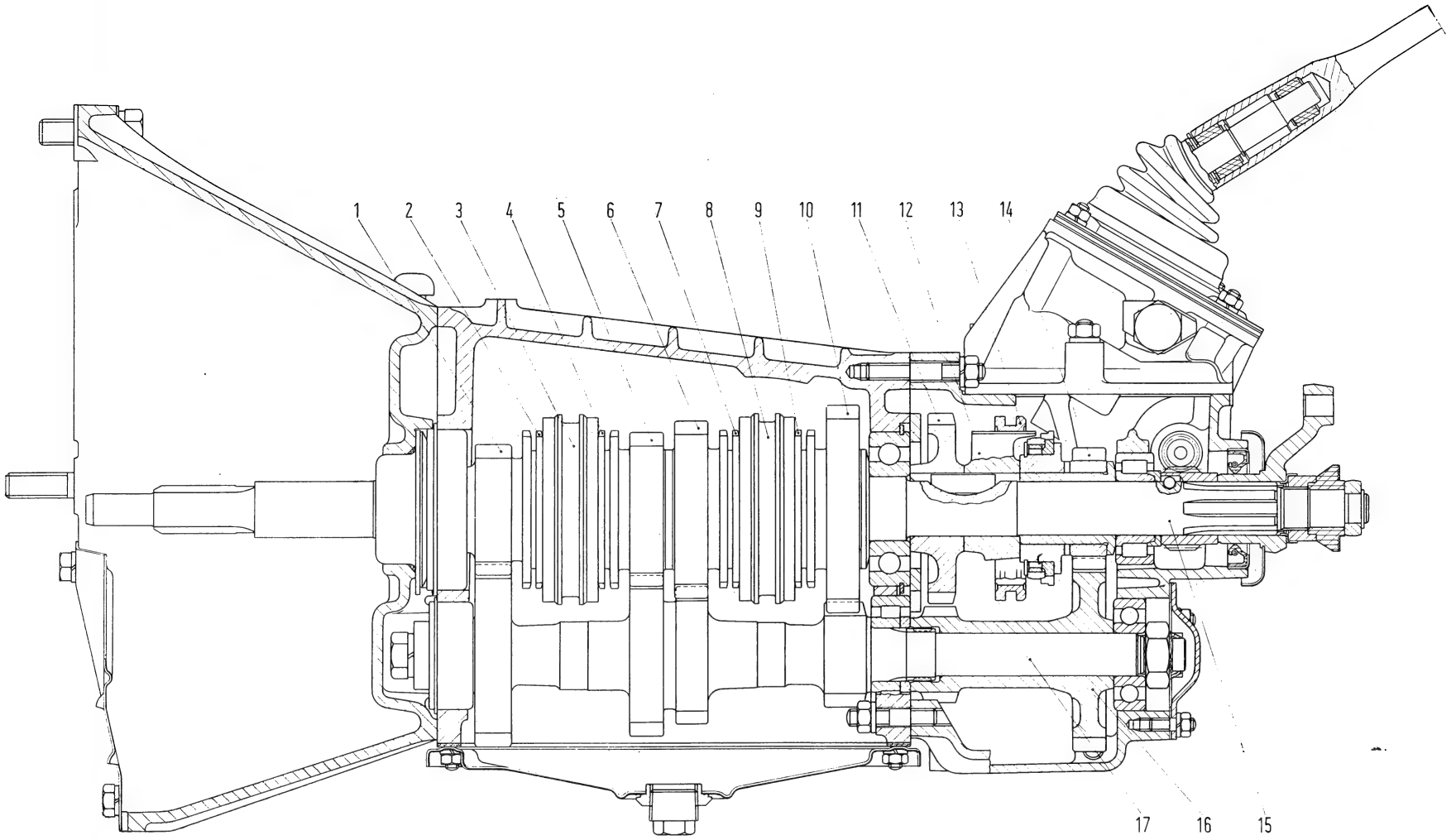
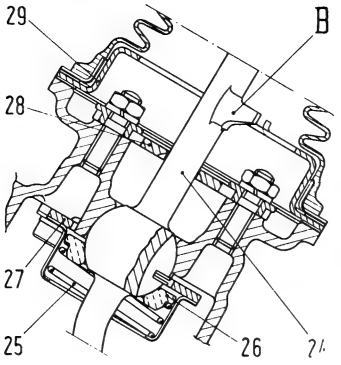


Fig. 115. - Side sectional view of 1500 Cabriolet transmission across overdrive and reverse gears. Transmission to suit 1600 S Cabriolet differs from the assembly shown here above in the maincase and bell housing design.

1. Clutch shaft with constant mesh and fourth speed gears - 2. Synchromesh ring - 3. Third and fourth slip sleeve - 4. Synchromesh ring - 5. Third speed gear - 6. Second speed gear - 7. Synchromesh ring - 8. First and second slip sleeve - 9. Synchromesh ring - 10. First speed gear - 11. Reverse gear - 12. Hub - 13. Overdrive slip sleeve - 14. Overdrive gear with synchromesh ring - 15. Mainshaft - 16. Overdrive and reverse gear train - 17. Countershaft - 18. Reverse shaft - 19. Reverse sliding gear - 20. Overdrive and reverse shifter shaft - 21. Third and fourth shifter shaft - 22. First and second shifter shaft - 23. Overdrive and reverse shifter fork - 24. Gearshift lever fulcrum pin - 25. Reverse stiffening spring - 26. Fulcrum pin ball socket - 27. Fulcrum pin positioning plate - 28, 30. Fulcrum pin guide plate - 29. Overdrive and reverse control safety plate - 31. First, second, overdrive and reverse stiffening spring spindle.

A. Fulcrum pin dog - B. Reverse safety plate.

NOTE - The countershaft rear bearing locking solution by nut, as shown in figure, has been adopted starting from 1500 Cabriolet Chassis No. 043093 Parts serial No. 1425735, and 1600 S Cabriolet Chassis No. 042440 Parts serial No. 1427680.



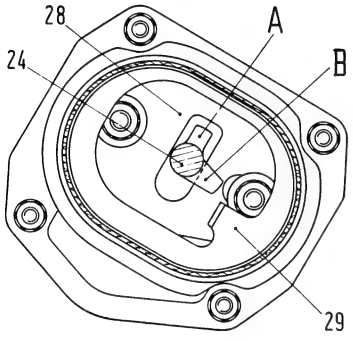


Fig. 116. - Sectional views of gearshift lever support.

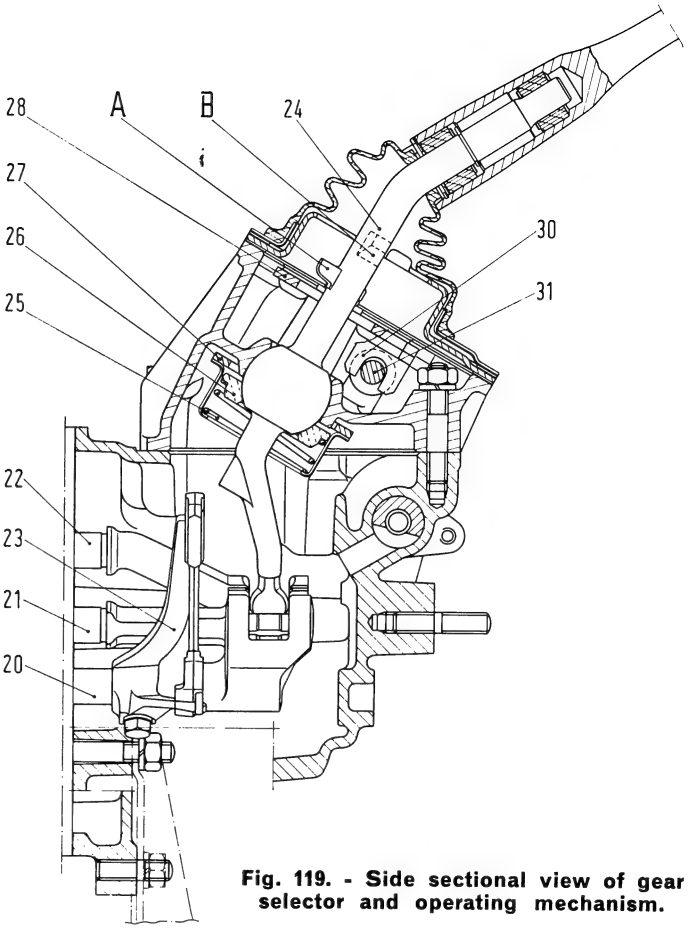


Fig. 119. - Side sectional view of gear selector and operating mechanism.

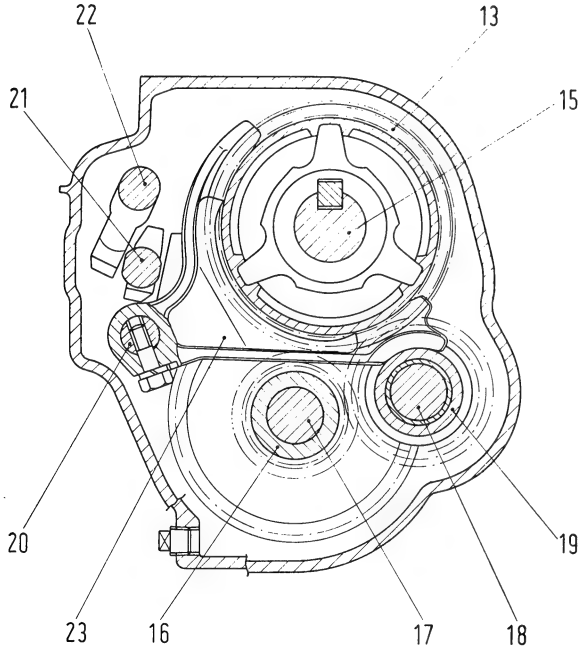


Fig. 117. - End sectional view of overdrive control.

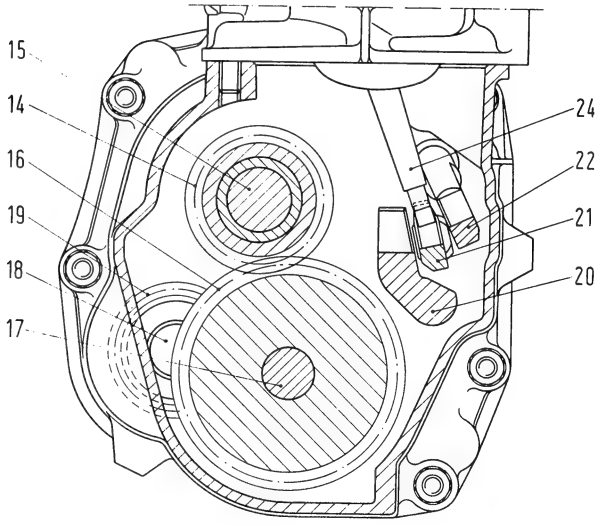


Fig. 120.

End sectional view of overdrive gear train.

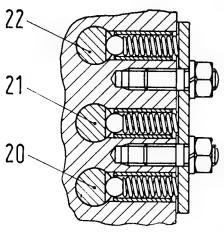


Fig. 118. - Sectional view of shifter shaft detent balls.

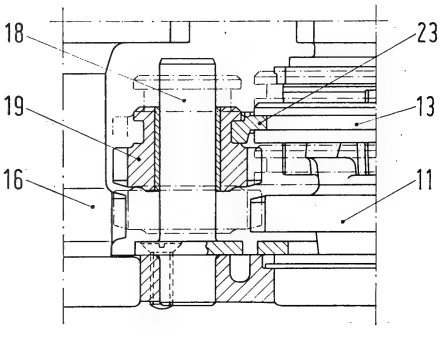


Fig. 121.

View and developed section of reverse gears.

Thread in the intermediate ball bearing from the rear end of mainshaft and, using a driver, tap it into transmission case bore; secure the bearing plate and stake locking screws.

Slide the reverse idler gear shaft into seat in transmission case and secure the bearing flange to the case rigidly with the shaft.

Working on bench, install the ball bearing and lock washer on clutch shaft, then, using driver **A. 74079**, insert the bearing snap ring in the shaft spline.

Fit the clutch shaft inner thrust ring (8, fig. 114) in the shaft groove, position the twenty-three needle rollers (7) for mainshaft end bearing and insert the outer thrust ring (6).

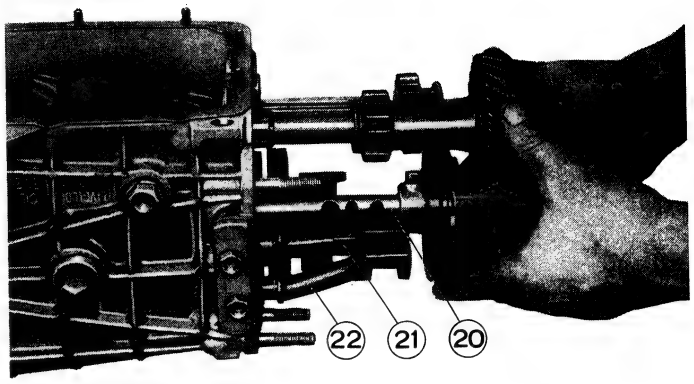


Fig. 122. - Assembling transmission.

20. Overdrive and reverse shifter shaft - 21. Third and fourth shifter shaft - 22. First and second shifter shaft.

NOTE - Hold needle rollers by coating their seat with thick grease. So the risk will be avoided that any of them may fall down when being fitted on mainshaft end.

Thread the clutch shaft through the transmission case bore and fit it on to mainshaft end, with the fourth synchromesh ring in between.

Position the first and second shifter fork on slip sleeve, then from the outside start the shifter shaft into the fork.

Slide in the shifter shaft safety roller; secure the shifter fork to the shaft by means of a screw and lock plate and bend down the plate tabs.

Position the third and fourth shifter fork on slip sleeve; slide in the shifter shaft while engaging the fork and place the shaft safety roller into seat. Locking the shifter fork to the shaft should be postponed inasmuch as further assembly procedure involves the simultaneous engagement of two gears to prevent shaft rotation.

Fit the countershaft, which incorporates first second third and constant mesh gear train, in place in the maincase.

Hold the shafts stationary by engaging two gears at the same time. Fit the plain and spring washer and, using a torque wrench, draw up the countershaft front double-race ball bearing screw with 68.7 ft.lbs (9.5 kgm) of torque.

Place the Woodruff key into the proper groove on mainshaft and slide in the reverse driven gear (11, fig. 115) and the overdrive slip sleeve hub (12).

On the main, counter and reverse shaft, install at the same time (figs. 122 and 124): the slip sleeve and the overdrive gear with its synchromesh ring and bushing, the reverse and overdrive driving gear

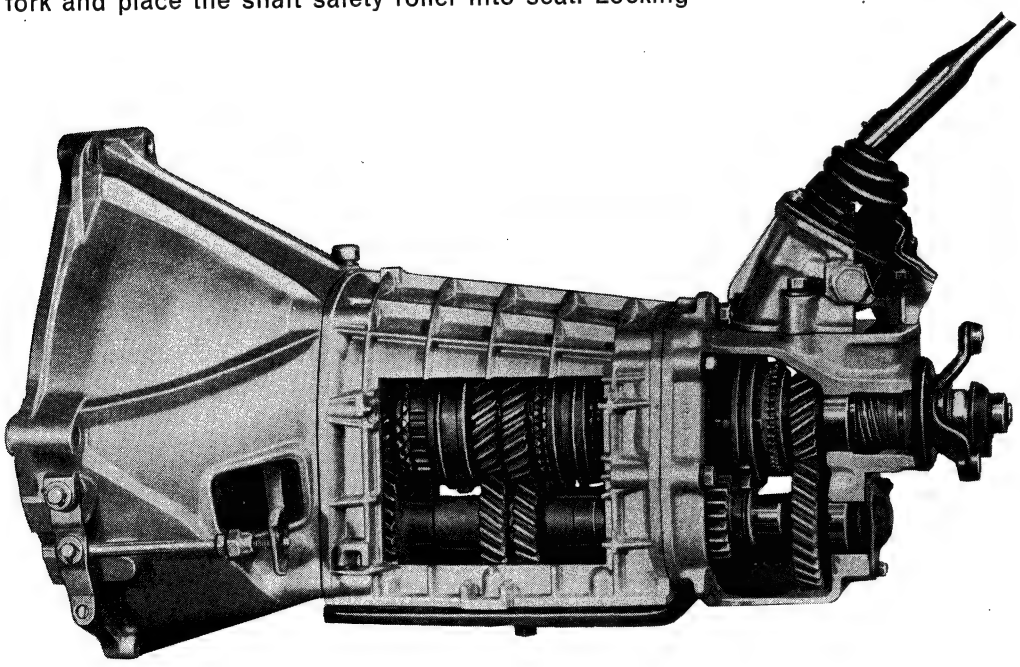


Fig. 123.

Cutaway view of transmission left hand side.

train, the overdrive and reverse shifter fork and the reverse sliding gear.

Fit the overdrive and reverse shifter shaft safety roller into place in maincase, then slide in the shifter shaft and tie the fork thereto.

Install the mainshaft rear roller bearing and the speedo drive gear with drive ball.

Install the rear ball bearing on mainshaft and draw up the lock nut with 86.8 to 101.3 ft.lbs (12 to 14 kgm) of torque; then stake the nut collar.

NOTE - Some five-speed transmissions of early production were designed with the mainshaft rear ball bearing lock by a screw (57, fig. 114) having a torque specification of 68.7 ft.lbs (9.5 kgm).

This solution was adopted up to:

- **1500 Cabriolet Chassis No. 042092 Parts Serial No. 1425734;**
- **1600 S Cabriolet Chassis No. 042439 Parts Serial No. 1427679.**

Fit the spring-type oil seal on extension housing and attach the extension to the maincase with the gasket in between.

Install and secure the back cover and gasket at countershaft.

Install and secure the speedo drive support and gasket on extension housing.

Thread the flexible joint yoke sleeve and lock washer on to mainshaft end; engage two gears simultaneously so to hold the mainshaft firmly and, using a torque wrench, draw up the yoke flange nut with 57.9 ft. lbs (8 kgm) of torque; bend up the washer tabs on nut.

Slide the seal ring on mainshaft, then, with the aid

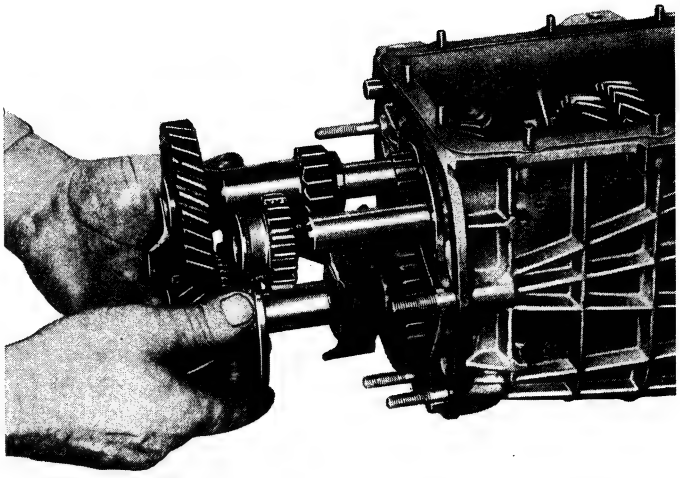


Fig. 124. - Installing overdrive and reverse gears.

of a driver, install the flexible joint dowel ring and insert the snap ring in the proper groove; use of roundnose pliers **A. 81101** will be of assistance in this step.

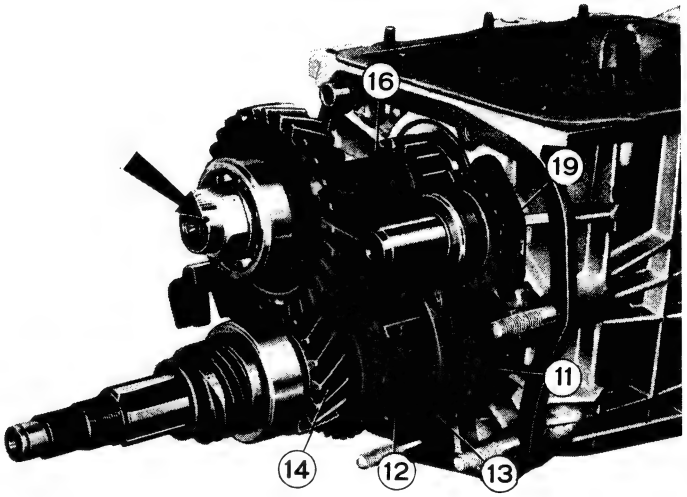


Fig. 125. - Overdrive and reverse gears in place on transmission.

11. Reverse gear - 12, 13. Overdrive slip sleeve and hub - 14. Overdrive gear and synchromesh ring - 16. Reverse and overdrive gear train - 19. Reverse sliding gear.

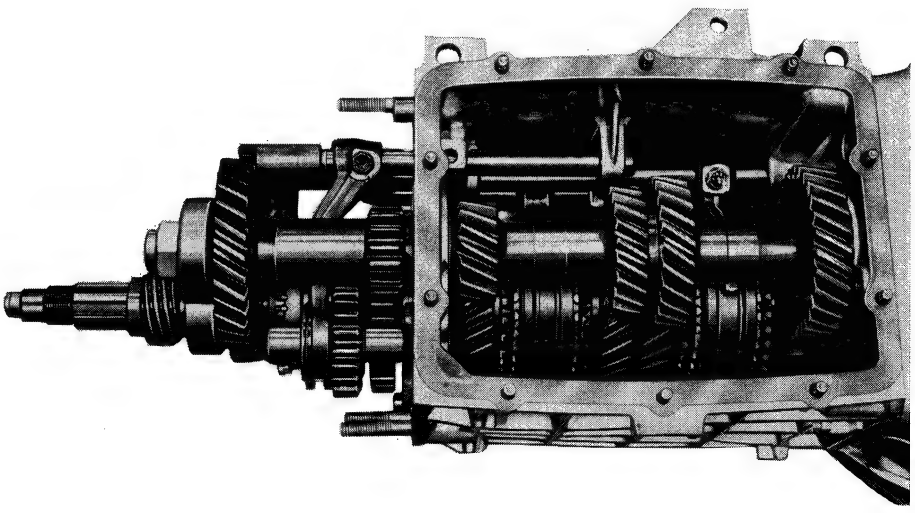


Fig. 126.

Capsized transmission without lower cover and extension.

Turn to the work bench and, using a driver, tap the spring-type oil seal in place in front cover at clutch shaft; then fit the front cover to the bell housing with the oil seal ring in between.

Fit the cover spring washer on clutch shaft and fit and secure the bell housing to the transmission case, after setting the housing gasket.

Secure the third and fourth shifter fork to the shaft by means of a screw and lock plate, the tabs of which are bent down on screw head.

Slide three shifter shaft detent balls and springs into seats in maincase (the reverse and overdrive ball spring is different from remaining two); fit and secure the spring cover with gasket.

Fit the lower cover and gasket and secure to the maincase; screw in the oil drain plug securely.

Attach the cross member for rear power plant mounting at extension studs.

Install the clutch throwont bearing sleeve and thrust bearing on center cover at clutch shaft; thread in the throwout yoke lever.

Remove the transmission assembly from service stand; pour in the lube oil which should be the FIAT W 90 M type (SAE 90 EP grade). Transmission capacity: 1.4 G.B. qts - 1.7 U.S. qts (1.6 lt).

Fill up to the filler hole brim as shown by a mark cast on maincase; tighten down the filler plug.

Fit and secure the gear control housing assy, to the transmission extension.

ASSEMBLING GEARSHIFT MECHANISM

Slide the overdrive and reverse stiffening spring (8, fig. 127) in place in housing (9), setting end cups (6 and 17).

Insert the spring spindle (27) and, using a proper tool, drive it in compressing the spring (8) to such an extent as the guide plate (16) can be fitted with its end fork engaging the spindle over the cup (17).

Fit and lock both spacers (5) on studs (1).

Thread the first and second stiffening spring (18) on to the spindle (27) and screw in the plug (25) with lock plate (26).

From the underside of housing, slide in the lever fulcrum pin (28) and place the lever positioning plate (11), the ball socket (12) and reverse stiffening spring (13).

Fit and secure the spring cover (14).

On top side, install the overdrive and reverse control safety plate (3) with gasket (4).

Fit and secure the boot (2).

NOTE - The fitting of the gearshift lever must be made after the transmission has been installed on car.

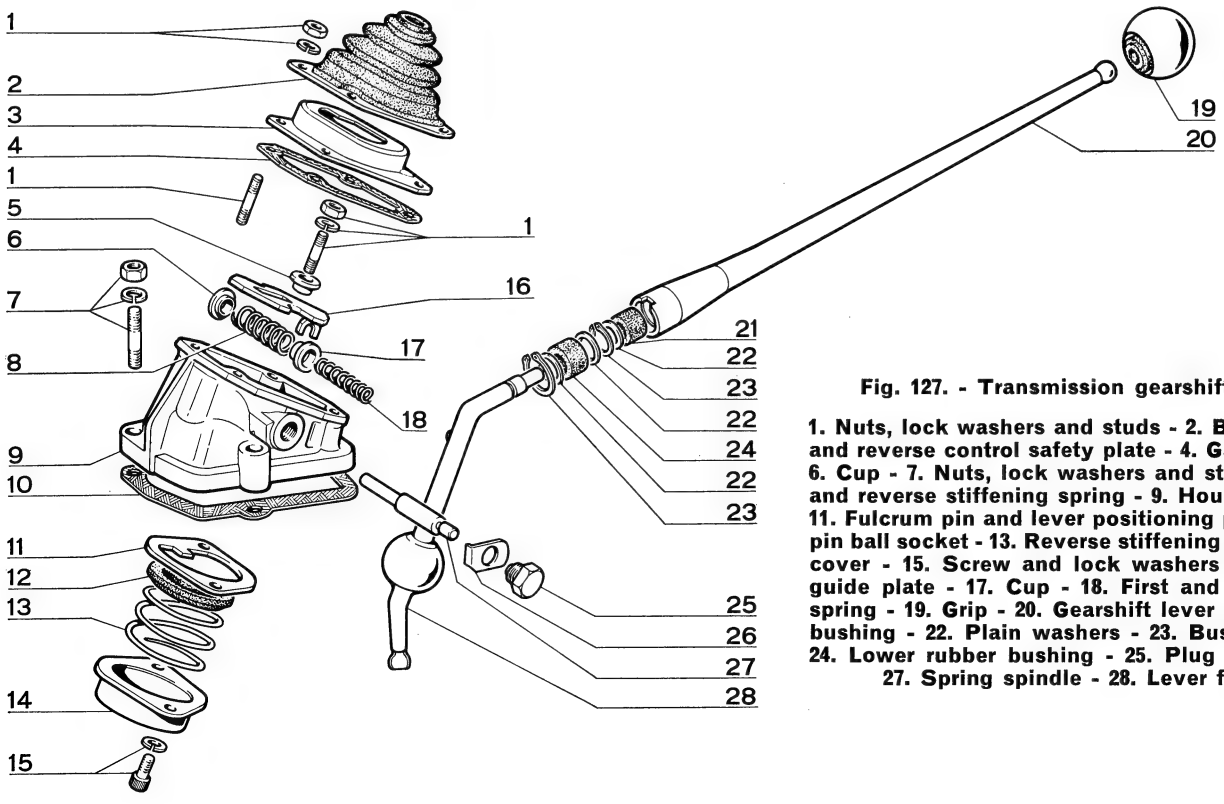


Fig. 127. - Transmission gearshift mechanism.

1. Nuts, lock washers and studs - 2. Boot - 3. Overdrive and reverse control safety plate - 4. Gasket - 5. Spacer - 6. Cup - 7. Nuts, lock washers and studs - 8. Overdrive and reverse stiffening spring - 9. Housing - 10. Gasket - 11. Fulcrum pin and lever positioning plate - 12. Fulcrum pin ball socket - 13. Reverse stiffening spring - 14. Spring cover - 15. Screw and lock washers - 16. Fulcrum pin guide plate - 17. Cup - 18. First and second stiffening spring - 19. Grip - 20. Gearshift lever - 21. Upper rubber bushing - 22. Plain washers - 23. Bushing snap rings - 24. Lower rubber bushing - 25. Plug - 26. Lock plate - 27. Spring spindle - 28. Lever fulcrum pin.

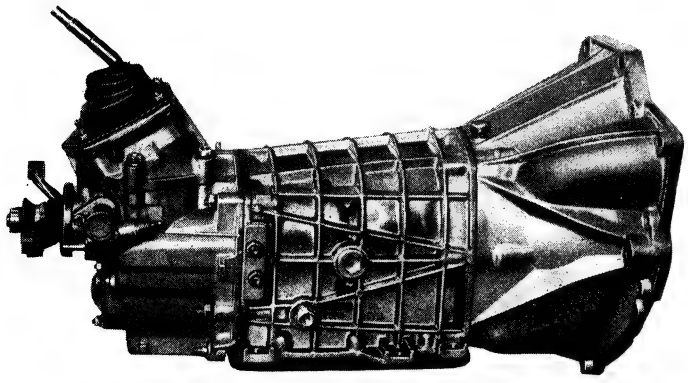


Fig. 128. - Right hand side view of 1500 Cabriolet transmission assembly.

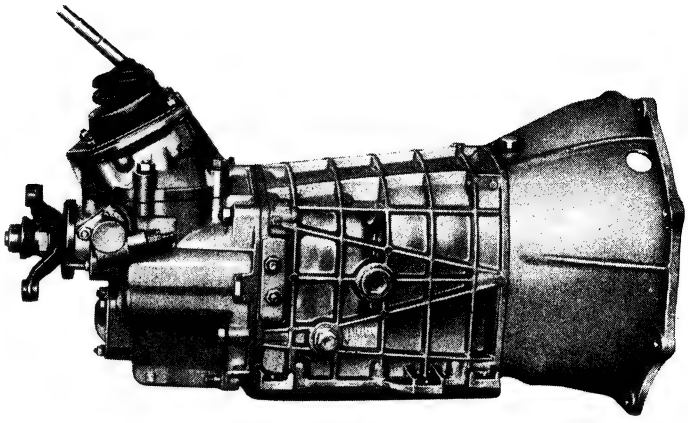


Fig. 129. - Right hand side view of 1600 S Cabriolet transmission assembly.

TRANSMISSION SPECIFICATIONS

Speeds	five forward and reverse
Synchromesh rings { free type spring type	first - second - third - fourth gears overdrive
Gear type: first, second, third, constant mesh fourth overdrive reverse	helical toothed, constant meshed spur toothed spur toothed, constant meshed spur toothed
Gear ratios: first	$\frac{28 \times 33}{19 \times 15} = 3.242$ to 1
second	$\frac{28 \times 27}{19 \times 20} = 1.989$ to 1
third	$\frac{28 \times 22}{19 \times 23} = 1.410$ to 1
fourth	= 1 to 1
overdrive	$\frac{28 \times 17}{19 \times 29} = 0.864$ to 1
reverse	$\frac{28 \times 34}{19 \times 15} = 3.340$ to 1
Gear backlash	.0039″ (0.1 mm)
Radial play of ball bearings	.0020″ (0.05 mm) max.
Axial play of ball bearings	.020″ (0.50 mm) max.
Shaft alignment (max. runout)	.0010″ (0.025 mm)
Lube oil: — grade — capacity	 FIAT W 90 M (SAE 90 EP) 1.4 G.B. qts - 1.7 U.S. qts (1.6 lt)

Propeller Shaft and Joints

Power drive to rear wheels is transmitted by means of a two-section center-supported propeller shaft (fig. 131).

The front propeller shaft is connected to the transmission through a flexible joint (fig. 131).

In the vicinity of the rear flange sleeve of the front propeller shaft there is the pillow block providing for an elastic support of the drive line.

The rear propeller shaft is connected to the front propeller shaft and to the rear axle through universal joints. Splined front end allows for sliding motion of universal joint slip yoke.

Checking and Servicing the Propeller Shaft.

The front and rear propeller shaft should be checked for runout separately: straighten shafts, if necessary, using exclusively an arbor press.

If the weight distribution is uneven in respect of shaft rotation axis, apply putty on the lighter side to make up unbalance and then solder an equal amount of tin on the same spots where the putty was applied.

Check the front propeller shaft bearing for no radial clearance and minimum linear clearance.

The flexible joint should be in satisfactory condition as well as the rubber pads of front propeller shaft bearing casing.

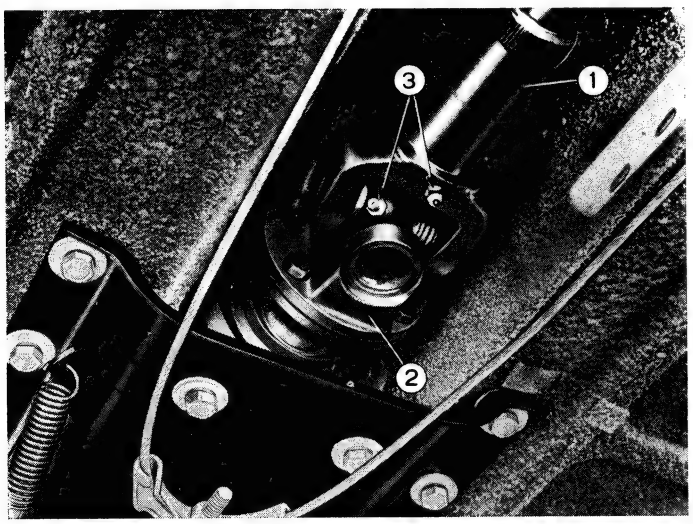


Fig. 130. - Detail of prop shaft center universal joint.

1. Slip sleeve with yoke - 2. Yoke flange - 3. Lubrication fittings for spider and yoke sleeve.

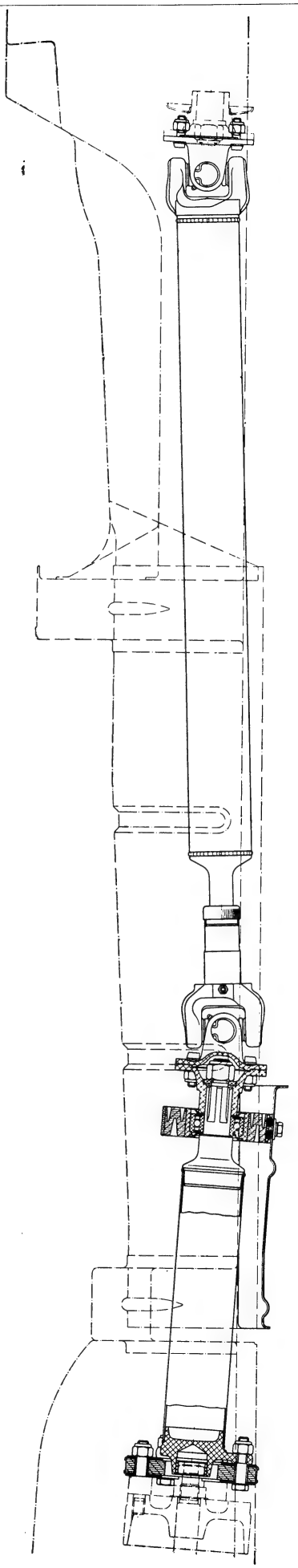


Fig. 131. - Dual propeller shaft with center pillow block.

Rear Axle

The following service procedures apply to both Models. Actually rear axle assemblies differ only as far as the type of brakes and the final drive ratio are concerned.

AXLE SHAFTS

To check axle shafts for runout, set the axle shaft between centers and, while turning it about, with a dial indicator see whether:

a) at points A and B (fig. 132), machined surfaces, the out-of-true is in excess of **.0012″ (0.03 mm)**;

b) at points C and D, rough surfaces, the out of-true is in excess of **.0394″ (1 mm)**.

In the affirmative, the axle shaft should be straightened using exclusively an arbor press.

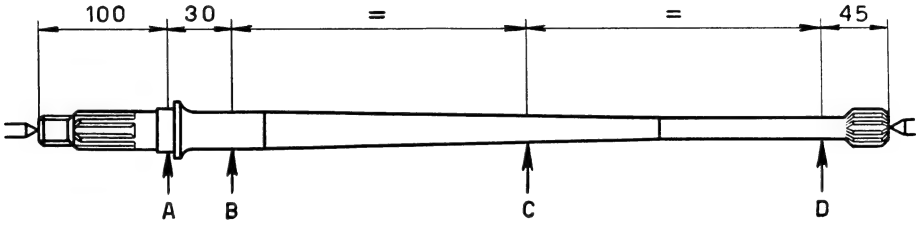


Fig. 132. - Diagram for runout inspection of axle shafts.

Letters and figures indicate the points where checks should be carried out.

100 = $3\,^{15}/_{16}''$ - 30 = $1\,^{3}/_{16}''$ - 45 = $1\,^{25}/_{32}''$.

DIFFERENTIAL CARRIER ASSEMBLY

The differential gear does not call for particular recommendations as far as disassembly is concerned. For differential assembly and adjustment, adhere to the following procedures:

1) Gauge the thickness of the drive pinion thrust ring by installing a dummy pinion **A. 70084**, to which a dial indicator is affixed.
Tighten down the pinion lock nut.
Rotate the dummy pinion some turns to be sure it is well seated.
Touch the indicator plunger to the cup seat of either differential case bearing and observe the dial reading.
Touch the indicator plunger to the other bearing cup seat and figure the average of two readings.
The resulting value corresponds to the difference between the theoretical and the actual distance of the differential case bearing bore centerline to the pinion rear bearing cone shoulder face. Add to or subtract from such amount, the value (in hundredths of a mm) scribed electrically on drive pinion:

— if the number stamped on drive pinion is preceded by the « plus sign », the thickness of the thrust ring is obtained by « subtracting » this figure from the indicator reading.

NOTE - All final drive gear sets are stamped in production, with an indelible process (fig. 133):

— **ring gear, the serial number;**

— **drive pinion, the serial number and the variation (in hundredths of a mm) between the actual assembly clearance and the nominal one, as specified in blue prints.**

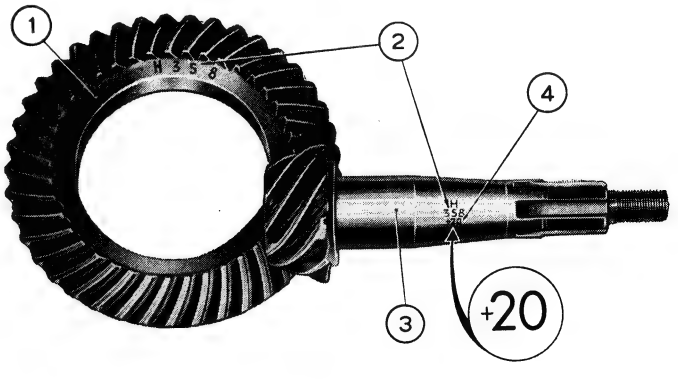


Fig. 133. - Ring gear and pinion.

1. Ring gear - 2. Progressive serial and matching number - 3. Drive pinion - 4. Value representing the variation (in hundredths of a mm) between the assembly and the nominal clearance.

HOW TO FIGURE REAR DRIVE PINION ROLLER BEARING THRUST RING THICKNESS

If « a » is the reading on dial indicator (fig. 134), and « b » is the value stamped on pinion (fig. 133), thickness « S » of thrust ring to be fitted is obtained as follows:

$$S = a - (+ b) = a - b$$
$$\text{or } S = a - (- b) = a + b$$

In other words:

— if number on pinion is preceded by **plus** (+) **sign**, the thickness of thrust ring is obtained by **subtracting** the number from dial gauge reading:

— if number on pinion is preceded by **minus** (—) **sign**, the thickness of thrust ring is obtained by **adding** the number to indicator reading.

Example: take a = 2.90 mm (dial gauge reading), and
b = — 5 (centesimal value on pinion)
then S = a — (— b)
S = 2.90 — (— 0.05)
S = 2.90 + 0.05
S = 2.95

Hence, in a case like this, a thrust ring 2.95 mm thick should be fitted.

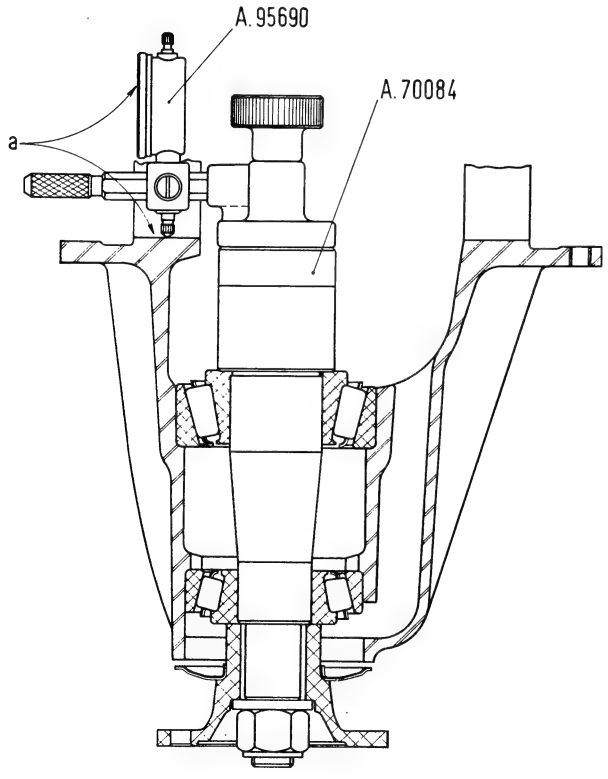


Fig. 134. - Diagrammatic view of how dummy pinion A. 70084 and dial indicator A. 95690 should be fitted to determine drive pinion rear bearing thrust ring thickness.

a = Indicator dial reading, from which pinion shaft setting value should be subtracted.

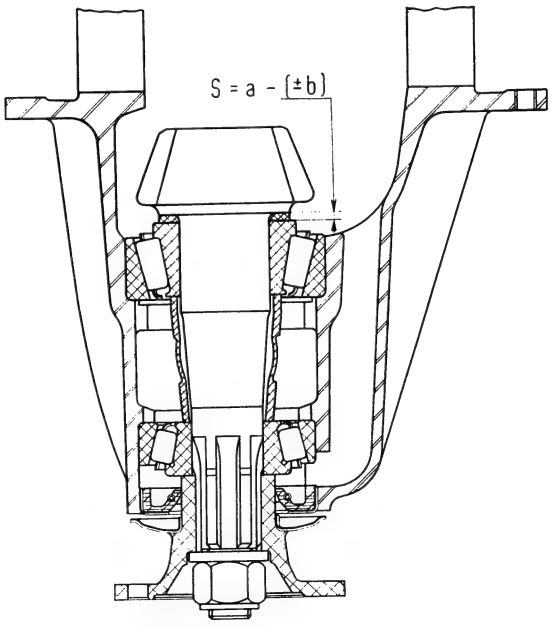


Fig. 135. - Diagrammatic view of drive pinion installation, where:

S = rear bearing thrust ring thickness;
a = indicator dial reading;
b = setting value as stamped in production on pinion shaft.

— conversely, if the number stamped on drive pinion is preceded by the « minus sign », the thickness of the thrust ring is obtained by « adding » this figure to the indicator reading.

NOTE - The rear roller bearing thrust ring on drive pinion comes for replacement in the following thickness range: .1063″ - .1083″ - .1102″ - .1122″ - .1142″ - .1161″ - .1181″ - .1201″ - .1221″ - .1240″ - .1260″ - .1280″ - .1299″ (2.70 - 2.75 - 2.80 - 2.85 - 2.90 - 2.95 - 3.00 - 3.05 - 3.10 - 3.15 - 3.20 - 3.25 - 3.30 mm).

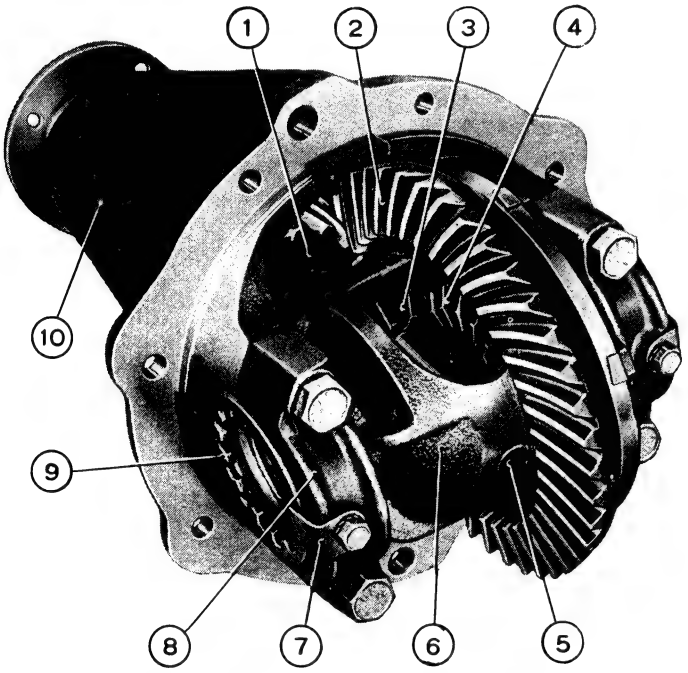


Fig. 136. - Differential carrier assembly.

1. Drive pinion - 2. Ring gear - 3. Pinion gear - 4. Side gear - 5. Pinion gear shaft - 6. Differential case - 7. Bearing adjuster lock plate - 8. Carrier cap - 9. Differential case roller bearing adjuster - 10. Carrier housing.

2) Carry out the definite installation of the drive pinion and related items on differential carrier, then, using a torque wrench, gradually tighten the lock nut on pinion shank, with **57.9 to 115.7 ft.lbs (8 to 16 kgm) of torque** and alternately check pinion rolling torque by means of a dynamometer.

NOTE - Pinion rolling torque should range from 1.08 to 1.16 ft.lbs (0.15 to 0.16 kgm).

In the event that pinion rolling torque turns out to exceed specification, replace the collapsible spacer between either pinion bearing and repeat above procedure.

3) Install differential pinion and side gears in differential case; after the assembly has been completed, check the rolling torque of a side gear (by locking the other gear and leaving the case free). The gear rolling torque should be 21.7 to 36.2 ft.lbs (3 to 5 kgm). Should a different torque be read, replace

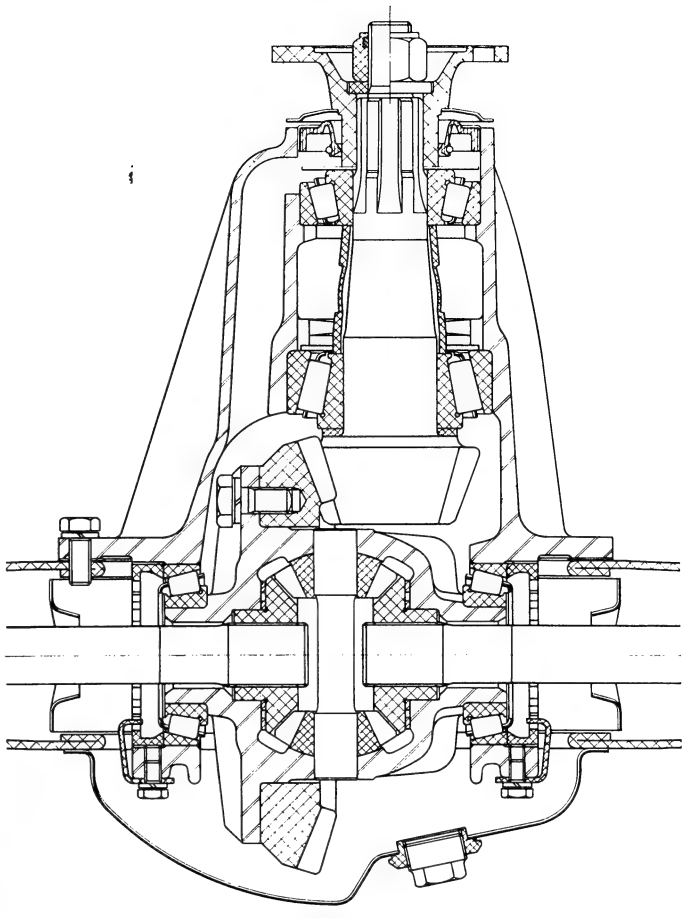


Fig. 137. - Section view of differential carrier assembly across final drive gear and differential case gear.

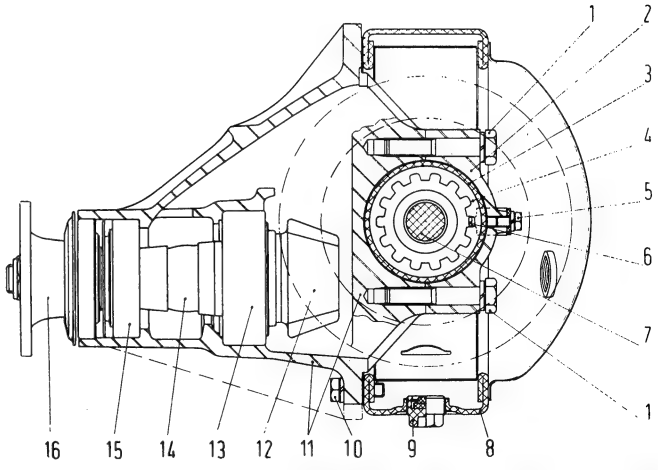


Fig. 138. - Section view of differential carrier assembly across drive pinion and case bearing adjusters.

1. Carrier cap screws - 2. Differential carrier cap - 3. Differential bearing cap - 4. Bearing adjuster - 5. Bearing plate screw - 6. Bearing plate - 7. Axle shaft - 8. Rear axle housing - 9. Oil drain plug - 10. Differential carrier-to-axle housing screws - 11. Differential carrier - 12. Drive pinion - 13. Rear roller bearing - 14. Collapsible spacer - 15. Front roller bearing - 16. Universal joint flange sleeve.

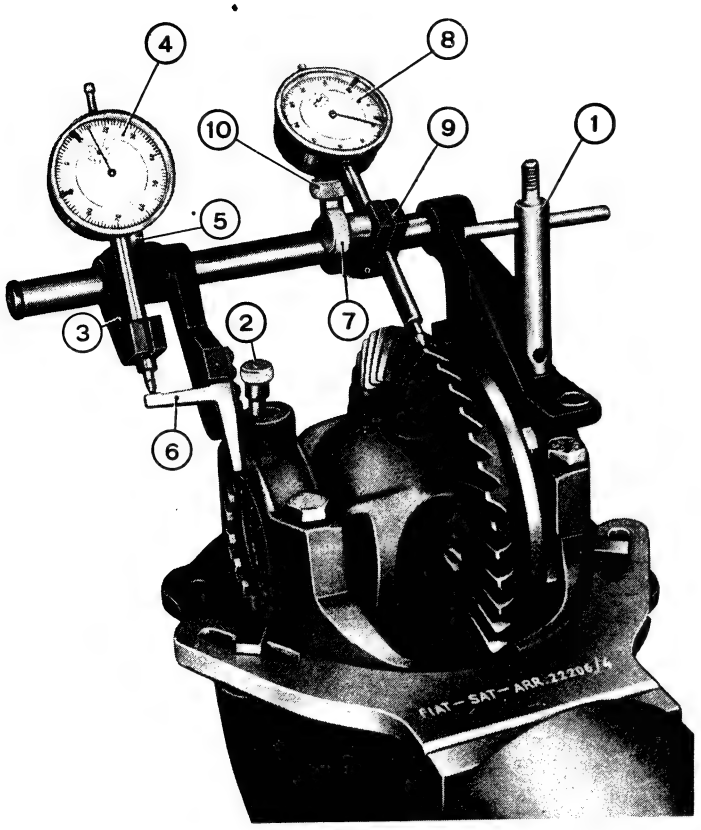


Fig. 139. - Checking ring gear-to-pinion backlash and differential case roller bearing preload using fixture A. 95688.

1. Handle stud - 2. Support knob - 3. Dial indicator support - 4. Differential case roller bearing preload gauge - 5. Support knob - 6. Carrier cap divergence relay lever - 7. Dial indicator plunger knob - 8. Ring gear-to-pinion backlash gauge - 9. Dial indicator support - 10. Support knob.

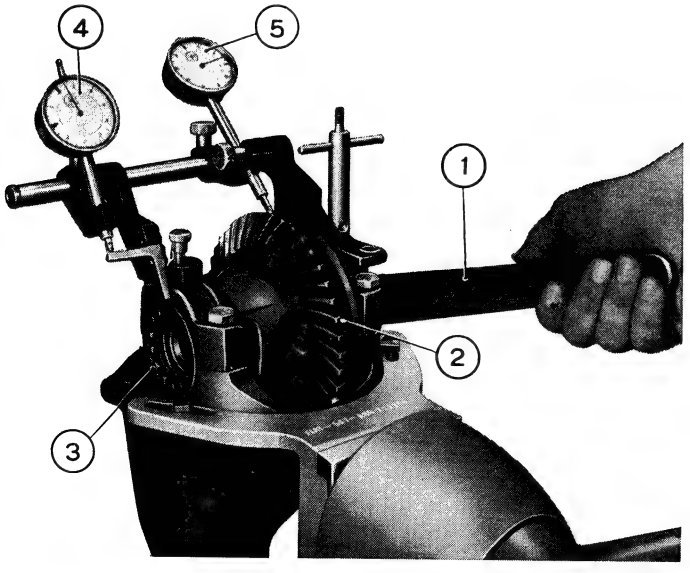


Fig. 140. - Tightening bearing adjusters to preload differential case roller bearings.

1. Wrench A. 55043 - 2. Ring gear - 3. Bearing adjuster - 4. Carrier cap divergence dial indicator - 5. Ring gear-to-pinion backlash dial indicator.

side gear thrust rings. Side gear thrust rings come for service in the following thicknesses: .0787″ - .0825″ (2.00-2.07 mm).

Install the ring gear on differential case: ring gear mounting screws should be drawn up with 65.1 to 79.6 ft.lbs (9 to 11 kgm) of torque, using a torque wrench.

Lay the differential case and bearing assembly on carrier and position the two adjusters in touch with bearings; fit the carrier caps and tighten the cap screws to 36.2 to 47 ft.lbs (5 to 6.5 kgm) of torque.

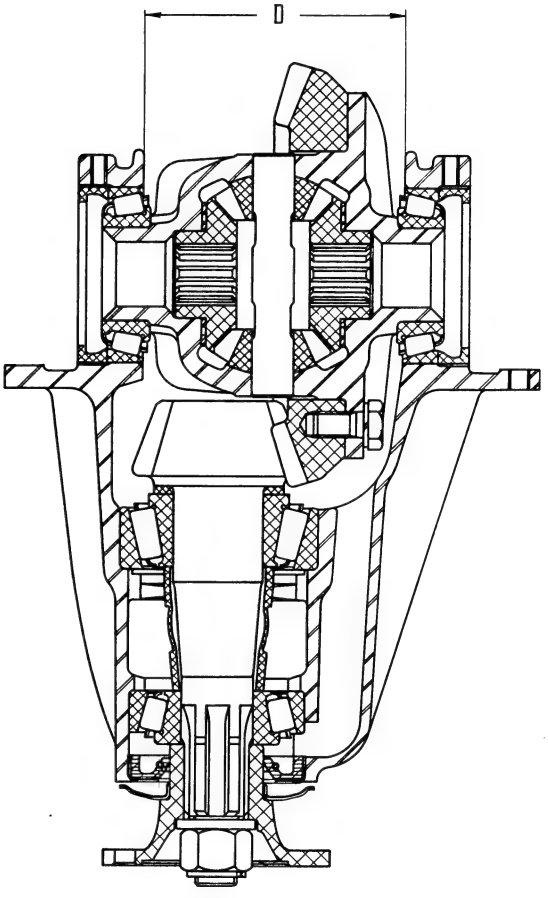


Fig. 141. - Differential case roller bearing preload inspection diagram.

D. Distance between either differential cap: tighten bearing adjusters until distance « D » increases by .0051″ (0.13 mm) approx.

4) Work on bearing adjusters to set a .0031″ to .0047″ (0.08 to 0.12 mm) pinion-to-ring gear backlash; tighten bearing adjusters until the distance (D, fig. 141) between the carrier caps, measured on top, increases by .0051″ (0.13 mm), approximately.

This procedure involves the use of a proper double-dial fixture (fig. 139), assuring the simultaneous

inspection of both the gear backlash and the carrier cap distance. Fit the bearing adjuster lock plates.

5) Install the differential carrier on the axle housing, with the carrier gasket in between; the carrier mounting screws should be drawn up with 14 1/2 to 18.1 ft.lbs (2 to 2.5 kgm) of torque.

REAR AXLE SPECIFICATIONS

	1500 Cabriolet	1600 S Cabriolet
Type	semi-floating	
Ring gear and pinion set	hypoid	
Gear ratio	4.1-1 (10/41)	3.9-1 (9/40)
Pinion bearings	2	
Bearing type	taper roller	
Pinion bearing pre-load setting	collapsible spacer and nut tightening with torque wrench	
Pinion bearing pre-load (pinion nut torque)	57.9 to 115.7 ft.lbs (8 to 16 kgm)	
Pinion rolling torque	1.08 to 1.16 ft.lbs (0.15 to 0.16 kgm)	
Differential case bearings	2	
Bearing type	taper roller	
Adjustment	threaded adjusters	
Bearing pre-load: differential carrier cap divergence	.0051″ approx. (0.13 mm)	
Side gear positioning	backing rings	
Rolling torque of either side gear (with loose differential case and the other side gear locked)	21.7 to 36.2 ft.lbs (3 to 5 kgm)	
Ring gear and pinion	in mesh	
Ring gear-to-pinion backlash	.0031″ to .0047″ (0.08 to 0.12 mm)	
Axle shaft type	load carrying	
Axle shaft bearing	ball	
Rear tread	48 3/8″ (1,230 mm)	47 3/4″ (1,215 mm)
Lube oil — type (grade)	FIAT W 90/M (SAE 90 EP)	
Lube oil — capacity	.79 Imp. qts - .95 U.S. qts 0.90 lt - 0.85 kg	

Steering System

The worm and roller steering gear has a gear ratio of 16.4 to 1.

The steering column is mounted on two ball bearings and fitted with a pair of universal joints (fig. 146).

The steering gear is attached to the body inner panel, on left-hand side of engine compartment.

NOTE - Prior to going over worm and roller for adjustment, make sure that the steering linkage is operating properly.

STEERING LINKAGE

The pitman arm, press fitted on roller shaft, operates an intermediate track rod (3, fig. 142) which is attached, at the opposite end, to an idler arm. Two side tie rods (6 and 7) are connected to the idler arm and pivoted, at the opposite end, to knuckle arms.

The idler arm bracket is secured to the dash bracing in engine compartment interior.

During total turning travel, the outer wheel develops a 27° angle, whereas inner wheel turning angle is $35° \pm 1° 30'$.

Turning circle: $34\,^1/_2$ ft (10.50 m).

Both side tie rods are provided with an adjusting sleeve (3, fig. 143) for correct positioning of front wheels.

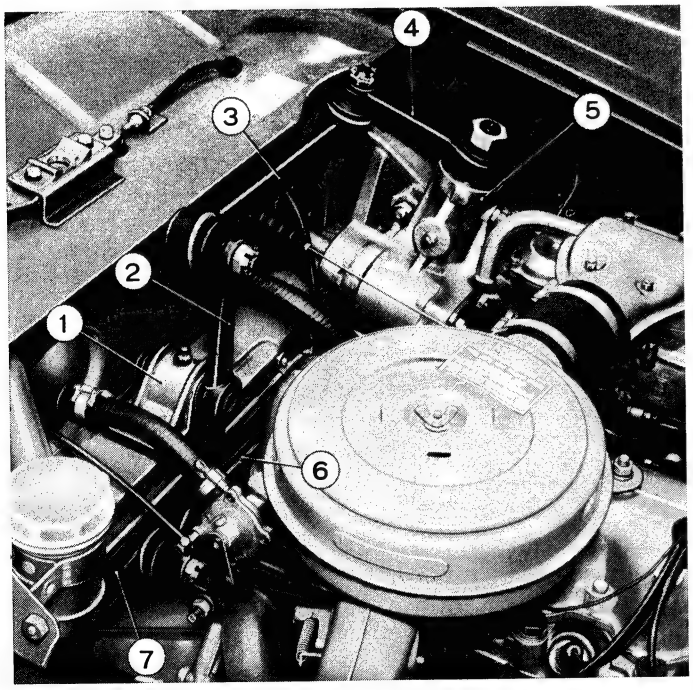


Fig. 142. - Arrangement of steering gear and linkage on vehicle.
1. Idler arm support - 2. Idler arm - 3. Intermediate track rod - 4. Pitman arm - 5. Steering gear - 6. Left side tie rod - 7. Right side tie rod.

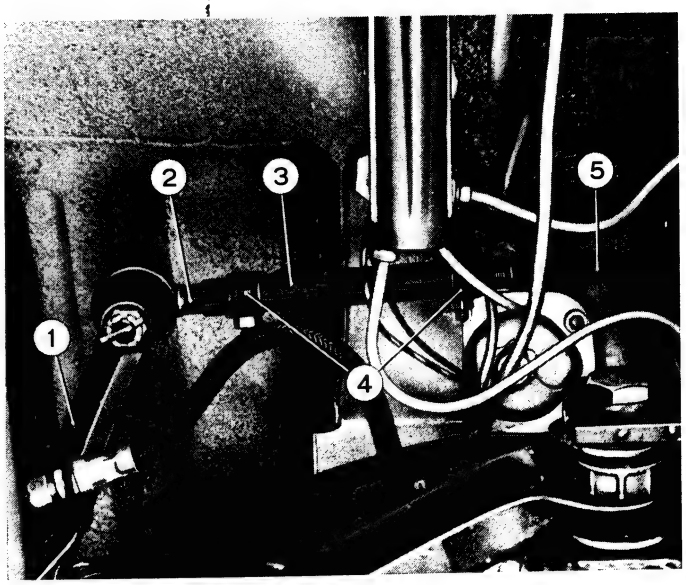


Fig. 143. - Detail of left side tie rod.
1. Left knuckle arm - 2. Side tie rod end joint - 3. Tie rod adjusting sleeve - 4. Adjusting sleeve clamps - 5. Intermediate track rod and end joint.

The linkage end joints are of « for life » type and need not be lubricated.

Inspection and Repair.

Disconnect side tie rods from intermediate track rod and knuckle arms. Make an accurate inspection of ball-and-socket rod ends.

If excessive clearance is noticed or ball stud stem is damaged, replace rod end assembly.

Renew unserviceable gaskets.

Steering Gear Assembly and Adjustment.

Clamp the steering gear to all-purpose service fixture **A. 74076/1** equipped with adapter **A. 74076/2.**

In case roller shaft bushings must be replaced, insert both bushings in gear housing seats using the same driver A. 74105 as for removal and then ream them by means of reamer A. 90336.

Position the adjusting shims (3, fig. 144) and drive the worm upper roller bearing cup into the gear housing bore.

The quantity of the bearing adjusting shims should be the same as it was counted on disassembly, provided the worm and roller teeth showed a correct center mesh. Otherwise, vary the number of shims according to whether the worm has to be moved up or down.

Arrange the cones of both roller bearings on the worm and thread the steering column and worm assembly into the gear housing.

Insert the cup of lower roller bearing (6, fig. 144) into the gear housing bore, then install the thrust cover (8) with the prescribed quantity of adjusting shims (7) between cover and housing face.

NOTE - Adjusting shims of worm screw bearings are available in the following thicknesses: .0039″ - .0059″ (0.10 - 0.15 mm).

Using dynamometer **A. 95697**, check the wormshaft rotation torque which should range from .14 to .47 ft.lbs (0.020 to 0.065 kgm).

If the torque reading is less than specified, decrease the thickness of shim pack. Conversely, if the torque is excessive, increase the thickness of shim pack.

Position the roller shaft oil seal (19, fig. 145) in place on gear housing.

Install the roller shaft and fit the cover and the cover gasket, along with the adjusting screw, shim, lock plate and nut.

Then secure the cover to the gear housing by means of four mounting nuts and spring washers.

NOTE - The adjusting screw should be fitted on roller shaft with a linear play ranging between .000″ and .002″ (0 and 0.05 mm); use the shim to set the screw play.

Temporarily drive the pitman arm on to the roller shaft.

Start from the mid-position of the pitman arm and move it in both directions: check that on an angular travel at least 30° wide of the steering column with wormscrew (not the pitman arm) either for rightward or leftward steering, the roller-to-worm lash is nil. To remove any lash present, work on the adjusting screw (13, fig. 145). Tighten the screw nut.

NOTE - Lash adjustment between worm and roller should be made with the pitman arm in midway position, corresponding to front wheels set for straight ahead drive. To determine the pitman arm mid-position, turn the steering wheel from lock to lock counting the number of turns of the steering column in this movement.

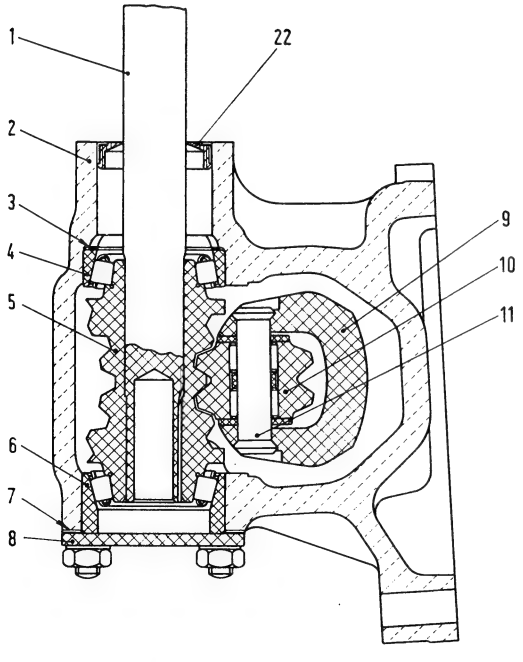


Fig. 144. - Sectional view of the steering gear across the steering column with worm screw.

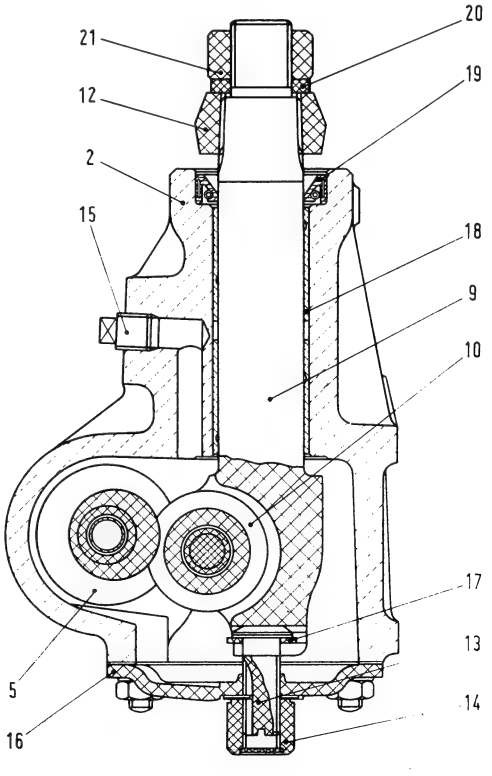


Fig. 145. - Sectional view of the steering gear across the roller shaft.

1. Steering column - 2. Steering housing - 3. Steering worm rear bearing shim - 4. Rear roller bearing - 5. Worm screw - 6. Front roller bearing - 7. Steering worm front bearing shims - 8. Steering worm thrust cover - 9. Roller shaft - 10. Steering worm roller - 11. Roller pin - 12. Pitman arm - 13. Roller shaft adjusting screw - 14. Adjusting screw nut - 15. Steering housing plug - 16. Steering housing cover - 17. Roller shaft adjusting screw lock plate - 18. Roller shaft bushings - 19. Roller shaft seal - 20. Pitman arm lock washer - 21. Pitman arm-to-roller shaft nut.

After the roller-to-worm lash has been adjusted, use dynamometer **A. 95697** and check the wormshaft for the following rolling torques:

1) .65 to .87 ft.lbs (0.090 to 0.120 kgm) on a steering column angle of some 30°, both leftward and rightward, starting from the mid-position of the pitman arm.

2) some .51 ft.lbs (0.070 kgm) beyond 30° angle, as the steering locks are approached.

The above specified 30° angle refers to the turning of the steering wheel, that is the worm shaft.

If during worm-to-roller lash adjustment, roller should prove not to mesh at center of worm, work on worm bearing ring shims (3, fig. 144) and plate shims (7, fig. 144) so to set the worm at center on roller. In this event, repeat the worm bearing clearance adjustment, as well as the worm-to-roller lash adjustment, then check the rolling torque as previously recommended. Drive the pitman arm on to the roller shaft definitely and secure with nut and spring washer. Draw up the pitman arm nut with 144.7 to 173.6 ft.lbs (20 to 24 kgm) of torque, using a torque wrench.

NOTE - The correct relative position of the pitman arm to the roller shaft is assured thanks to the presence of a double tooth on the roller shaft and a corresponding double tooth space on the arm.

Pour .14 G.B. qts - .17 U.S. qts (0.160 lt) of FIAT W 90/M oil (SAE 90 EP) into the steering housing through the filler opening and screw up the filler plug.

CHECKING STEERING SETTING

Proceed as follows:

— Remove rubber lining A (fig. 146) and working from the engine compartment, with a graduated straight-edge scribe a reference notch (R) on shaft (B) 3.1496″ (80 mm) apart from the front face of yoke (C) hub.

— Back out the lock screw (D) of yoke (C) and, with the front wheels away from the floor, make two or three full turning movements. Measure the distance between the front face of the yoke hub and the reference notch (R) on shaft.

At this point the alternative must be considered that a variation is found in this distance of more or less than .0394″ (1 mm) (in excess or in defect) in respect of the initial value.

1) **Variation less than .0394″ (1 mm).**

a) Make sure that on the shaft there is the flat (E) as specified. To check on this condition, slide the yoke (C) half way out of the shaft (B).

If the flat is present, again turn the wheels two or three times fully, then fit the screw (D) which should enter its seat snugly and not be forced.

Fit and lock the screw nut (F).

b) Should a drag be felt when fitting the screw (D), this means that it was positioned in such a way as to interfere with either end (G, fig. 147) of flat (E). If so, loosen screws (H, fig. 146) mounting the support (1) of the upper steering column (O) and shift the support so that its position does not prevent the screw (D) from fitting snugly.

During this step check that the distance between the lower edge of the steering wheel and the floor is $15\,{}^{11}/_{32}'' \pm {}^{3}/_{16}''$ (390 ± 5 mm) (fig. 146).

To adjust this distance, movement of the support is possible thanks to the presence of elongated holes (L) cut on the body.

Access to support mounting screws (H) can be gained by removing the upper lining of the instrument panel.

Next secure support mounting screws and also the screw (D) by means of nut (F).

c) Due to the fact that on first production cars the shaft (B) is fitted with two round grooves (M, fig. 147) in addition to the flat, the screw may happen not to be at the flat but engage in a groove.

In such event the steering gear must be removed in order to mate the yoke (C, fig. 146) with the shaft (B) at the correct angle. To this effect the following condition must be obtained: the distance in the drawing between the eye center (Q) of arm (N, fig. 147) and the steering gear mounting face should measure $1\,{}^{13}/_{32}''$ (46 mm) (actual distance on the vehicle $1\,{}^{13}/_{32}'' \pm 1/8''$ - 46 ± 3 mm).

Provided this condition is not affected, prior to locking the steering gear an action can be made, if necessary, on the relative fitting angle of the upper steering shaft to the intermediate shaft yoke (P) in order to position the steering wheel spokes correctly, viz with the center spoke upright and downward.

Front wheels must be set for straight forward drive and the pitman arm (N) as outlined above. Should it not be so, work on steering rods.

d) In the absence of flat (E) cut it using a file with the steering gear out. Position and sizes of flat should be as shown in fig. 147. Next assemble following the procedure outlined at c.

2) **Variation more than .0394″ (1 mm).**

The upper steering shaft (O) must be renewed. The mating of the shaft with yoke (P) should be so deep as the screw (S) engages the end groove in the shaft. For the position of support (I) adhere to the directions at 1, item b.

Now, with the wheels raised from ground, turn them two or three times fully and proceed as outlined at 1) from item a) on.

IMPORTANT NOTICE

Whatever the work carried out, **the screw (D) should be always tightened for the last one (with nut F).**

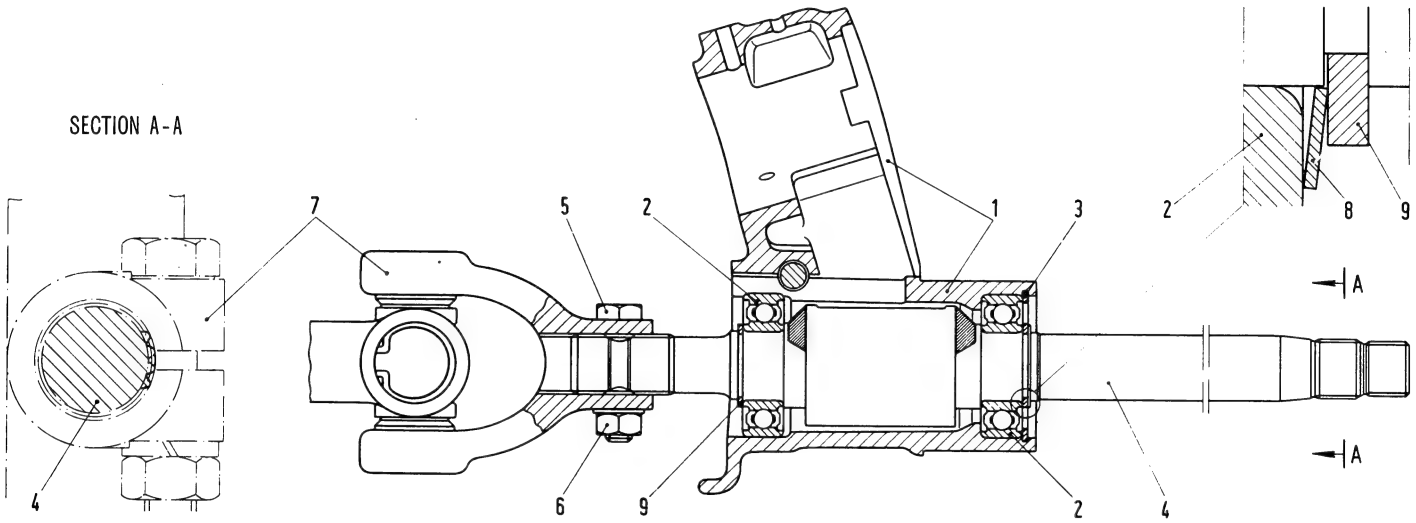


Fig. 148. - Upper steering shaft support assy (with flexible joint).
1. Support - 2. Bearings - 3. Snap ring - 4. Upper shaft - 5-6. Screw and nut, articulated shaft upper yoke-to-upper shaft - 7. Upper yoke and « U » joint - 8. Spring washer - 9. Snap rings.

STEERING SYSTEM SPECIFICATIONS

Steering gear type	worm and roller
Gear ratio	16.4 to 1
Wormshaft bearings	roller
Roller shaft bushings	two, bronze
Bearing adjustment	ring shims, top; plate shims, bottom
Worm-to-roller lash adjustment	adjusting screw with shim on roller shaft
Roller shaft bushing bore	1.1298″ to 1.1307″ (28.698 to 28.720 mm)
Roller shaft diameter	1.1295″ to 1.1287″ (28.690 to 28.669 mm)
Roller shaft-to-bushing fit clearance	.0003″ to .0020″ (0.008 to 0.051 mm) (wear limit .0039″ - 0.10 mm)
Turning circle	34 1/2 ft (10.50 m)
Side tie rods	symmetrical and independent with adjustable end joints
Intermediate track rod	with non-adjustable end joints
Turning angle { outer wheel	27°
Turning angle { inner wheel	35° ± 1° 30′
Front wheel toe-in, fully laden	.0394″ to .1181″ (1 to 3 mm)
Steering gear oil { grade	FIAT W 90/M (SAE 90 EP)
Steering gear oil { capacity	.14 G.B. qts - .17 U.S. qts (0.160 lt - 0.150 kg)

Front Suspension

Independent wheel front suspension, with coil springs and hydraulic telescoping double acting shock absorbers (1500) or oleo-pneumatic shock absorbers (1600 S).

Sway bar attached to lower control arms.

COIL SPRINGS

Coil springs are fitted on lower control arm at bottom and on a boxed plate of pillar at top.

If must be noted that front coil springs, in production, are selected and graded into two classes.

— Class A: springs identified by a stripe of yellow paint on center turns; these develop a camber of over 7.165″ (182 mm) under 970 lbs (440 kg) of load.

— Class B: springs identified by a grind mark on top and a stripe of green paint on center turns; these develop a camber of 7.165″ (182 mm) or less, under 970 lbs (440 kg) of load.

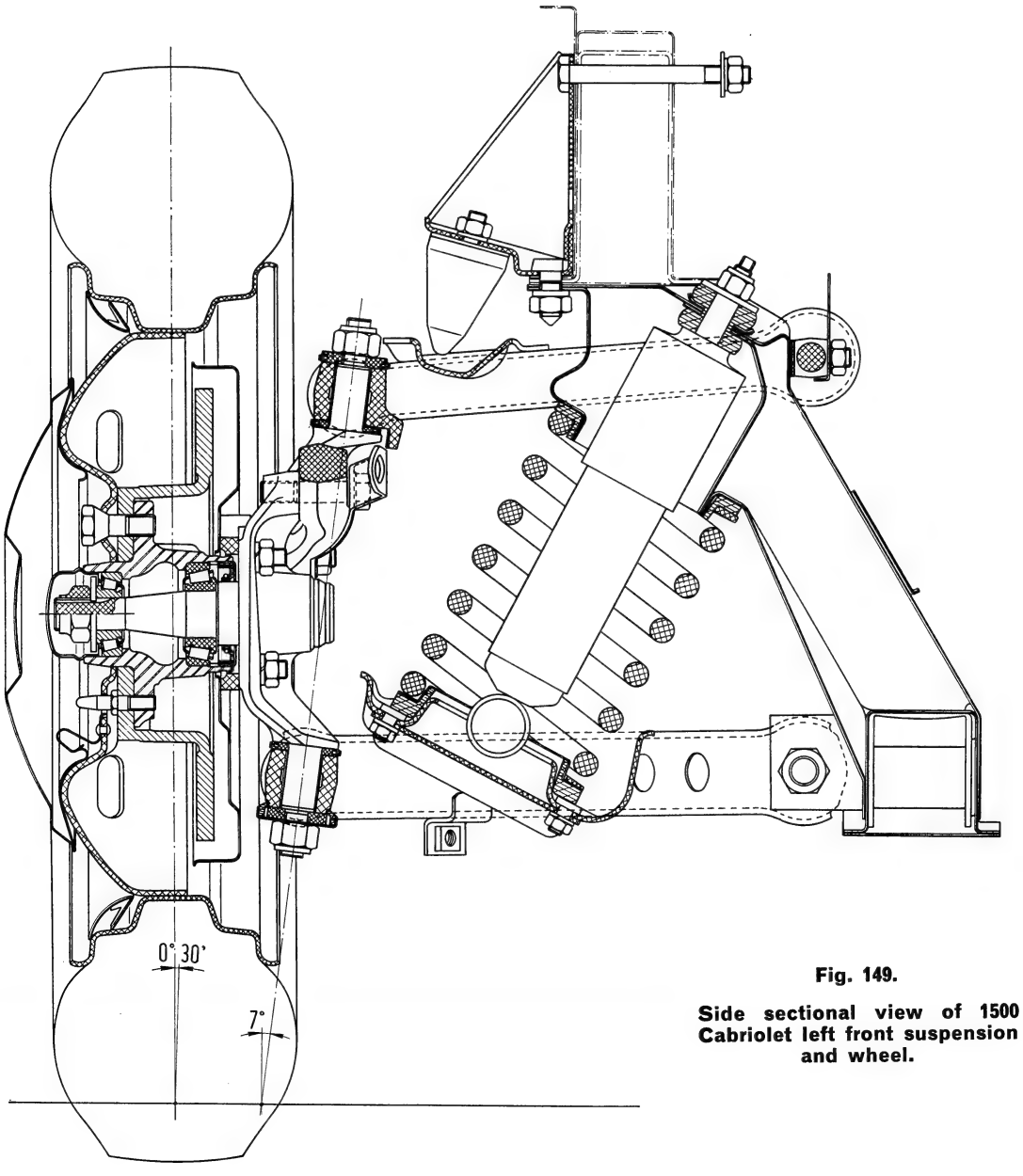


Fig. 149.

Side sectional view of 1500 Cabriolet left front suspension and wheel.

When servicing the front suspension, make sure that coil spring pairs belong to the same class. Replace springs by new ones if they are cracked or sagged.

Check spring rubber seats for damage and replace them, if necessary.

COIL SPRING SPECIFICATIONS

Wire diameter		.5118″ ± .0019″ (13 ± 0.05 mm)
Inside diameter		3.5433″ ± .0354″ (90 ± 0.9 mm)
Total turns		$7\,^{1}/_{4}$
Working turns		$5\,^{3}/_{4}$
Direction of winding		clockwise
Free length		10.374″ (263.5 mm) appr.
Length under 970 ± 48.5 lbs (440 ± 22 lbs) of load	class A, over	7.165″ (182 mm)
	class B, up to	7.165″ (182 mm)

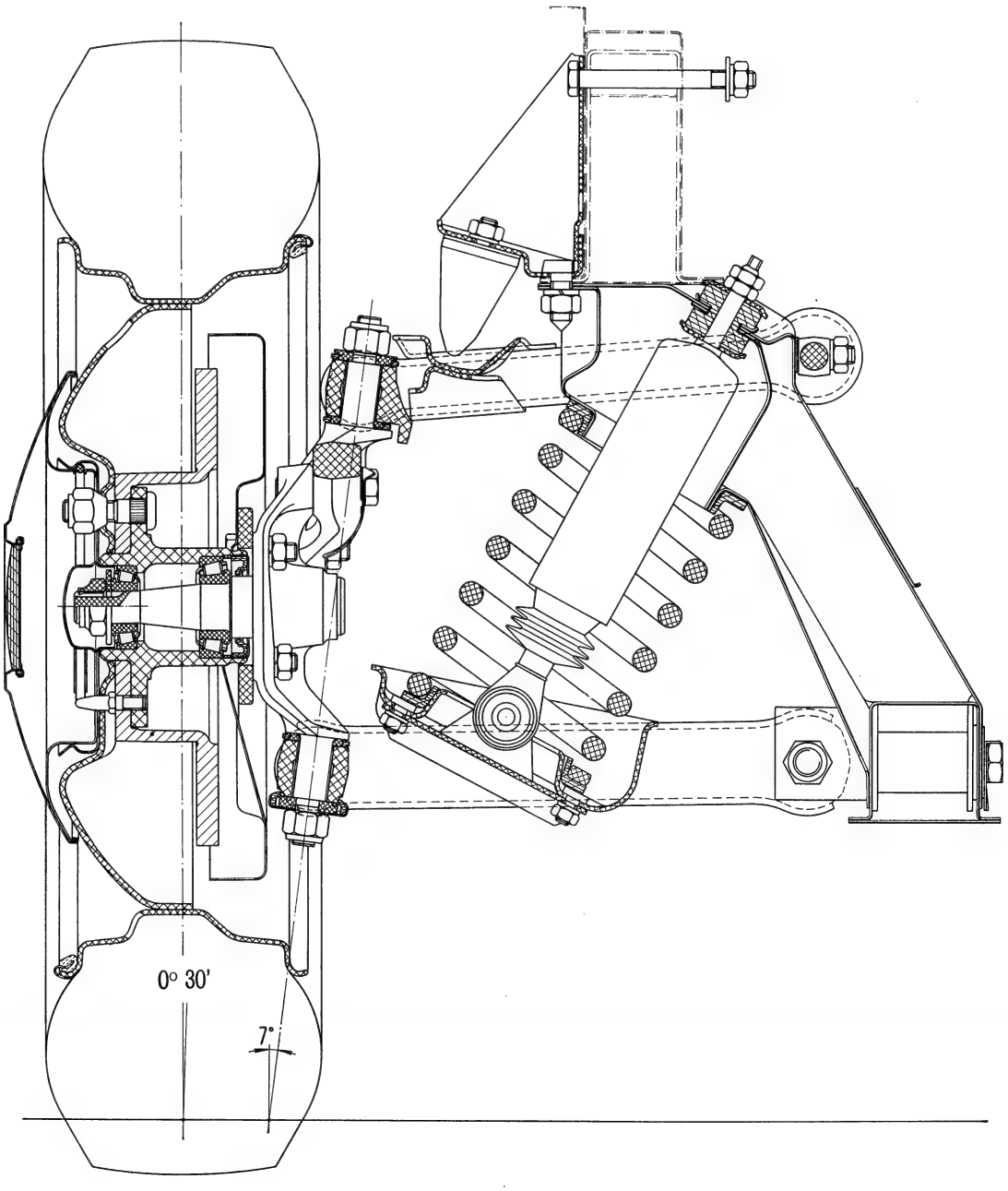


Fig. 150.

Side sectional view of 1600 S Cabriolet left front suspension and wheel.

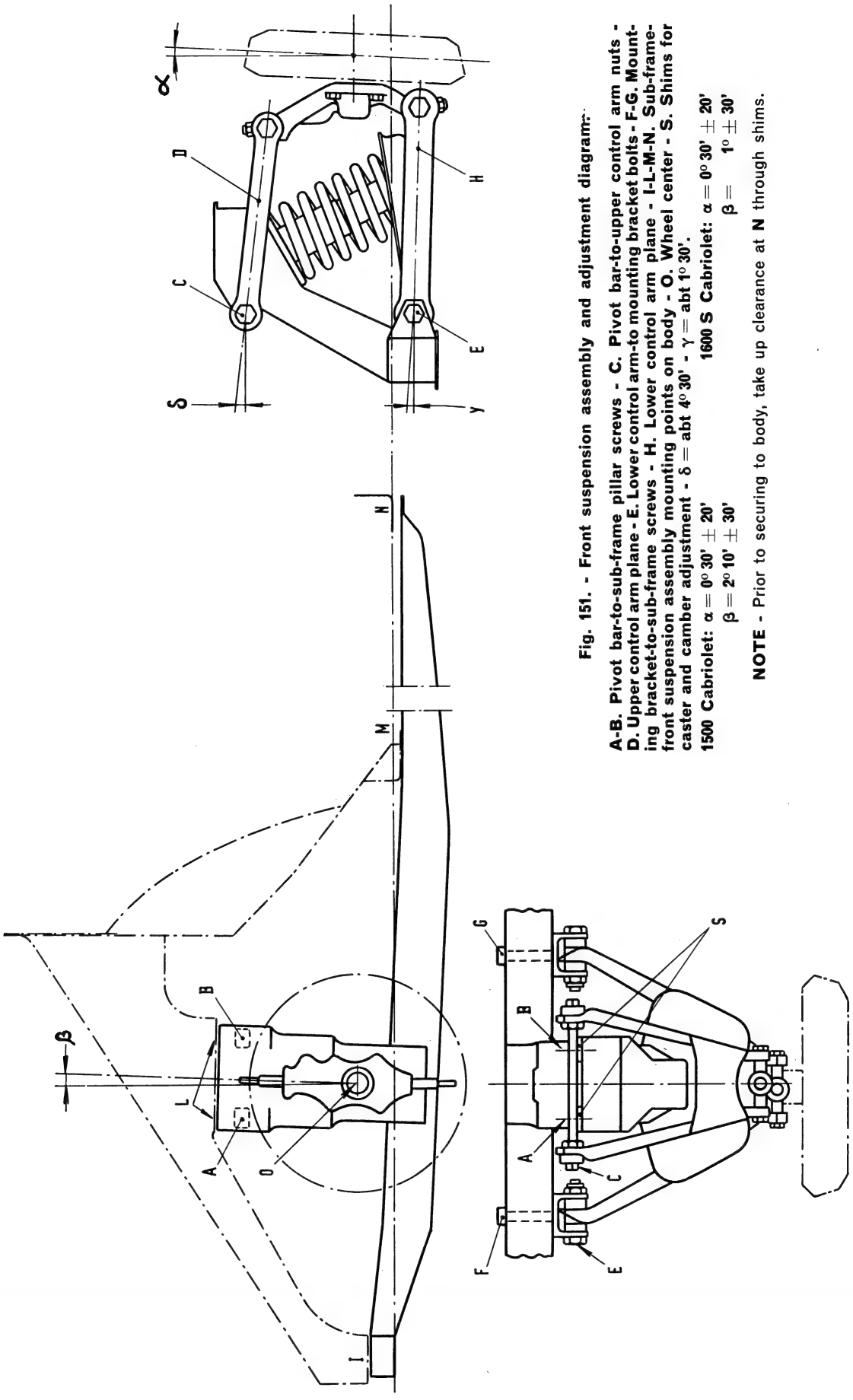


Fig. 151. - Front suspension assembly and adjustment diagram:

A-B. Pivot bar-to-sub-frame pillar screws - C. Pivot bar-to-upper control arm nuts - D. Upper control arm plane - E. Lower control arm-to mounting bracket bolts - F-G. Mounting bracket-to-sub-frame screws - H. Lower control arm plane - I-L-M-N. Sub-frame-front suspension assembly mounting points on body - O. Wheel center - S. Shims for caster and camber adjustment - δ = abt 4° 30' - γ = abt 1° 30'.

1500 Cabriolet: α = 0° 30' ± 20' **1600 S Cabriolet: α = 0° 30' ± 20'**

β = 2° 10' ± 30' **β = 1° ± 30'**

NOTE - Prior to securing to body, take up clearance at **N** through shims.

SUSPENSION ASSEMBLY

In case the front sub-frame and suspension assembly has been stripped for service reasons, on assembly proceed as follows:

— lock nuts C (fig. 151) when the axis of screws A and B and the plane D meet at an angle « δ » of some 4° 30′;

— lock nuts of bolts E when the axis of screws F and G and the plane H meet at an angle « γ » of some 1° 30′;

— place shims « S » on to screws A and B (fig. 151) securing upper control arm pivot bar to front frame; shims should be in the same amount as counted on disassembly;

— fasten the sub-frame and suspension assembly to the body at points I-L-M-N; in this step use care to take up clearance at N using shims.

Checking and Adjusting Front End Geometry.

The angles of the front end geometry, with the vehicle in a « static load » condition, should be the following:

	1500	1600 S
— camber (α, fig. 151)	0° 30′ ± 20′	0° 30′ ± 20′
— caster (β, fig. 151)	2° 10′ ± 30′	1° ± 30′
— toe-in	.0394″ to .1181″ (1 to 3 mm)	.0394″ to .1181″ (1 to 3 mm)

Checking the front wheel alignment is required whenever uneven tire wear or irregular operation of the steering are observed, as well as after reassembly.

To check camber and caster fixture **Ap. 5106** is used while use of gauge **Ap. 5107** is recommended for toe-in check.

In order to avoid incorrect data on wheel alignment check, carry out some preliminary inspections of car units which are apt to affect the front end geometry, as follows:

— Tire pressure: should be as specified for each single Model.

— Tire fitting: run-out and misalignment not in excess of .1181″ (3 mm).

— Front wheel roller bearing play: take up if necessary.

— Steering worm-to-roller lash: adjust if necessary.

— Steering knuckle pillar-to-control arm spider clearance: replace worn parts.

— Steering ball stud-to-tie rod end clearance: if excessive, replace rod end assemblies.

— Efficiency of shock absorbers: overhaul or replace, as required.

Next, orderly set the car under « static load » conditions, so that:

— distance (A, fig. 152) of wheel centers from ground is:
1500 Cabriolet, abt . . . . . 10 5/8″ (270 mm)
1600 S Cabriolet, abt . . . . . 11 9/16″ (284 mm)

— distance (B, fig. 152) of body floor side members from ground at four points shown in fig. 152 is:
1500 Cabriolet, abt . . . . . 7 1/2″ (190 mm)
1600 S Cabriolet, abt . . . . . 8″ (203 mm)

Set the steering wheel at mid-travel with road wheels for straight-ahead drive.

Raise front wheels and set turntables of fixture **Ap. 5106** under them in center position so to facilitate turning wheels to prescribed angles. Arrange two wood tables under rear wheels. These tables should be of the same thickness as turntables to assure perfect leveling of car (if available, another pair of turntables may be used).

Install the fixture on the wheel under inspection and proceed as follows.

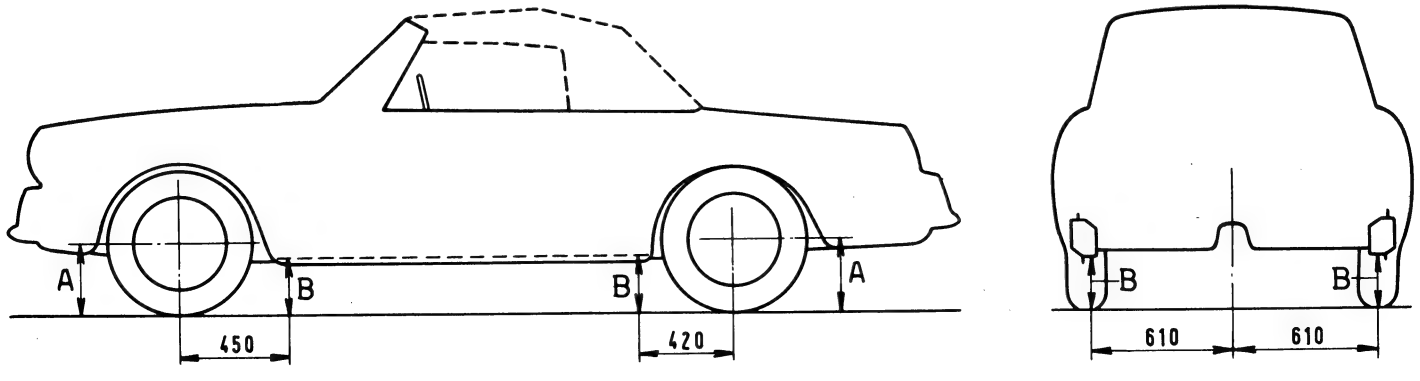


Fig. 152. - Trim diagram of vehicle under « static load » for checking front end geometry.

450 = 17 23/32″ - 420 = 16 17/32″ - 610 = 24″.

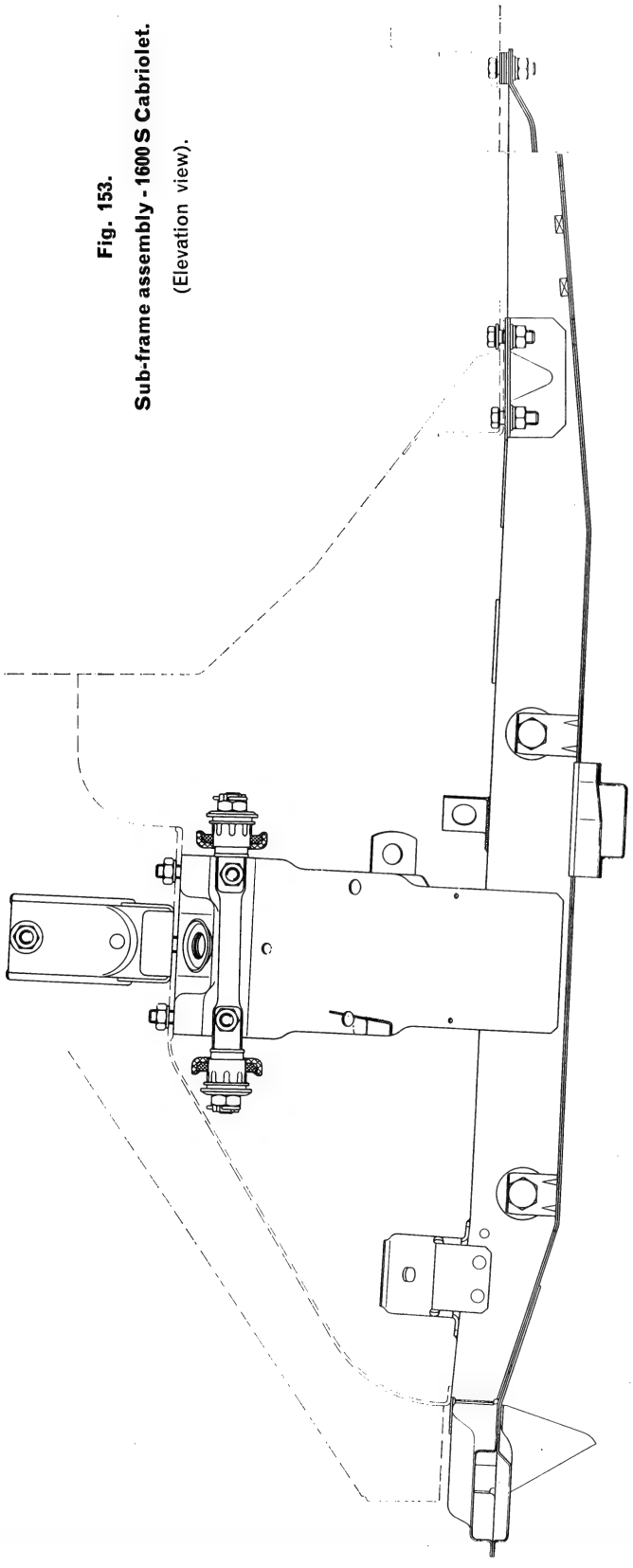


Fig. 153.
Sub-frame assembly - 1600 S Cabriolet.
(Elevation view).

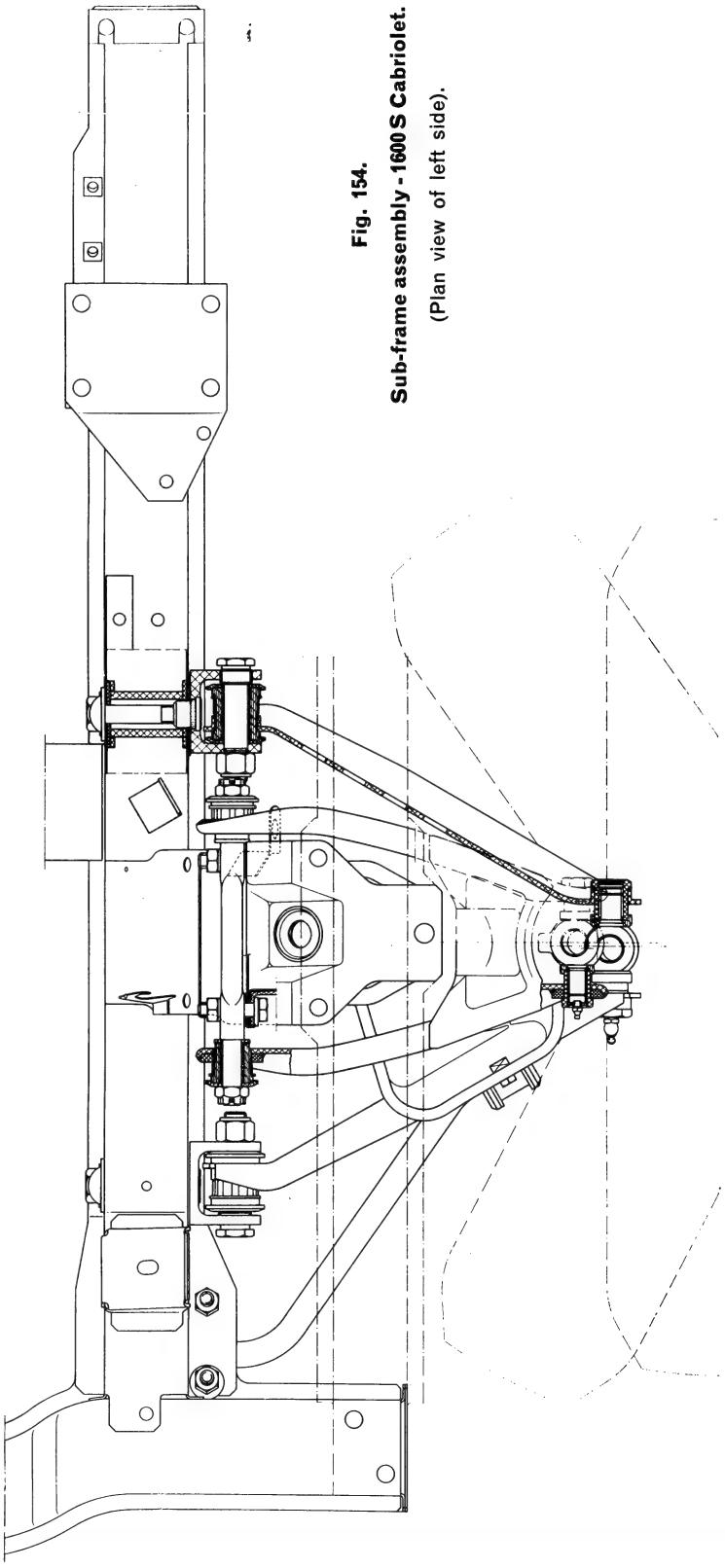


Fig. 154.
Sub-frame assembly - 1600 S Cabriolet.
(Plan view of left side).

Checking Camber.

With the fixture clamped to the wheel and the gauge at right angle to car centerline, read the value of camber angle on « Camber » scale of gauge at the gauge pointer.

WARNING - To avoid possible errors due to the wheel being out of center, after reading camber as above outlined, turn the wheel 180° and take a new reading; the average between the two readings will be the correct value.

Checking Caster.

Keep the fixture in the same position as for camber inspection.

Turn the wheel 20° out.

Set the movable scale of gauge (« Caster » scale) at zero, so to bring the zero in the scale in line with the gauge pointer.

Turn the wheel 20° in and read the value of caster angle on « Caster » scale.

Adjustment.

Should caster and camber readings not correspond to specifications, adjust as follows:

a) **Caster.**

Back out the nuts securing upper control arm pivot bar to frame pillar and add or remove shims « S » at **A** or **B** (fig. 151). Add shims at **B** to increase caster angle or at **A** to diminish it.

b) **Camber.**

Back out the nuts securing upper control arm pivot bar to frame pillar and remove an equal number of shims from **A** and **B**, if the camber angle must be increased (fig. 151).

To diminish camber angle, add an equal number of shims at **A** and **B**.

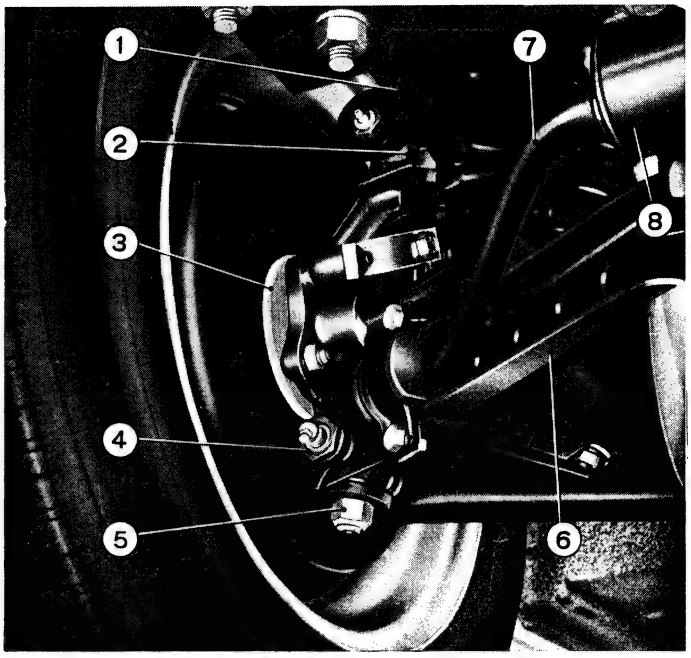


Fig. 155. - Scrap view of 1600 S Cabriolet right front suspension.

1. Upper control arm - 2. Steering knuckle pillar - 3. Brake caliper mounting plate - 4. Self-threading bushing - 5. Self-locking nut - 6. Lower control arm - 7. Sway bar - 8. Sway bar support.

Adding or removing the same amount of shims at **A** and **B** (fig. 151) it will be possible to set camber without disturbing caster adjustment as previously made.

Checking and Adjusting Front Wheel Toe-in.

Preparatory to toe-in check, make sure that:

— tire pressure is correct;

— steering wheel is at mid-travel with road wheels in straight-ahead drive position or parallel to car centerline.

Set pointers of gauge **Ap. 5107** at the wheel center, then position the gauge for the pointers to touch the outer edges of wheel rims at the rear. Mark contact points with chalk.

Position the gauge at the front and, by moving the car, rotate the wheels 180° so that chalk marks are brought at gauge pointers.

Touch a gauge pointer against the wheel rim and measure the distance between the opposite pointer and the other wheel rim.

This distance should be:

— with car under « static load » (fig. 152): .0394″ to .1181″ (1 to 3 mm).

If not so, adjust as follows.

Loosen the four clamps securing sleeve adjusters to tie rod ends. Turn sleeve adjusters an equal amount in the same direction, both sides; in fact sleeve adjusters are clockwise threaded at one end and counterclockwise threaded at the other.

After setting toe-in, tighten down four sleeve adjuster clamps. With locked clamps nuts, clamp ends should not be touching.

See that the gaps of sleeves and clamps are flush.

FRONT SUSPENSION SPECIFICATIONS

	1500 Cabriolet	1600 S Cabriolet
Type	independent wheel, with shock absorbers, sway eliminator and coil springs	
Sway eliminator	rubber mounted cross bar	
Camber (*)	0° 30′ ± 20′	0° 30′ ± 20′
Caster (*)	2° 10′ ± 30′	1° ± 30′
King pin angle	7°	7°
Toe-in (*)	.0394″ to .1181″ (1 to 3 mm)	.0394″ to .1181″ (1 to 3 mm)
Tread, front (on ground)	48.503″ (1,232 mm)	48.897″ (1,242 mm)
Wheelbase	92.126″ (2,340 mm)	92.126″ (2,340 mm)
Trim of vehicle under « static load »:		
— Distance (A, fig. 152) of wheel centers from ground, abt	10 5/8″ (270 mm)	11 9/16″ (284 mm)
— Distance (B, fig. 152) of body floor side members from floor at four points shown in figure, abt	7 1/2″ (190 mm)	8″ (203 mm)
Shock absorbers	2	2
Type	hydraulic	oleo-pneumatic
Pressure cylinder bore	1.260″ (32 mm)	—
Length (between lower eye center and upper mounting face):		
— retracted	8.228″ (209 mm)	8.504″ (216 mm)
— extended	11.417″ (290 mm)	11.964″ (304 mm)
Setting compression	.1181″ ± .0394″ (3 ± 1 mm)	—
Setting rebound	.4331″ ± .0591″ (11 ± 1.5 mm)	—
Abutting begins	2.894″ (73.5 mm)	3.464″ (88 mm)
Fluid quality	FIAT S.A.I.	—
Fluid capacity	.29 G.B. pts - .35 U.S. pts (0.165 lt)	—

(*) Check at « static load ».

Front Wheels

The front wheel bearings are secured to the hub by means of nuts being locked against the steering knuckle by a single staking.

When servicing the wheel hubs, free the hub nut using a punch and then undo it. **The old nut must be replaced by a new one and scrapped.**

LUBRICATION DIRECTIONS

When mounting the roller bearings, lubricate with FIAT MR 3 grease.

Bearings.

The bearings must not be installed without lubricant.

Before installation on steering knuckles, the space between cage and bearing cone must be packed with grease.

Wheel Hub.

The hub must not be completely filled but the amount of grease should be such as to guarantee a thorough lubrication of the outer bearing and be distributed all around in the pocket between the bearing cup and cone.

Amount of grease specified for each hub: $1\,^1/_4$ oz (35 gr).

Hub Cap.

The cap need not be completely filled but the amount of grease should be such (7/8 oz - 25 gr) that the gap between cap and outer bearing is fully packed after mounting the cap on the hub.

ADJUSTMENT DIRECTIONS

Torque wrenches must be accurate within $\pm 5\,\%$.

Before securing the hub make sure the nut screws in freely, then tighten with 14.5 ft.lbs (2 kgm) of torque while rocking the wheel hub 4 or 5 times to guarantee proper setting of bearings; at this point, undo the nut all the way and finally tighten with a torque of 5.1 ft.lbs (0.7 kgm).

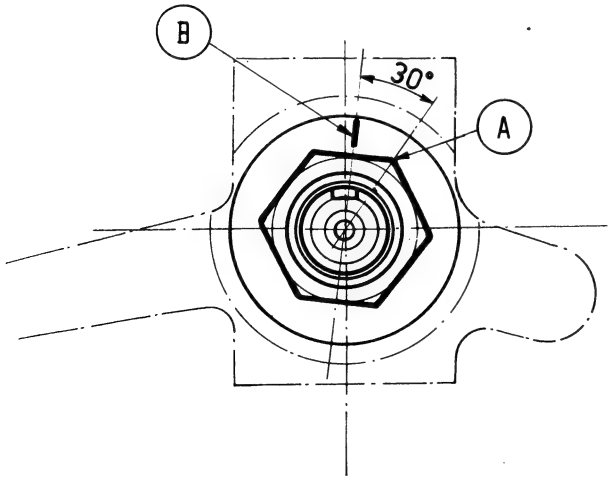
Next, back out the nut 30°. To do so, punch a mark (B, fig. 156) on the nut washer at a point corresponding to the center of one of the six flats of the nut, then unscrew the nut until the adjacent corner (A, fig. 156) comes in alignment with the punch mark.

Once the nut has been slackened as required, lock it in position by staking its collar with pliers **A. 74129** into the groove machined in the steering knuckle end, then again rock the hub.

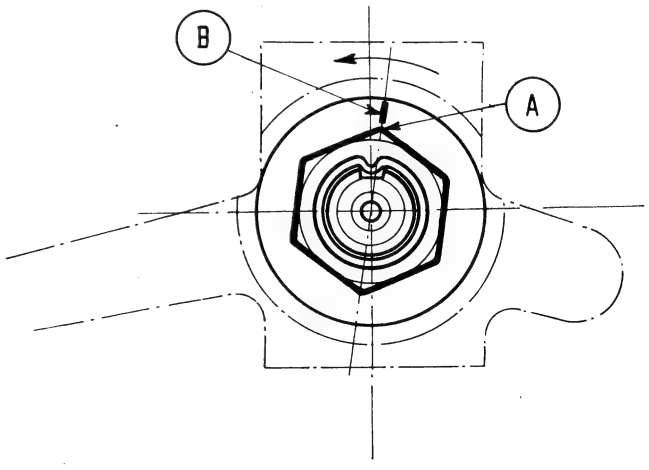
The hub end play should be .0010″ to .0039″ (0.025 to 0.100 mm).

CHECKING END PLAY

The wheel hub end play can be checked with either the wheel on or down, as directed hereafter.



Drawing up hub nut with 5.1 ft.lbs (0.7 kgm) of torque.



Backing out hub nut 30°.

Fig. 156. - Locking and adjusting front wheel hubs.
A. Corner of the nut - B. Mark on nut washer.

The figure shows the adjustment of the left front hub. To adjust the right hub, the procedure should be reversed because the nut is counterclockwise threaded.

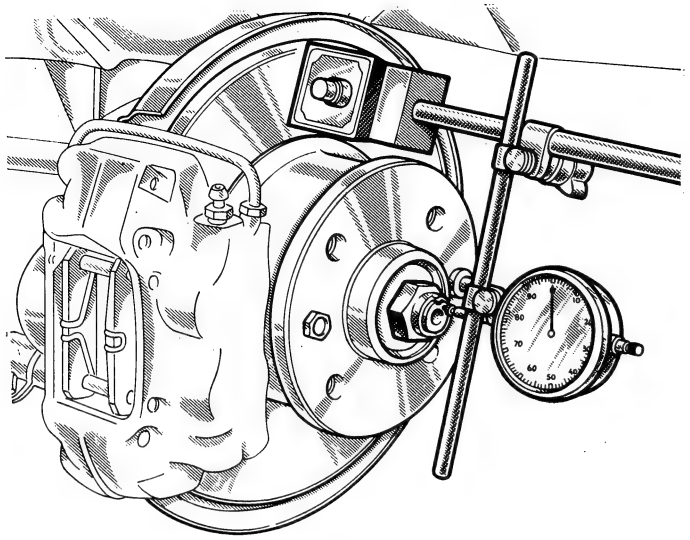


Fig. 157. - Using dial indicator with magnetic base to check wheel hub end play.

End play should be .0010″ to .0039″ (0.025 to 0.100 mm).

CHECK WITH WHEEL DOWN

After removing the hub cap, push the brake drum straight on towards car, then apply a dial indicator with magnetic base plate to the flat face of the drum.

Touch the dial indicator plunger to the end of the steering knuckle spindle and set the indicator at zero in such conditions. Pull the drum all the way outward: the resulting movement, such as registered by the dial needle, will correspond to the end play of the wheel hub.

CHECK WITH WHEEL ON

After removing the wheel cover and hub cap, undo a wheel screw then affix bracket **A. 74029** to rim by said screw. Push the wheel straight on towards car then apply on bracket the dial indicator with magnetic base plate and proceed as previously described.

WARNING - When only the hub adjustment is necessary, first replace the nut, then adjust as directed above.

The hub end play must be adjusted when it is in excess of .0051″ (0.13 mm).

Rear Suspension

SEMI-ELLIPTIC SPRINGS

SEMI-ELLIPTIC SPRING SPECIFICATIONS

	ITEM	Load	Camber	Camber in 2nd and 3rd positions	Deflection Rate
1st	Initial load for checking deflection rate	220 lbs (100 kg)	2.83″ ± .118″ (72 ± 3 mm)	—	
2nd	Static load	496 lbs (225 kg)	—	2.72″ ± .138″ (69 ± 3.5 mm)	.714 ± .036 in/100 lbs (40 ± 2 mm/100 kg)
3rd	Bottoming load	849 lbs (385 kg)	—	4.49″ ± .236″ (114 ± 6 mm)	
4th	Settled load (*)	992 lbs (450 kg)	—	—	—

(*) Measure camber at settled load. The axes of main leaf eyes must be parallel to the plane of the main leaf and at right angles to its axis.

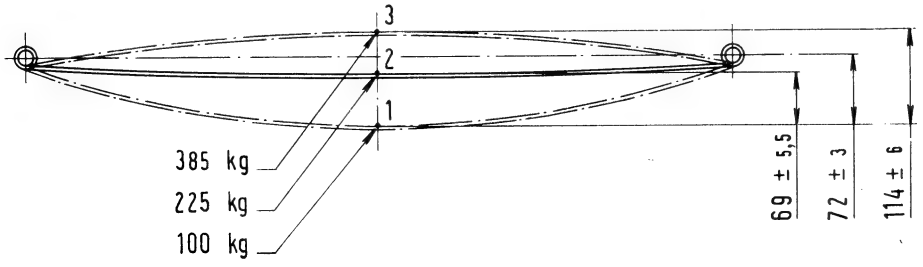


Fig. 158. - Semi-elliptic spring main leaf oscillation diagram and elastic stress data for checking spring characteristics.

385 kg = 849 lbs - 225 kg = 496 lbs - 100 kg = 220 lbs

69 ± 3,5 = 2.72″ ± .138″ - 72 ± 3 = = 2.83″ ± .118″ - 114 ± 6 = 4.49″ ± .236″

Inspection and Repair of Semi-Elliptic Spring.

If the spring must be overhauled, take it apart and check as follows:

a) Examine spring leaves to make sure that none is snapped or cracked, otherwise the whole spring package must be replaced; actually the main leaf only comes for replacement.

b) Compare the spring test data with those in the chart on foot of page and fig. 158.

c) Remove any sign of paint, nicks or roughness from leaf mating faces.

d) Examine the condition of rubber bushings in main leaf eyes and rear mounting bracket: bushing noises or squeaks are apparent with the spring mounted on car. Renew bushings if they prove to be worn.

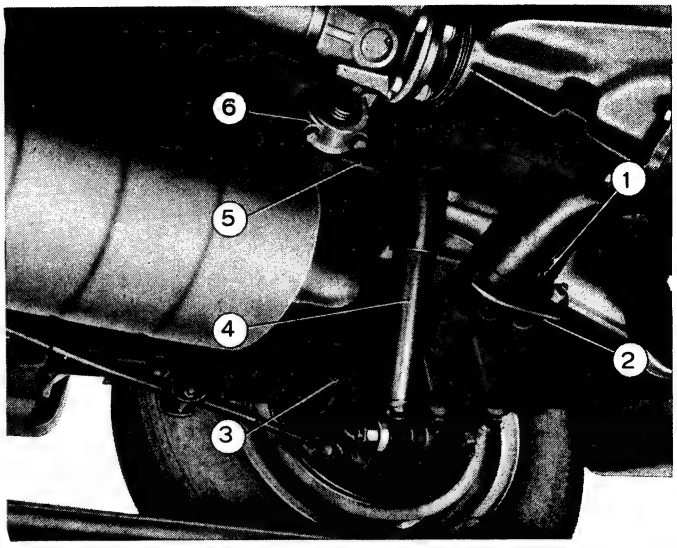


Fig. 159. - Detail of rear suspension.
1. Sway bar link - 2. Link anchor bracket - 3. Semi-elliptic spring - 4. Shock absorber - 5. Sway bar - 6. Sway bar mounting pad.

REAR SUSPENSION SPECIFICATIONS

	1500	1600 S
Semi-Elliptic Springs	two	
Composition	one main leaf and ten spring leaves	
Camber, settled spring	2.83″ ± .118″ (72 ± 3 mm) (under a load of 220 lbs - 100 kg)	
Anchor bushings	rubber	
Setting of rubber bushings:		
— in spring rear eye	42° (to the eye centerline - free spring)	
— in rear mounting bracket	35° (to the vertical)	
Lubrication: leaves and interliner recesses at leaf ends	GAMMA 1 G grease	
Shock Absorbers	2	2
Type	hydraulic	oleo-pneumatic
Pressure cylinder bore	1.063″ (27 mm)	—
Length, between eye centers:		
— retracted	12.244″ (311 mm)	12.480″ (317 mm)
— extended	19.882″ (505 mm)	19.842″ (504 mm)
Stroke (abutting begins)	7.638″ (194 mm)	7.362″ (187 mm)
Setting — compression	.1181″ ± .0394″ (3 ± 1 mm)	—
Setting — rebound	.3937″ ± .0591″ (10 ± 1.5 mm)	—
Fluid quality	FIAT S.A.I.	—
Fluid capacity	.33 G.B. pts - .39 U.S. pts (0.185 lt)	—
Sway Bar	Mounted on underbody through rubber blocks and anchored to axle housing through links	

Brakes

1500 CABRIOLET

The braking system consists of:

— Hydraulic, pedal-operated service brakes of the disc type at front and of the drum type at rear.

— Mechanical parking and emergency brake on rear wheels, controlled by a ratchet lever.

— Vacuum brake booster to relieve the driver's effort on brake pedal.

— Floating valve-type master cylinder.

1600 S CABRIOLET

The braking system differs from the above description just because disc brakes are adopted throughout and a pressure regulator is fitted to control fluid pressure to rear brakes.

DISC BRAKES

This brake type consists basically of a cast-iron disc and a caliper also of cast-iron. The brake disc, which is attached to and rotates with the hub, is straddled by the caliper being integrated to the steering knuckle pillar (and axle housing, 1600 S only) through a plate.

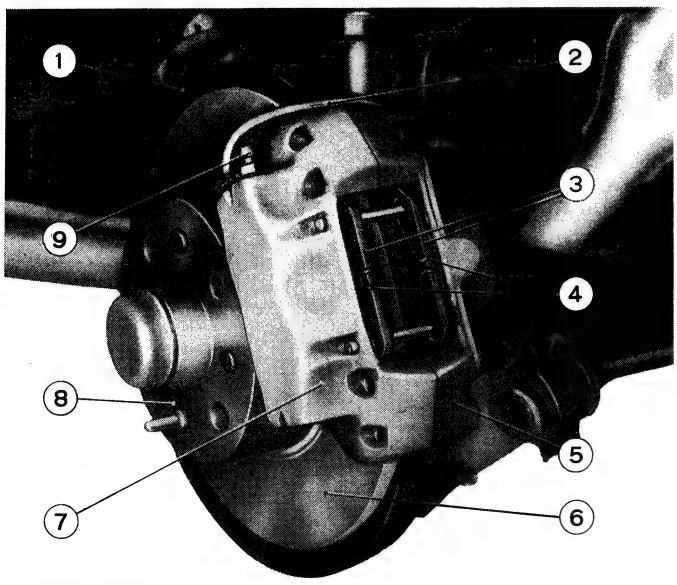


Fig. 160. - Right front wheel disc brake assembly - 1500 Cabriolet.

1. Shield - 2. Fluid line interconnecting caliper halves - 3. Friction lining pad and plate assemblies - 4. Fasteners - 5. Inboard caliper half - 6. Brake disc - 7. Outboard caliper half - 8. Wheel hub - 9. Bleeder screw.

Fig. 161. - Left front wheel brake caliper - 1500 Cabriolet.

1. Brake caliper - 2-3. Caliper half interlocking bolts - 4. Plates with lining pads - 5. Spring fasteners - 6. Screws, caliper to plate - 7. Screws and nuts, plate to knuckle pillar.

The caliper is fitted with three cylinders: one cylinder on caliper inboard half and two cylinders on caliper outboard half (fig. 160). The brake fluid line from master cylinder is connected with the caliper inner half and circuited to relevant cylinder. The two cylinders of the caliper outer half are circuited to the inner half cylinder through a proper line (2, fig. 160). Friction lining pads are fitted between pistons and the brake disc and retained in calipers by means of pins, fasteners and cotters.

The braking action is developed by the lining pads on both sides of the rotary disc; in stationary position lining pads are just in touch with the disc, ready for the next braking action.

Provision is made for automatic take-up of clearance from wear; therefore no manual adjustment is required.

In 1600 S, a manual linkage fitted to the rear calipers operates the brake disc through separate friction pads.

Prior to carrying out any maintenance job to the braking system, take care to clean the system using exclusively warm water with **FIAT LD detergent:** dry immediately with an air blast. Follow this procedure whenever the vehicle is cleaned.

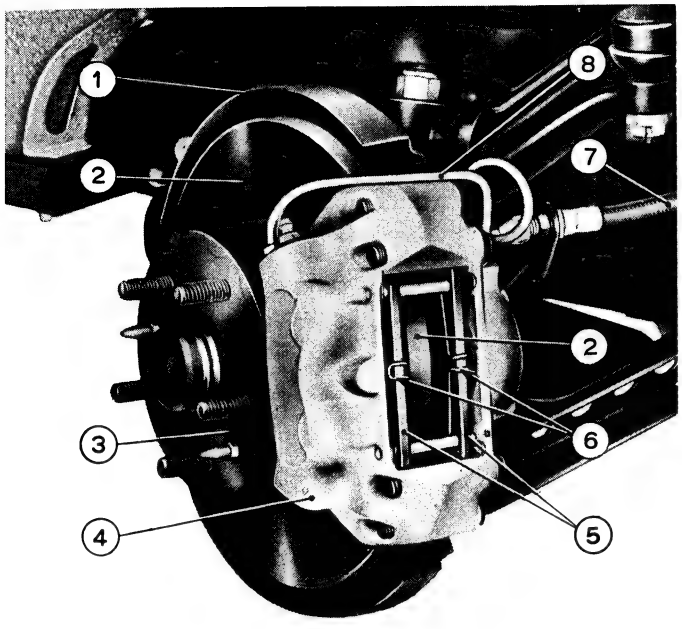


Fig. 162. - Left front wheel disc brake - 1600 S Cabriolet.

1. Shield - 2. Disc - 3. Wheel hub - 4. Caliper - 5. Plates with lining pads - 6. Pad spring retainers - 7. Brake fluid line to caliper inboard half - 8. Bridge pipe, inboard-to-outboard caliper half.

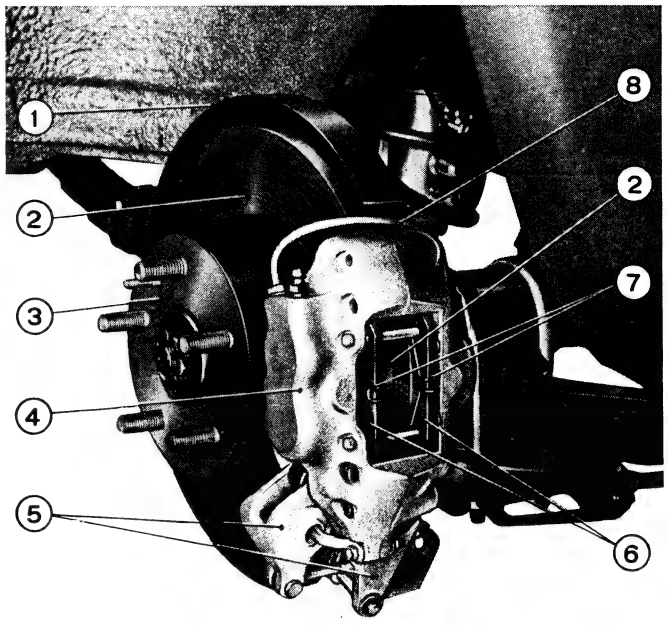


Fig. 163. - Left rear wheel disc brake - 1600 S Cabriolet.

1. Shield - 2. Disc - 3. Wheel hub - 4. Caliper - 5. Manual brake mechanism - 6. Plates with lining pads - 7. Pad spring retainers - 8. Bridge pipe, inboard-to-outboard caliper half.

Manual Brake Mechanism on Rear Discs (1600 S).

When the ratchet lever (fig. 187) is pulled, it displaces the adjustment rod and metal rope at whose ends are fixed the pull yokes operating the manual brake mechanism; the manual brake is quite efficient and capable of immobilizing the vehicle even if parked on a steep incline.

Replacing Lining Pads.

Lining pads can be inspected from outside the caliper, after removing the road wheel; replace the lining pads if damaged or worn to .1181″ (3 mm) thickness.

Withdraw lining pads as follows: remove fasteners (4, fig. 160), slide off retaining pins and remove the plates (3) which carry the lining pads. Push in pistons in cylinder bores, using care not to ruin cylinder rubber seals in doing so.

Insert the plates with a new set of lining pads, install retaining pins, cotter pins and fasteners.

Before driving away the car after lining pad replacement, the brake pedal should be pumped until a solid resistance is felt: this will re-set the pistons in position.

NOTE - Recourse should be made only to the specified type of cleaner (FIAT LDC) to wash the disc brakes.

Use of different fluids (such as gasoline, diesel fuel, trichloroethylene or mineral solvents of any kind) might cause damage to cylinder seals.

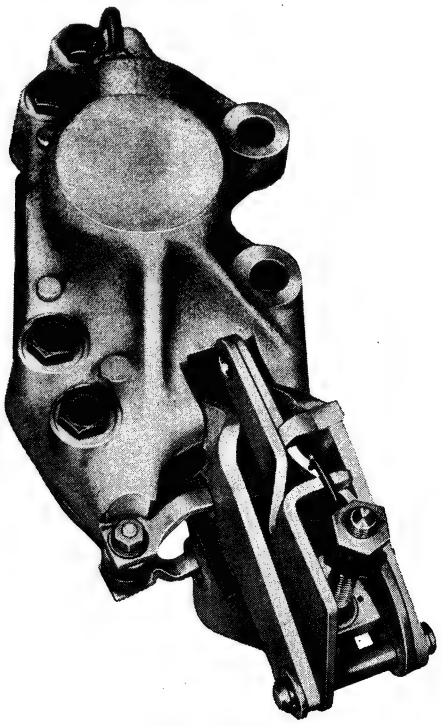


Fig. 164. - Left rear caliper assembly with manual brake mechanism - 1600 S Cabriolet.

FRONT AND REAR DISC BRAKES FOR 1600 S CABRIOLET

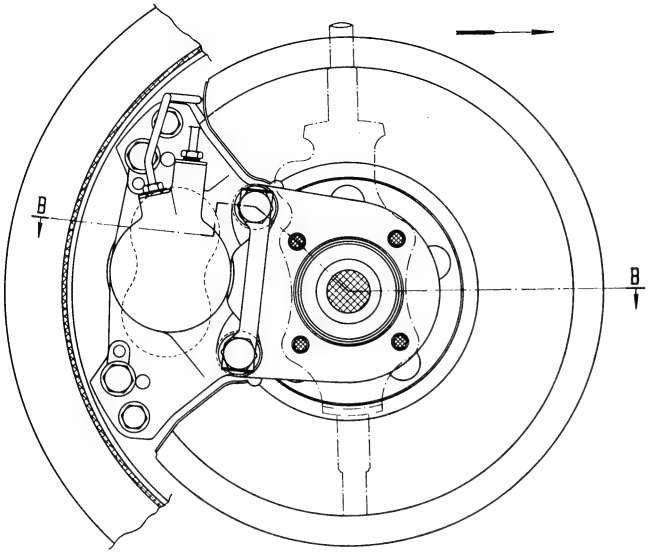


Fig. 165.

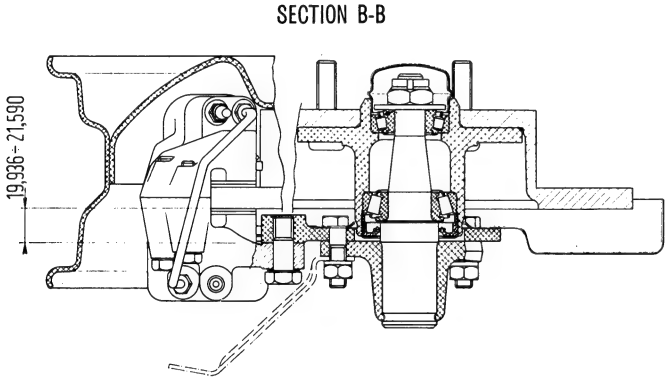


Fig. 166.

Figs. 165 and 166. - Detail of brake disc and of caliper installation on its mounting plate at steering knuckle.

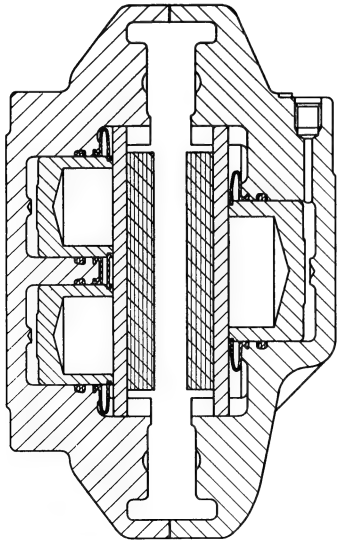


Fig. 167. - Front caliper - Sectional view across pistons, lining pads and backing plates.

Piston seal rings and dust covers are also shown.

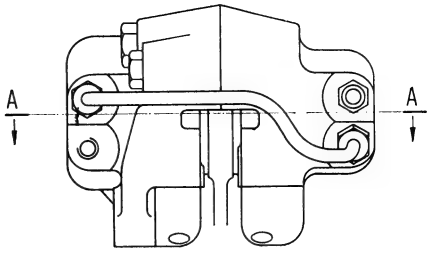


Fig. 168.

In foreground, the bridge pipe interconnecting the cylinders of two caliper halves.

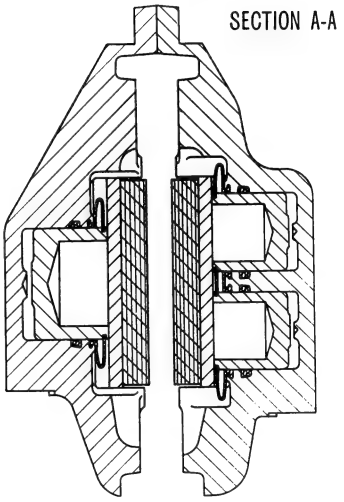


Fig. 169.

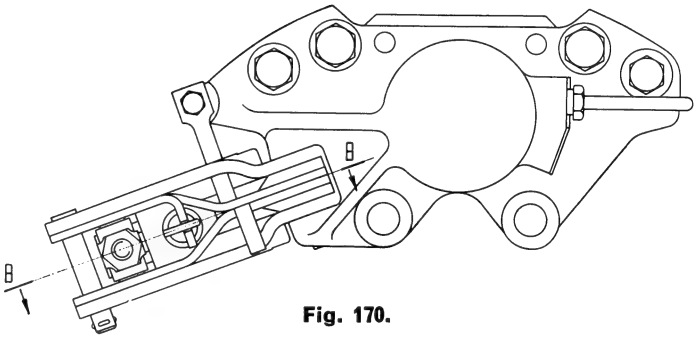


Fig. 170.

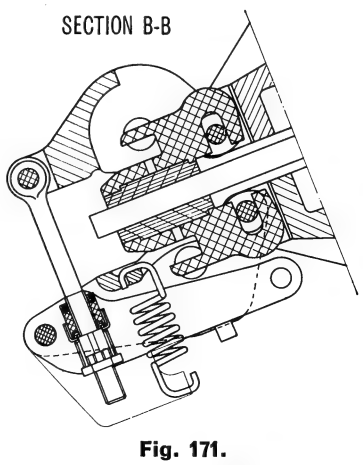


Fig. 171.

Figs. 168, 169, 170 and 171. - Rear caliper assembly - Sectional views across pistons, plates and lining pads, and manual brake mechanism.

Service Procedures.

CALIPER HALVES

Caliper halves should be separated only in very exceptional cases. If calipers have been opened, when halves are again joined together it is essential to first align the retaining pin holes using two pegs of .2570" (6.527 mm) in diam. and then apply the mounting bolts. Lubricate bolts with FIAT special brake fluid (Blue Label) or equivalent, before insertion in their holes.

Specified tightening torques are as follows:

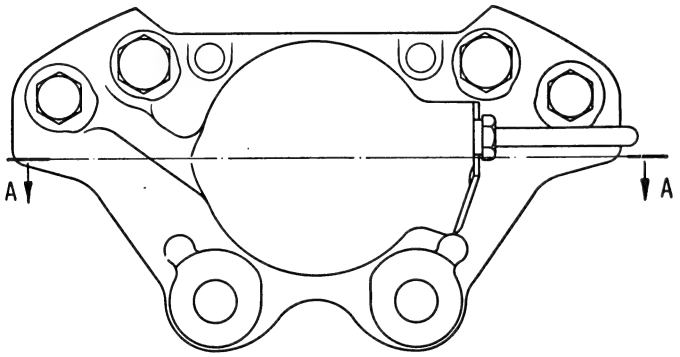
— **Front calipers** (fig. 173):

Inner pair of bolts (2): 1500 28.2 to 29.7 ft.lbs (3.9 to 4.1 kgm); 1600 S 66.5 to 70.2 ft.lbs (9.2 to 9.7 kgm)

Outer pair of bolts (1) (1500 and 1600 S) 52.1 to 55 ft.lbs (7.2 to 7.6 kgm)

— **Rear calipers** (1600 S, fig. 174):

Inner and outer pair of bolts . . . . . 52.1 to 55 ft.lbs (7.2 to 7.6 kgm)



SECTION A-A

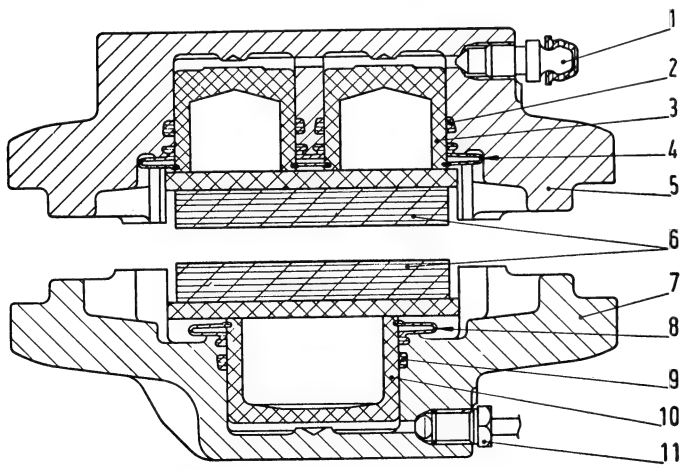


Fig. 172. - Side and section view of the right caliper for 1500 Cabriolet front wheel disc brake.

1. Bleeder screw - 2. Outer caliper half gasket - 3. Outer caliper half pistons - 4. Outer caliper half piston dust shield - 5. Outer caliper half - 6. Lining pads with carrier plate - 7. Inner caliper half - 8. Inner caliper half piston dust shield - 9. Inner caliper half gasket - 10. Inner caliper half piston - 11. Fluid pipe interconnecting caliper halves.

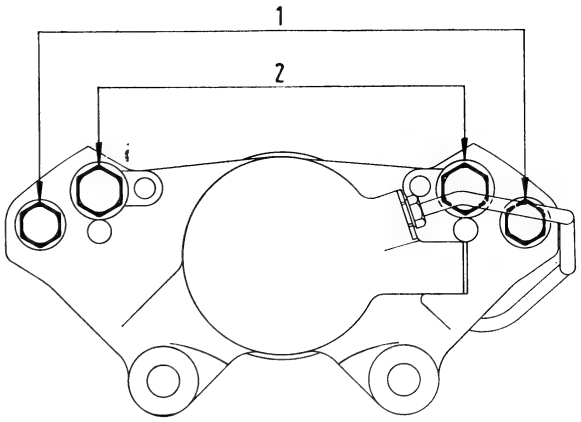


Fig. 173. - Tightening torques of front caliper halves.

1. 52.1 to 55 ft.lbs (7.2 to 7.6 kgm) for 1500 and 1600 S.
2. 28.2 to 29.7 ft.lbs (3.9 to 4.1 kgm) for 1500 - 66.5 to 70.2 ft.lbs (9.2 to 9.7 kgm) for 1600 S.

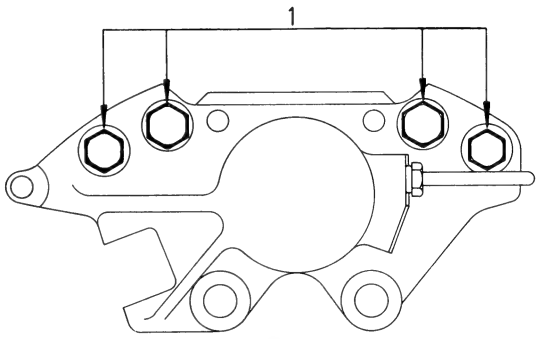


Fig. 174. - Tightening torques of rear caliper halves (1600 S Cabriolet).

1. 52.1 to 55 ft.lbs (7.2 to 7.6 kgm).

The two caliper-to-mounting plate screws, both front and rear, must be tightened to a torque of 65.1 to 72.3 ft.lbs (9 to 10 kgm).

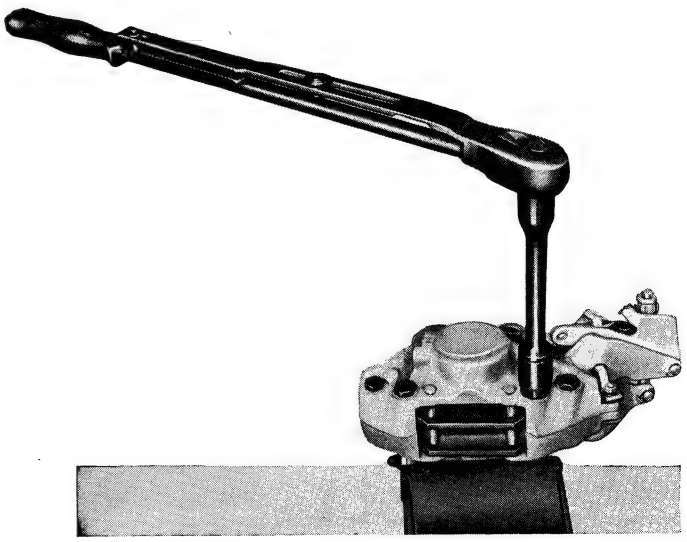


Fig. 175. - Drawing up caliper half interlocking screws using a torque wrench.

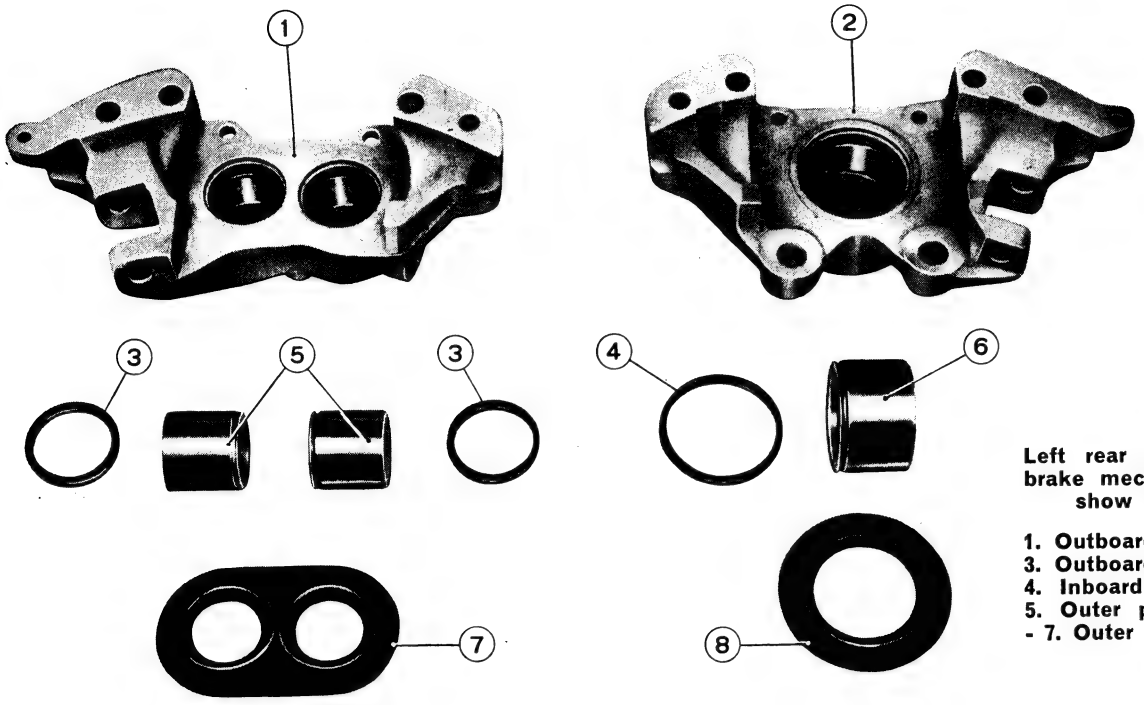


Fig. 176.

Left rear caliper (without manual brake mechanism) disassembled to show components (1600 S).

1. Outboard half - 2. Inboard half - 3. Outboard half piston seal rings - 4. Inboard half piston seal ring - 5. Outer pistons - 6. Inner piston - 7. Outer dust cover - 8. Inner dust cover.

PISTONS AND SEAL RINGS

To disassemble the pistons and seal rings proceed as follows:

— remove the caliper assembly from the vehicle. Then, after sliding out the lining pads, remove the rubber dust covers (see figs. 176 and 177);

— pistons and their seal rings are removed by withdrawing them from the caliper body without unbolting the caliper halves;

— the sealing rings may then be removed by inserting a blunt tool under the seals and prying out, taking care not to damage the locating grooves.

Clean the different parts after disassembly.

Examine the pistons and bores carefully for any signs of seizure or scuffing.

If necessary, replace any damaged component as required.

NOTE - Whenever pistons are removed for servicing, always replace the seal rings in caliper body as this is an essential condition for good operation of the system.

The re-assembly of seal rings and pistons must be done with great care making sure parts are perfectly clean.

The rubber dust covers must be located with a projecting lip in the groove provided in pistons and the other lip in the cylinder bore.

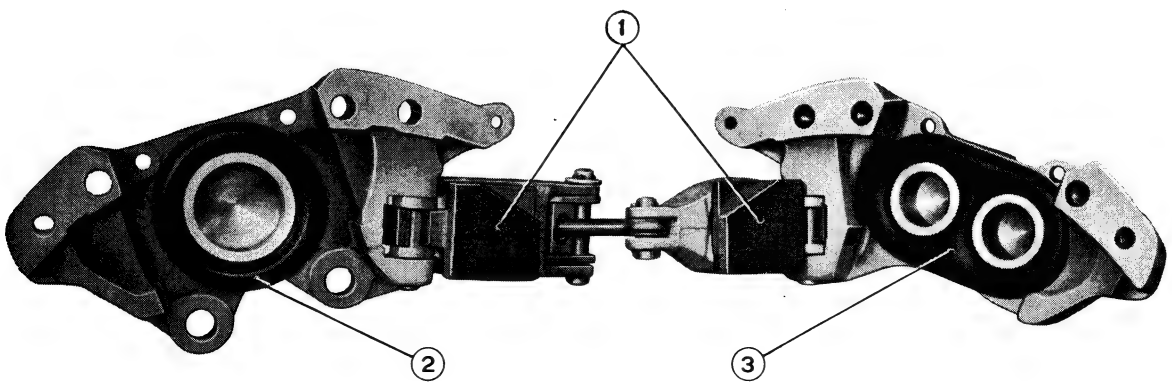


Fig. 177.

Left rear caliper assemby, with manual brake mechanism, viewed with an open caliper.

1. Manual brake lining pads - 2. Inner dust cover - 3. Outer dust cover.

BRAKE DISC

In case of replacement, check that discs of both front and rear brakes (1600 S) on car, run perfectly true between the pads (fig. 179). The maximum run-out permissible on the disc is .0059″ (0.15 mm).

If disc run-out is greater than .0059″ (0.15 mm), check accurately the location on steering knuckle (front discs) and/or the location on axle shaft (rear discs) (1600 S) and correct as required.

If out-of-true persists:

— front disc: replace by a new one;

— rear disc: an attempt may be made to correct the condition by changing the relative position of hub on axle shaft: to do so, re-locate the disc-and-hub of one or two splines; otherwise renew the disc.

In case of deep scoring marks or other signs of deterioration the brake disc may be re-ground: the stock removal on either face should not exceed .02″ (0.5 mm) in thickness.

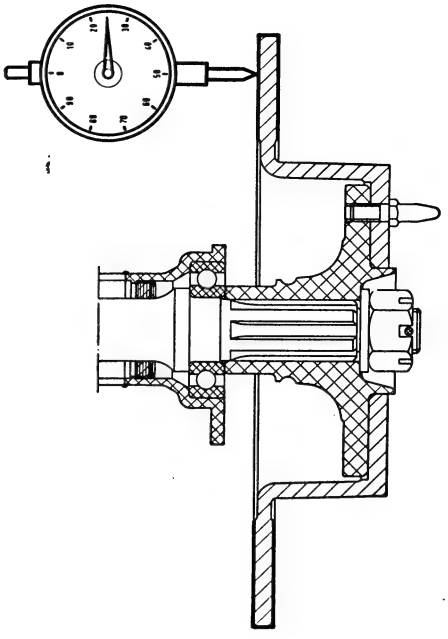


Fig. 179. - Checking brake disc run-out with a dial indicator.

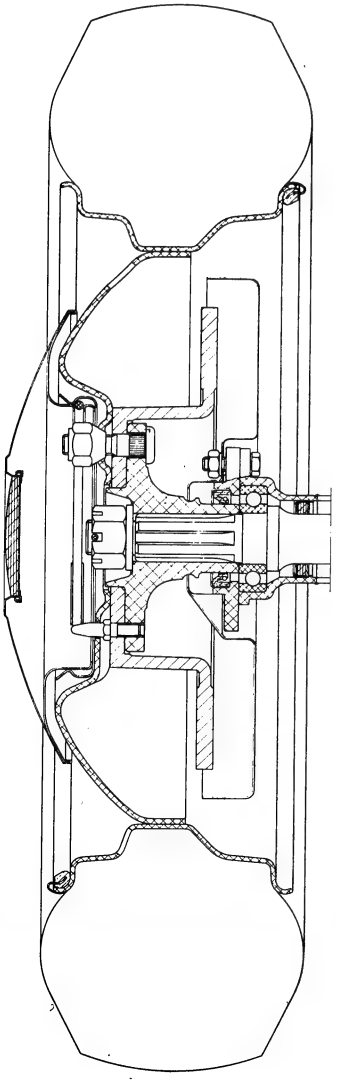


Fig. 178. - Sectional view of a rear wheel across hub and brake disc (1600 S Cabriolet).

REAR SHOE BRAKES

(1500 Cabriolet)

The rear wheel brakes are of the sheet-metal self-centering shoe, aluminum drum type with cast-iron ring. Shoe control by one dual-piston wheel cylinder at top.

The manual brake actuating lever is installed on the rear shoe.

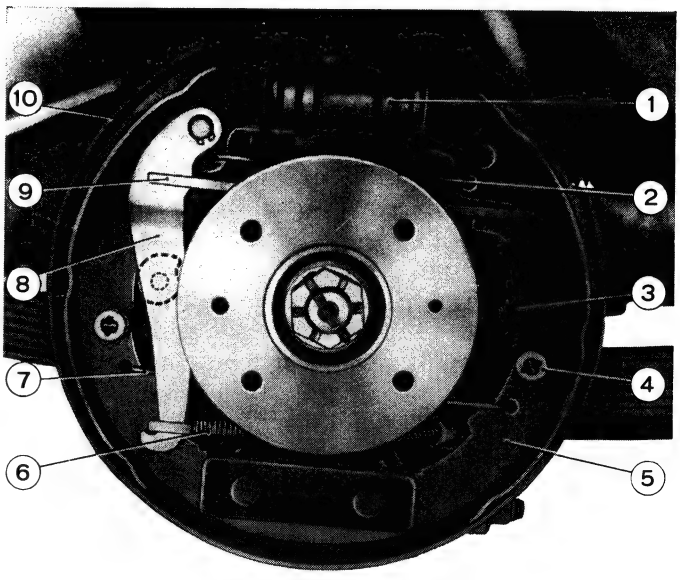


Fig. 180. - Right rear wheel brake backing plate assembly (1500 Cabriolet).

1. Wheel cylinder - 2. Shoe return spring, upper - 3. Brake shoe-to-drum clearance adjusting cam - 4. Shoe guide pins - 5. Brake shoe - 6. Manual brake control cable - 7. Shoe return spring, lower - 8. Manual brake shoe actuating lever - 9. Manual brake shoe actuating segment - 10. Brake backing plate.

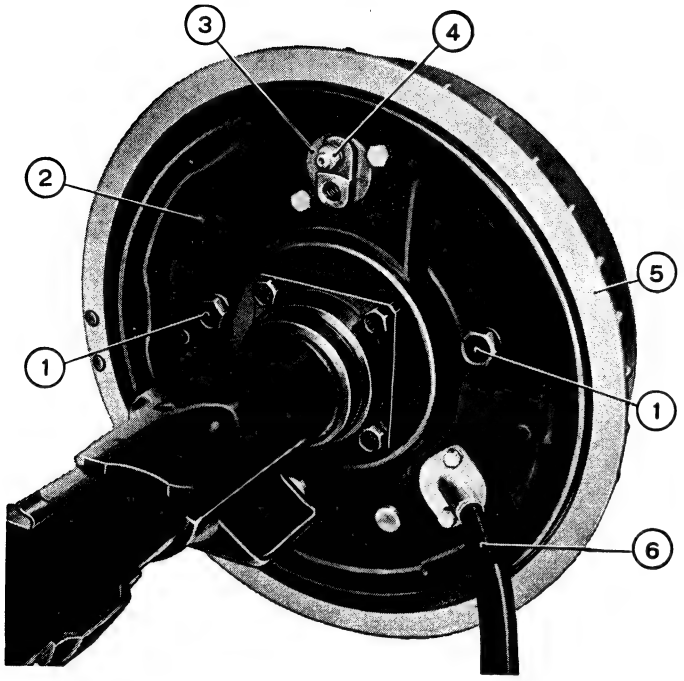


Fig. 181. - Close-up view of left-hand rear wheel brake backing plate (1500 Cabriolet).

1. Shoe-to-drum clearance adjusting cam nuts - 2. Brake backing plate - 3. Wheel cylinder - 4. Bleeder screw - 5. Brake drum - 6. Manual brake control cable.

Adjusting Shoe-to-Drum Clearance.

To adjust the shoe-to-drum clearance, proceed as follows:

a) Depress the brake pedal to have the shoes adhere against the drum.

b) With the shoes spreaded, turn the outer nuts (1, fig. 181) of the adjusting cams (3, fig. 180) so that these are brought in touch with the shoes; release the brake pedal and rotate nuts in opposite direction until a **.0039″ to .0059″ (0.10 to 0.15 mm) brake shoe-to-drum clearance** is obtained. To check clearance, thread a feeler stock through slots machined on drum outside.

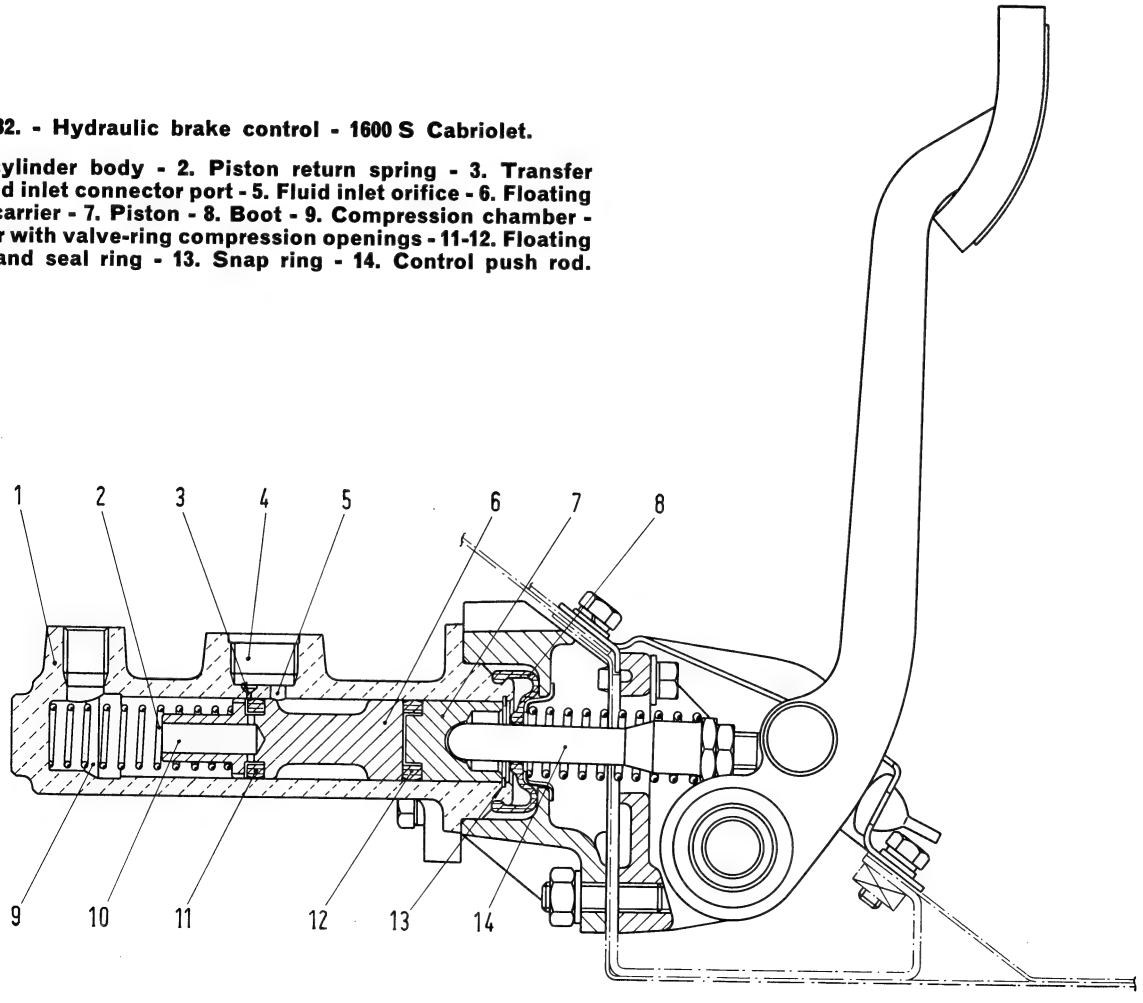
c) Work vigorously on brake pedal three or four times, again check clearance and correct any possible variations.

Brake Drums.

When brake drums are turned on lathe and lapped, the maximum oversize allowed in respect of their nominal diameter (9.8503″ to 9.8582″ - 250.2 to 250.4 mm), is .0315″ (0.8 mm).

Fig. 182. - Hydraulic brake control - 1600 S Cabriolet.

1. Master cylinder body - 2. Piston return spring - 3. Transfer port - 4. Fluid inlet connector port - 5. Fluid inlet orifice - 6. Floating valve-ring carrier - 7. Piston - 8. Boot - 9. Compression chamber - 10. Chamber with valve-ring compression openings - 11-12. Floating valve-ring and seal ring - 13. Snap ring - 14. Control push rod.



Never exceed this limit, or else both the drum strenght and the braking power would be adversely affected. As a matter of fact the longer shoe expansion travel would result in a weaker contact pressure.

MASTER CYLINDER

The pedal operates the master cylinder (fig. 182) which transmits the pressure to the wheel cylinders in wheel calipers. The master cylinder is of the conventional floating valve type; for inspection and servicing just proceed as directed in the service literature of current production motor cars.

PRESSURE REGULATOR

(1600 S Cabriolet)

This device (fig. 183) consists mainly of a body in which a dual diameter piston slides. The smaller diameter end of body forms a high-pressure chamber (A), while the larger diameter end forms a low-pressure chamber (B).

Chamber (A) communicates with master cylinder primary circuit, while chamber (B) communicates with the secondary circuit to rear wheel cylinders.

The two chambers (A) and (B) may intercommunicate only through a check valve (14) incorporated in differential diameter piston (5).

The reduction between the pressures in chamber (B) and chamber (A) is accomplished by the difference in the areas of the two working surfaces of piston (5).

In high pressure chamber (A) is housed a calibrated spring (17) which exerts its pressure on the smaller diameter face of the piston which, in its rest position, is thus kept pressed against cylinder end plug (10).

When in position of rest, therefore, valve (14) is kept open by grooved pushrod (4) which overcomes the resistance of reaction spring (15) thus allowing intercommunication between chambers (A) and (B).

When brake pedal is depressed, the fluid flows from chamber (A) to chamber (B) through valve (14).

As pressure increases the difference in pressure on the larger and smaller diameter faces of piston (5) moves piston towards chamber (A), overcomes the resistance of spring (17) and frees valve (14) from pushrod (4); valve (14) is then pushed towards its seat under the action of spring (15) determining its complete closing when the pressure reaches the specified figure of about 213 psi (15 kg/cm²).

As a result, under this condition the communication between chambers (A) and (B) is intercepted, delivery pressure acts on the smaller-diameter face of the differential piston and pressure in chamber (B) is thus lower than in chamber (A). Consequently, also the pressure in the rear wheel brake cylinders is proportionally lower than the pressure at master cylinder outlet.

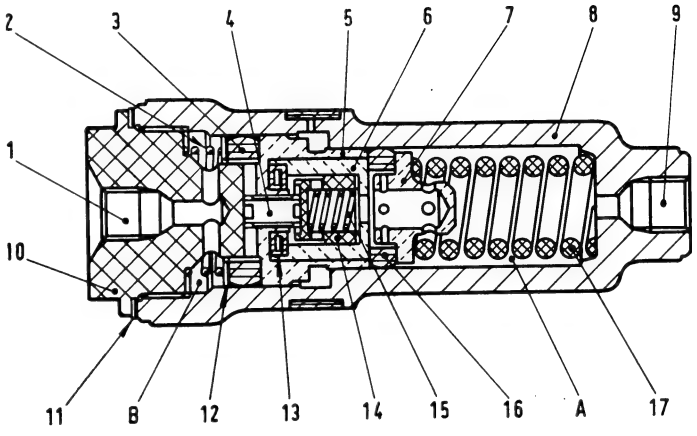


Fig. 183. - Longitudinal section view of pressure regulating cylinder.

1. Connection, fluid delivery line to rear wheel brake cylinders - 2. Spring, flexible seal ring - 3. Seal ring, low-pressure chamber - 4. Pushrod, valve - 5. Two-diameter (differential) piston - 6. Valve holder - 7. Seal ring carrier - 8. Body, pressure regulating cylinder - 9. Connection, line from master cylinder - 10. Plug, low-pressure chamber - 11. Gasket, plug - 12. Washer, spring seat - 13. Seal, valve - 14. Valve - 15. Spring, valve - 16. Seal ring, high-pressure chamber - 17. Spring, reaction.

A. High-pressure chamber - B. Low-pressure chamber.

When the pressure in chamber (A) further increases, piston (5) is again shifted towards chamber (B) thus opening valve (14) and allowing an additional amount of fluid to pass from chamber (A) into chamber (B). As this involves an increased pressure in the rear wheel brake circuit, it causes valve (14) to close again, thus re-instating the pressure differential between the rear wheel brake circuit and the master cylinder.

From the above description it is inferred that to close the passage between chambers (A) and (B) the differential piston (5) must move — after overcoming the resistance of spring (17) — of an amount sufficient to free valve (14) completely, and this is obtained starting from a delivery pressure of abt. 213 psi (15 kg/cm²).

When brake pedal is released, pressure in chamber (A) decreases, differential piston — under the action of spring (17) — is pushed against plug (10), valve (14) is opened by pushrod (4) and the fluid in the rear wheel brake circuit is sent back to master cylinder circuit.

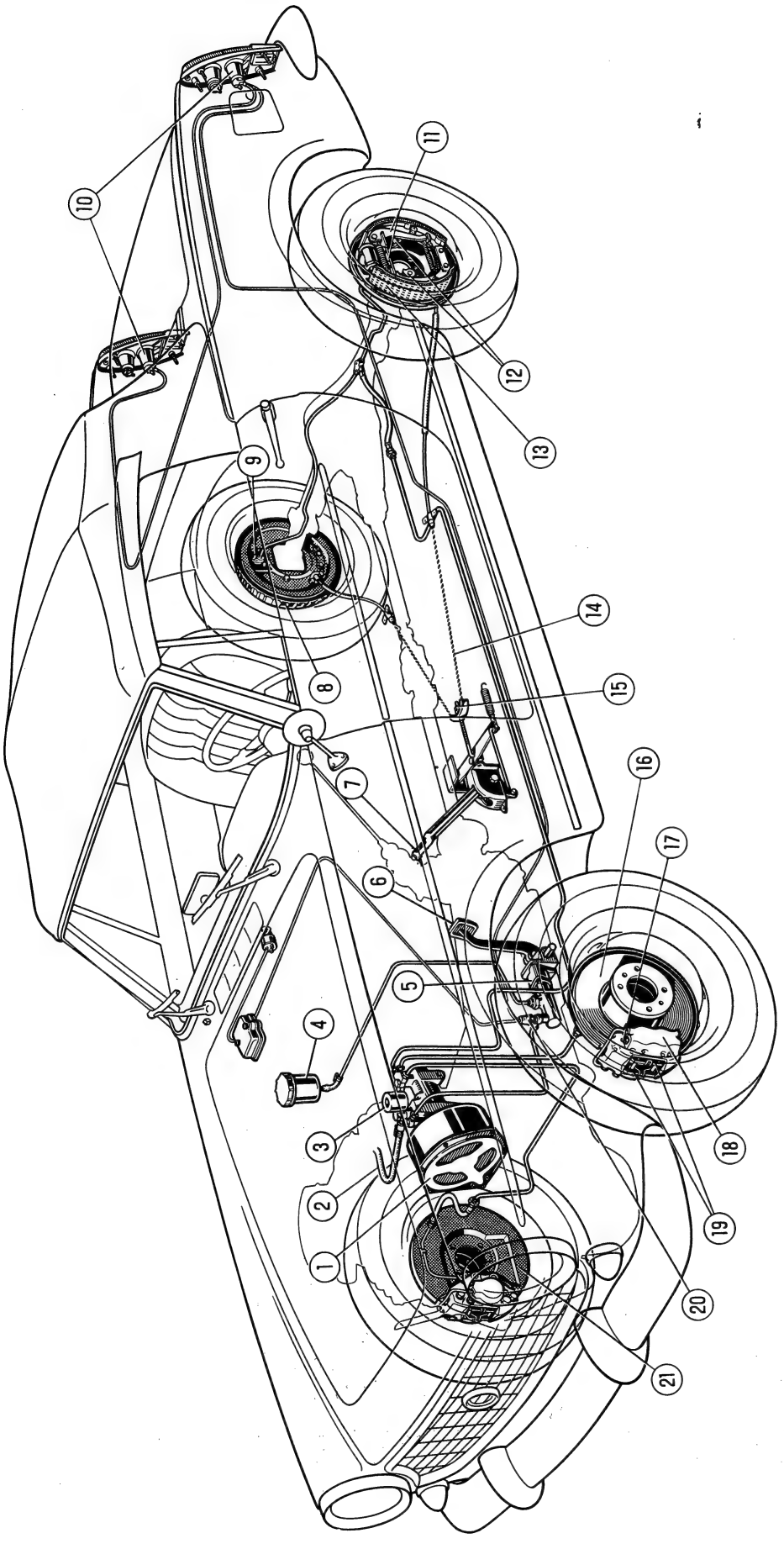


Fig. 184. - Service and parking brake system diagram - 1500 Cabriolet.

1. Vacuum brake booster - 2. Line from intake duct to brake booster - 3. Brake booster air filter - 4. Brake fluid reservoir - 5. Master cylinder - 6. Brake pedal - 7. Manual brake ratchet lever - 8. Rear brake drum - 9. Rear brakes circuit bleeder connection - 10. Stop lights - 11. Rear brake shoe operating lever, actuated by lever (7) - 12. Rear brake shoe-to-drum clearance adjustment campins - 13. Rear brake shoes - 14. Manual brake control cable - 15. Manual brake ratchet lever stroke adjuster - 16. Front brake disc - 17. Front brake circuit bleeder connection - 18. Front brake calipers - 19. Pad carrier plates - 20. Stop light jam switch - 21. Front brake disc shield.

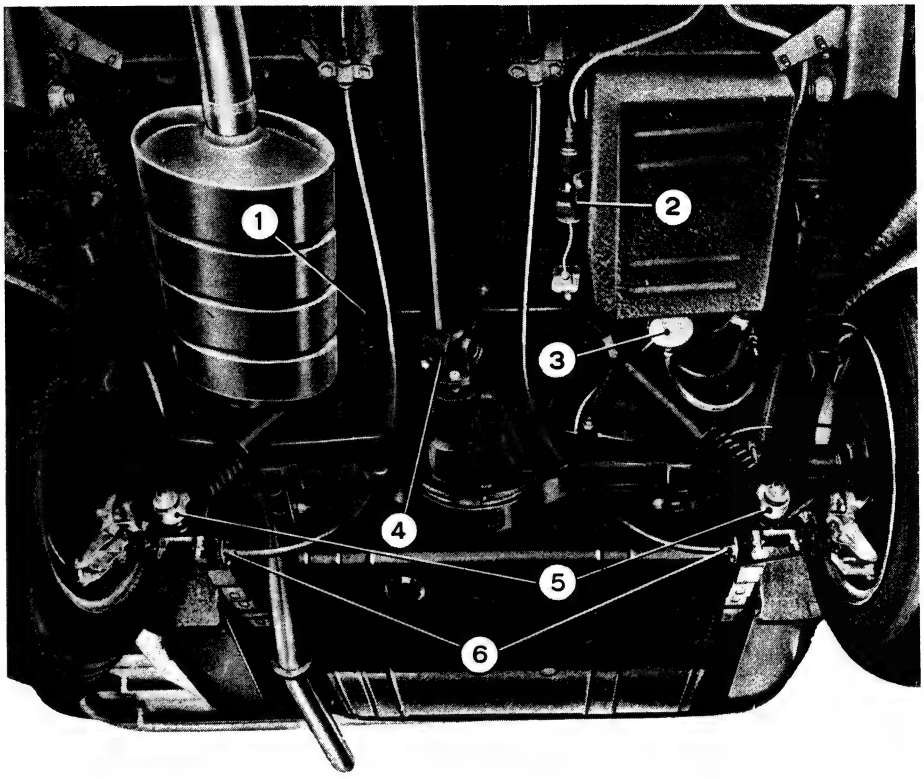


Fig. 185.

Bottom view of 1600 S Cabriolet rear end.

1. Sway bar - 2. Pressure regulator for rear wheel brakes - 3. Electric fuel pump - 4. « U » joint - 5. Shock absorber mountings - 6. Parking brake controls.

BLEEDING HYDRAULIC LINES

To air bleed the hydraulic brake system, follow the usual procedure, keeping mind to it that the front wheel brake bleeder screws are located on the outboard caliper half at the outer top cylinder (figs. 184 and 191).

The bleeder screw of rear shoe brakes (1500) is shown in fig. 184.

BRAKE BOOSTER

The brake booster (Girling « Hydrovac ») is installed in the hydraulic system between the master cylinder and the wheel cylinders; the outlet pipe from the master cylinder is connected to the booster hydraulic inlet and three lines from the booster outlet convey fluid to the wheel cylinders.

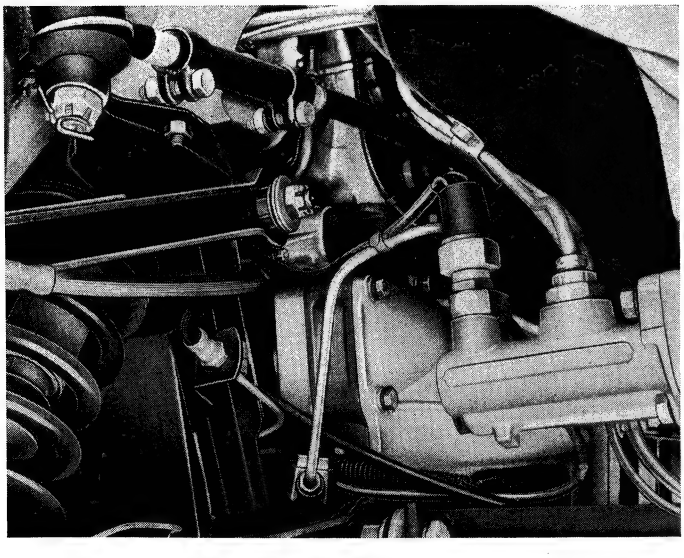


Fig. 186. - Detail showing 1600 S Cabriolet master cylinder.

The force required to augment the driver's effort on brake pedal is obtained by admitting atmospheric pressure to a vacuum cylinder containing a piston.

The pressure difference thus obtained across the vacuum piston produces a thrust load which is used to increase the hydraulic pressure available at the wheel cylinders.

The brake booster has been designed so that in case of damage to the engine, or of loss of vacuum in the unit, the brakes will operate all the same in the conventional method, using only the hydraulic pressure which is created in the master cylinder.

The unit may be considered in five parts:

1) The vacuum cylinder, which supplies the force to operate the output cylinder.
2) The air filter.
3) The valve chest, which houses the valves controlling the movement of air to and from the vacuum cylinder.
4) The valve control pistons, occupying the upper bore of the body.
5) The hydraulic output cylinder, from which the pressure is applied to the brakes.

1600 S CABRIOLET MANUAL BRAKE ON REAR WHEELS

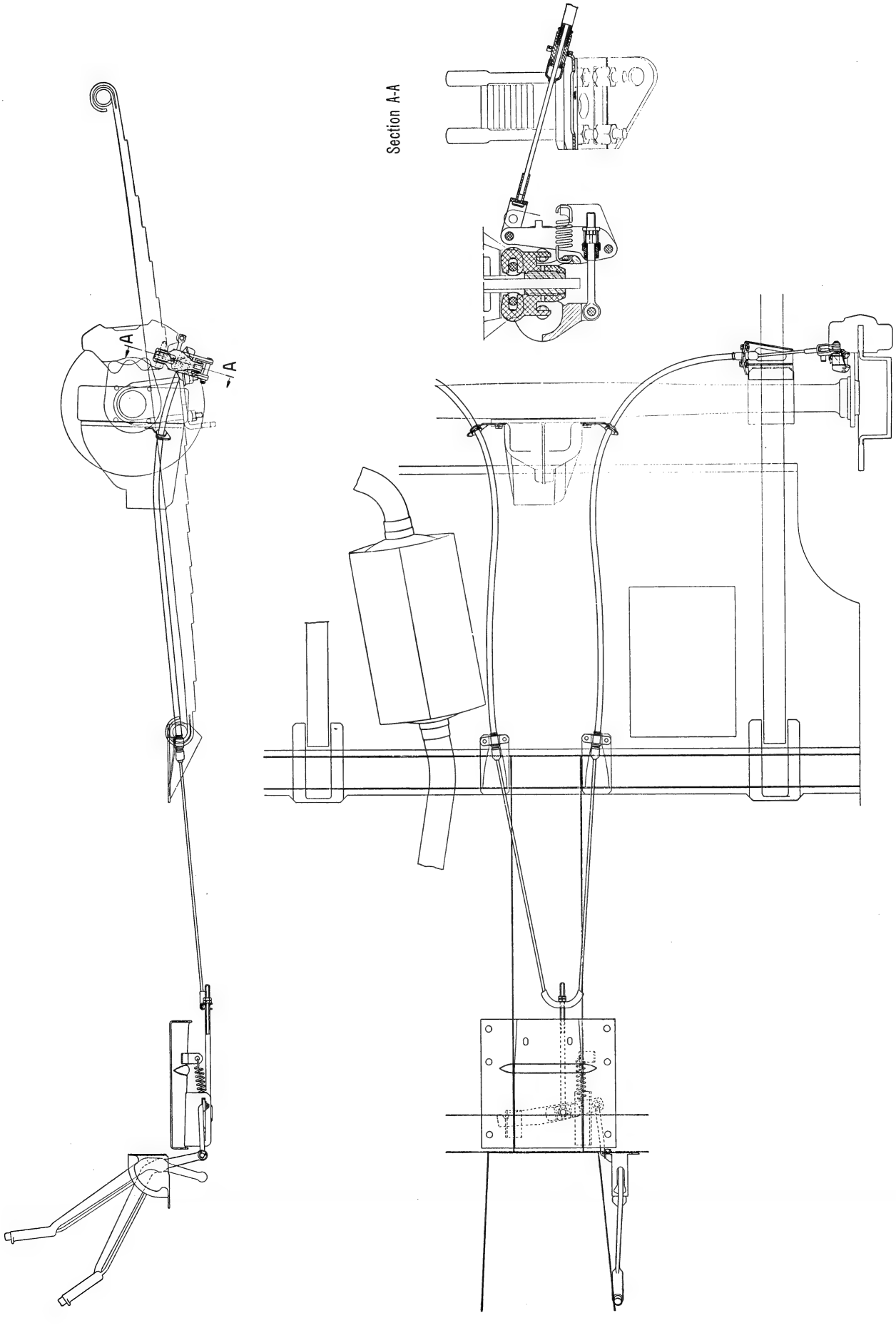


Fig. 187. - Layout of manual brake assembly with detail of actuating mechanism on rear wheel disc.

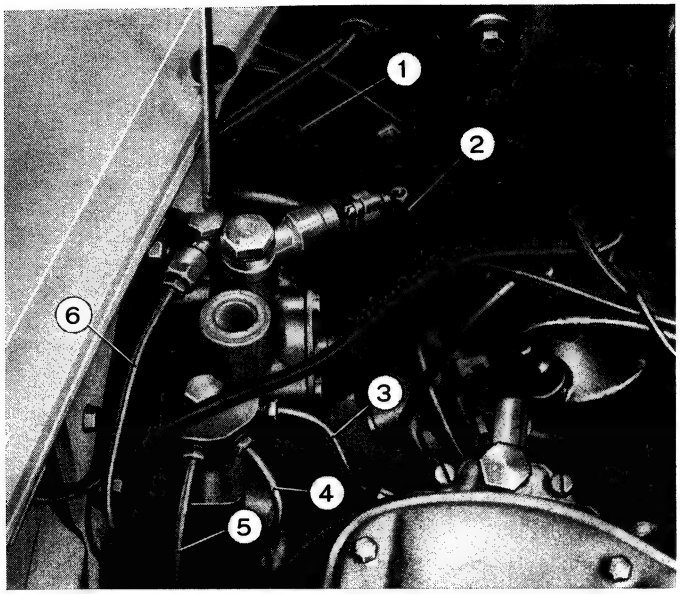


Fig. 188. - Detail of brake booster mounting on 1500 Cabriolet.

1. Brake booster - 2. Air hose from intake manifold - 3. Fluid line to right front wheel - 4. Fluid line to rear wheels - 5. Fluid line to left front wheel - 6. Fluid line from master cylinder to brake booster.

Inspection and Repair.

For check and rebuild procedures of the brake booster (Girling « Hydrovac »), reference should be made to « Brake Servo Units » Print SAT No. 1617 - Norm. 501.554.

EMERGENCY AND PARKING BRAKE

1500 Cabriolet.

After the brake shoe-to-drum clearance has been adjusted, as outlined on page 112, set the trip of manual brake handle.

Place the handle in rest position, then draw it up two ratchet serrations; in these conditions work on the tensioner (5, fig. 189) so that the cable is stretched out.

Place the handle in rest position and again check the shoe-to-drum clearance for the specified .0039″ to .0059″ (0.10 to .015 mm).

1600 S Cabriolet.

If the clearance between the brake disc and manual brake lining pads exceeds .0039″ (0.10 mm), adjust the manual brake as follows.

Set the manual brake handle in rest position.

Spread lining pads against both wheel brake discs by working on the adjusting nut (4, fig. 190).

Stretch the control cable by means of tensioner (5, fig. 189).

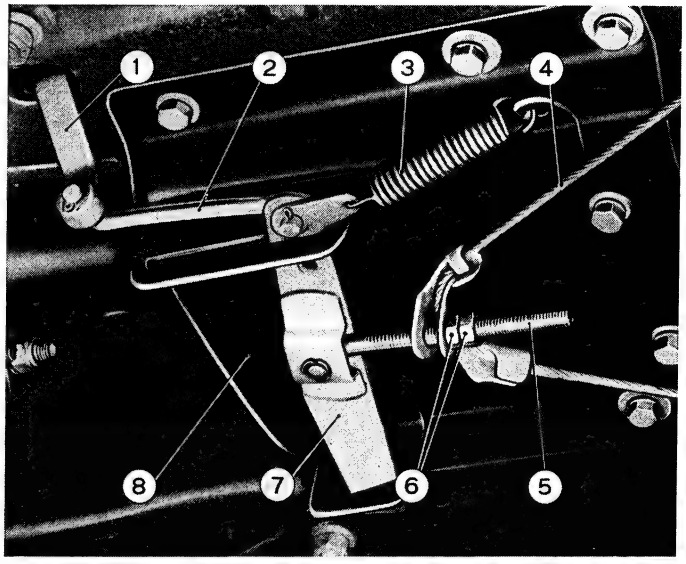


Fig. 189. - Scrap view of manual brake linkage.

1. Operating lever - 2. Link - 3. Lever return spring - 4. Cable - 5. Cable tensioner - 6. Tensioner adjuster and locking nuts - 7. Relay lever - 8. Supporting plate.

Loosen the adjusting nut (4, fig. 190) so that a clearance of .0039″ (0.10 mm) is restored between each lining pad and disc.

After actuating the manual brake handle several times, check that the .0039″ (0.10 mm) clearance between lining pads and disc has not been varied and the actuating mechanism is lined up to the disc.

Sparingly lubricate manual brake linkage articulations using care that grease does not soil either the lining pads or the disc.

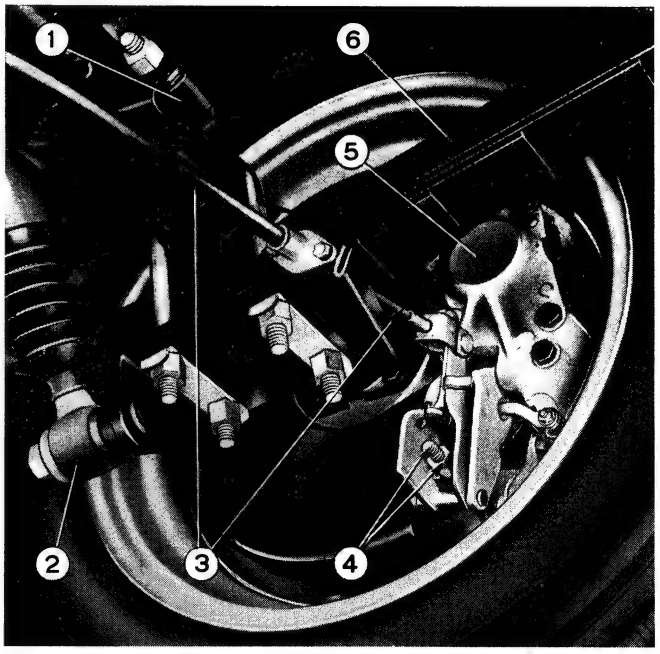


Fig. 190. - Detail of a rear wheel brake (1600 S).

1. Sway bar - 2. Shock absorber - 3. Manual brake control cable - 4. Manual brake lining pad adjusting screw and nut - 5. Disc brake caliper.

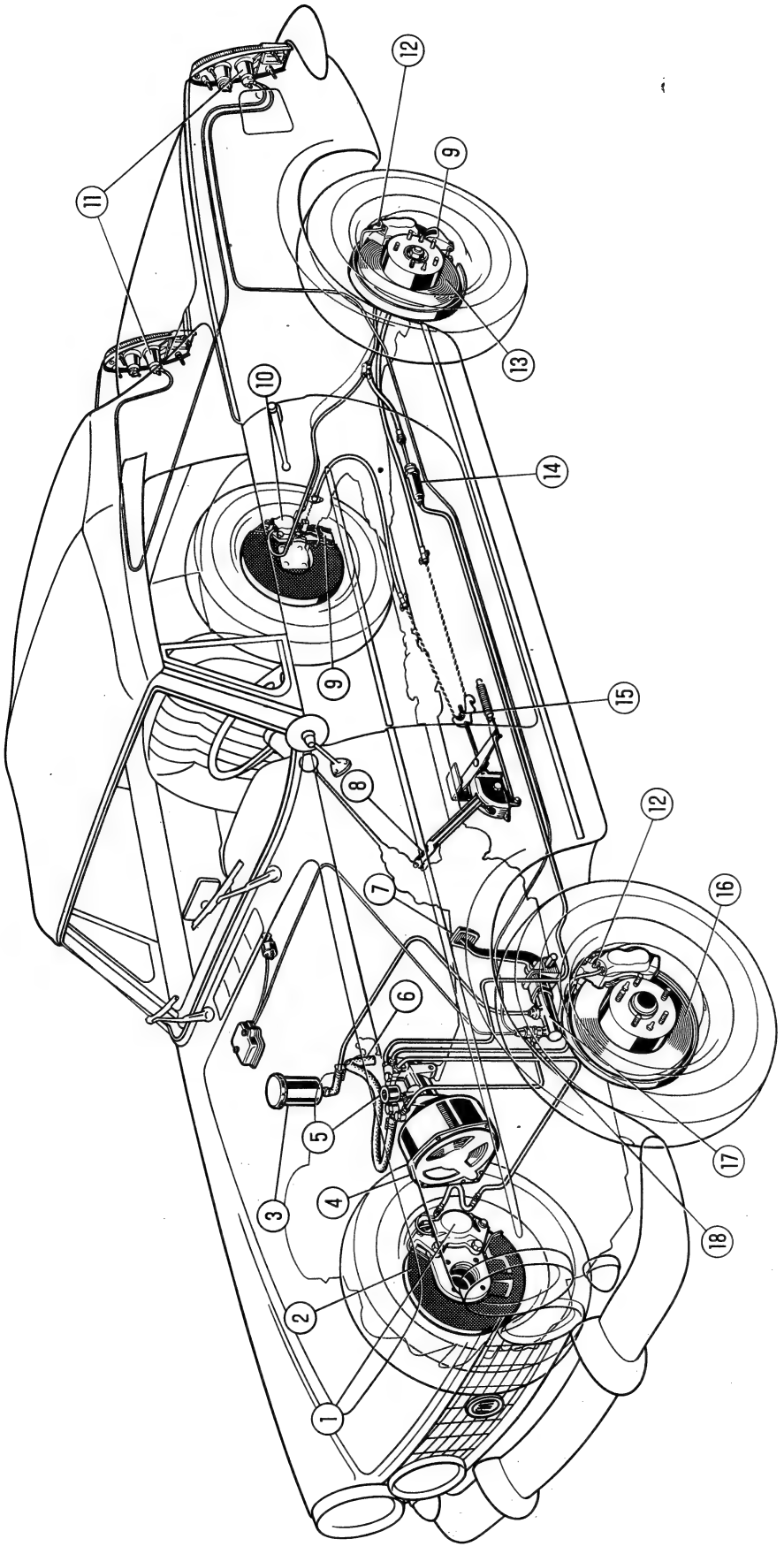


Fig. 191. - Service and parking brake system diagram - 1600 S Cabriolet.

1. Front disc brake calipers - 2. Brake disc shield - 3. Brake fluid reservoir - 4. Brake booster - 5. Brake booster air cleaner - 6. Intake manifold to-brake booster hose - 7. Service brake pedal - 8. Parking brake handle - 9. Parking brake actuating mechanism, controlled from handle 8 - 10. Rear disc brake calipers - 11. Stop lights - 12. Brake circuit bleeder connector - 13. Rear brake disc - 14. Rear brake circuit pressure regulator - 15. Manual brake handle stroke adjuster - 16. Front brake disc - 17. Master cylinder - 18. Stop light jam switch.

BRAKE SPECIFICATIONS

	1500	1600 S
Front Service Brakes.		
Type	disc, with friction linings	
Disc diameter	9 27/32″ (250 mm)	10 5/8″ (270 mm)
Bore of caliper cylinders — outer, two	1.3370″ to 1.3390″ (33.960 to 34.010 mm)	1.5028″ to 1.5047″ (38.170 to 38.220 mm)
Bore of caliper cylinders — inner, one	1.8940″ to 1.8960″ (48.107 to 48.158 mm)	2.1260″ to 2.1280″ (54.000 to 54.050 mm)
Total working area	22 sq.in (142 cm²)	29.1 sq.in (188 cm²)
Maximum wear and grinding of disc side faces	.02″ (0.5 mm) each	.02″ (0.5 mm) each
Minimum thickness of linings	.1181″ (3 mm)	.1181″ (3 mm)
Rear Service Brakes.		
Type	expanding, with self-centering shoes	disc, with friction linings
Diameter	9 27/32″ (250 mm) (drum)	10 5/8″ (270 mm) (disc)
Bore of wheel cylinders	3/4″	—
Bore of caliper cylinders — outer, two	—	1.1900″ to 1.1920″ (30.226 to 30.277 mm)
Bore of caliper cylinders — inner, one	—	1.6866″ to 1.6913″ (42.840 to 42.960 mm)
Total working area	70.7 sq.in (456 cm²)	28.8 sq.in (186 cm²)
Maximum wear and grinding of disc side faces	—	.02″ (0.5 mm) each
Maximum wear and grinding of brake drum	.0315″ (0.8 mm)	—
Minimum thickness of linings	.0591″ (1.5 mm)	.1181″ (3 mm)
Vacuum brake booster, type	air hydraulic (Girling « Hydrovac »)	
Master cylinder bore	7/8″	7/8″
Master cylinder push rod-to-piston clearance	.0039″ to .0118″ (0.10 to 0.30 mm)	.0039″ to .0118″ (0.10 to 0.30 mm)
Brake system fluid — grade	FIAT special blue label	
Brake system fluid — capacity	.65 G.B. pts - .78 U.S. pts (0.37 lt)	.74 G.B. pts - .88 U.S. pts (0.42 lt)
Disc brake cleaning fluid	FIAT LDC	
Manual brake, emergency and parking	mechanical on rear shoes	mechanical on rear discs

CHASSIS TIGHTENING REFERENCE

DESCRIPTION	Part No.	Thread Diam. and Pitch	Material	Torque	
				ft.lbs	kgm
Nut, flexible joint sleeve at mainshaft (3) .	4126567	M 20 x 1	R 50 Znt (shaft 19 CN 5, 20 NCD 12; Carbn 5)	57.9	8
Screw, countershaft front bearing (3) . . .	1/55404/20	M 12 x 1.25	R 80	68.7	9.5
Nut, countershaft rear bearing (3)	1/40441/71	M 18 x 1.5	C 40 Rct Znt (shaft 19 CN 5, 20 NCD 12; Carbn 5)	86.8 to 101.3	12 to 14
Nut, flexible joint-to-mainshaft sleeve and-to-prop shaft screw (3)	1/25745/11	M 10 x 1.25	R 50 Znt (screw R 80 Znt)	18.1 to 21.7	2.5 to 3
Nut, front prop shaft rear sleeve (3) . . .	1/25749/11	M 16 x 1.5	R 50 Znt (shaft 38 NCD 4 Bon)	144.7	20
Screw, prop shaft pillow-to-cross rail (3) .	1/60433/21	M 8 x 1.25	R 80 Znt	10.1 to 18.1	1.5 to 2.5
Screw, prop shaft pillow cross rail-to-body shell (3)	1/38260/21	M 8 x 1.25	R 80 Znt	10.1 to 18.1	1.5 to 2.5
Screw, differential carrier cap (3)	1/58887/21	M 10 x 1.25	R 80 Znt	36.2 to 47	5 to 6.5
Screw, differential carrier-to-axle housing (3)	1/60434/21	M 8 x 1.25	R 80 Znt	14.5 to 18.1	2 to 2.5
Screw, final drive ring gear (3)	4145197	M 10 x 1.25	40 Ni Cr Mo 2 Bon R 120 to 135	65.1 to 79.6	9 to 11
Nut, final drive pinion sleeve (3)	1/25749/11	M 16 x 1.5	R 50 Znt (pinion 19 CN 5 Carbn 9)	57.9 to 115.7	8 to 16
Nut, wheel hub-to-axle shaft (3)	875611	M 90 x 1.5	R 50 Cdt (shaft C 33 Tmp Ind (1) 38 NCD 4 Bon) (2)	159.1 minimum, before fitting cotter pin	22
Stud, wheel hub (1)	4103782	M 12 x 1.25	C 35 R Bon Cdt	39.8 to 54.2	5.5 to 7.5
Nut, wheel hub stud (2)	4009008	M 12 x 1.25	R 50 Cdt (stud C 35 R Bon Cdt)	54.2 to 61.5	7.5 to 8.5
Nut, semi-elliptic spring-to-rear axle « U » bolt (3)	735802	M 10 x 1.25	R 50 Znt (bolt 38 CD 4 Bon Cdt)	21.7 to 25.3	3 to 3.5
Nut, semi-elliptic spring shackle pin (3) . .	1/61008/11	M 8 x 1.25	R 50 Znt (pin C 20 Bon)	10.8	1.5

CHASSIS TIGHTENING REFERENCE

DESCRIPTION	Part No.	Thread Diam. and Pitch	Material	Torque ft.lbs	Torque kgm
Nut, semi-elliptic spring front mounting screw (3)	1/25748/11	M 14 x 1.5	R 50 Znt (screw R 50 Znt)	54.2 to 59.3	7.5 to 8.2
Nut, shock absorber lower mounting stud (3)	1/61050/11	M 12 x 1.25	R 50 Znt (stud 12 NC 3)	50.6 to 54.2	7 to 7.5
Nut, steering knuckle pillar (3)	1/25748/11	M 14 x 1.5	R 50 Znt (pillar 38 NCD 4 Bon)	86.8 to 101.3	12 to 14
Screw (short), knuckle arm-to-pillar (3)	4119364	M 12 x 1.5	R 80 Znt	65.1 to 72.3	9 to 10
Nut, caliper plate and knuckle arm-to-pillar screw (3)	1/21647/21	M 10 x 1.25	R 80 Znt (screw R 100)	32.5 to 47	4.5 to 6.5
Nut, steering knuckle (3)	1/40441/71 1/40448/71	M 18 x 1.5	C 40 Rct Znt (knuckle 38 CD 4 Bon)	see page 103	
Nut, steering wheel-to-column (3)	1/07914/11	M 16 x 1.5	R 50 Znt (column C 12 Tube (2) C 30 Norm) (1)	36.2	5
Nut, steering gear-to-body shell screw (3)	1/21647/11	M 10 x 1.25	R 50 Znt (screw R 80 Znt)	21.7 to 25.3	3 to 3.5
Nut, pitman arm-to-roller shaft (3)	1/21643/21	M 20 x 1.5	R 80 Znt (shaft 30 CD 4)	144.7 to 173.6	20 to 24
Nut, idler arm support screw (3)	1/21647/11	M 10 x 1.25	R 50 Znt (screw R 80 Znt)	25.3 to 28.9	3.5 to 4
Nut, ball stud-to-pitman and idler arm (3)	1/07934/11	M 14 x 1.5	R 50 Znt (stud 12 NC 3 Ind)	32.5 to 39.8	4.5 to 5.5
Nut, brake backing plate-to-rear axle screw (1)	1/61008/11	M 8 x 1.25	R 50 Znt (screw R 80 Znt)	14.5 to 18.1	2 to 2.5
Nut, brake shield and caliper plate-to-rear axle screw (2)	1/61008/21		R 80 Znt (screw R 100)		
Screw, front caliper assy-to-plate (1) Screw, front and rear caliper assy-to-plate (2)	4084893	M 12 x 1.25	R 100 Cdt	65.1 to 72.3	9 to 10
Bolt, thru, (*), front wheel brake caliper (2) (3) (1)	4071544 4071545 4071558	7/16" 24 UNF 3/8" 24 UNF 5/16" 14 UNF	35 NC 5 R Bon R 120 to 135	66.5 to 70.2 52.1 to 55 28.2 to 29.7	9.2 to 9.7 7.2 to 7.6 3.9 to 4.1
Bolt, thru, (*), rear wheel brake caliper (2)	4071545	3/8" 24 UNF	35 NC 5 R Bon R 120 to 135	52.1 to 55	7.2 to 7.6

(1) 1500 Cabriolet only.
(2) 1600 S Cabriolet only.
(3) 1500 and 1600 S Cabriolet.
(*) These screws should be **always** renewed, after removal.

Electric System

BATTERY

The battery is located in a recess on body floor behind the lefthand seat.

Cell connectors are sunk in sealing compound in this battery. Such construction feature improves battery insulation and cuts down intercell and ground current leakage. Moreover cell connector and terminal post corrosion is tapered down remarkably.

Electrolyte Level.

Battery cell covers are equipped with a « level sight » which is visible by unscrewing the cell cover.

This new design feature allows a quicker and easier battery topping up operation.

The cell is correctly filled in when the electrolyte level is flush with the circular hole at the bottom of the well inside the filler neck (fig. 192).

The filler neck is also fitted with two vertical openings to activate vapour vent.

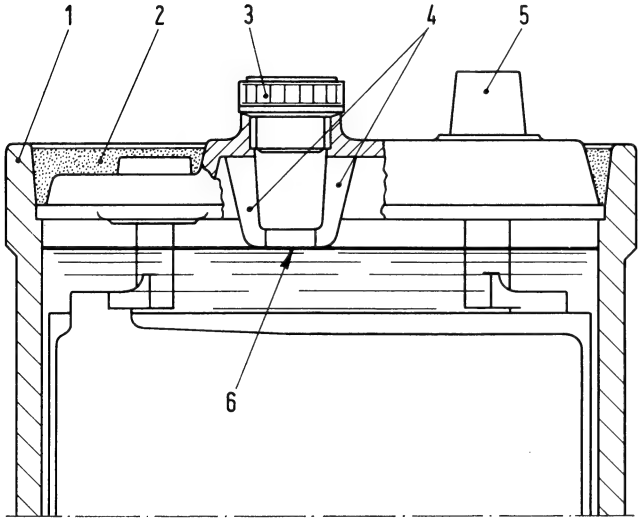


Fig. 192. - Section view across a battery at the filler neck having electrolyte « level sight ».

1. Battery case - 2. Sealing compound - 3. Plug - 4. Filler neck with slots for vapour venting - 5. Post - 6. Electrolyte level sight on the filler neck.

NOTE - Removal and installation of plus cable terminal clamp from battery post should be carried out after the minus cable (grounded on body) has been disconnected from the battery.

BATTERY SPECIFICATIONS

Voltage	12
Capacity (at 20 hrs discharge rate)	48 Amp/h
Length	10.2362″ (260 mm)
Width	6.7007″ (172 mm)
Height	8.8182″ (225 mm)
Weight including electrolyte	43 lbs (19.5 kg)
Weight without electrolyte	32 lbs (14.5 kg)

GENERATOR

FIAT 1500 Cabriolet is equipped with generator type D 115/12/28/4 and 1600 S Cabriolet with type D 115/12/28/4 C.

The armature rotates on a ball bearing at the drive end and at the commutator end on a bronze treated bushing having a capacious lubricator.

The ball bearing is force-fitted on to its seat on the drive end head and removable from armature shaft; furthermore it is fastened to the head by means of two disk retainers riveted to the head together with two covers housing the felt ring gaskets.

The heads are fastened to the frame by two thru bolts, passing between the pole shoes.

The commutator end head of the generator is fitted with reaction-type brush holders (fig. 195).

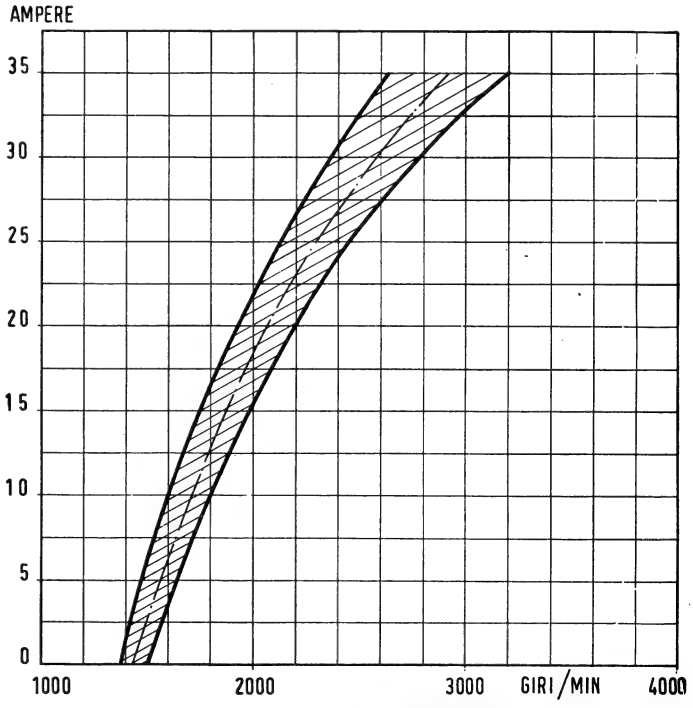


Fig. 193. - Output curve of FIAT D 115/12/28/4 generator (from warm). Steady voltage: 12.

GIRI/MIN = r.p.m.

Service Notes.

When disassembling generator end heads, use care to avoid brushes from falling violently on armature shaft, as they might be damaged.

Relieve brush spring pressure, first, and then slide off brushes from their seats.

When installing the armature, always check the armature-to-pole shoe air gap using a feeler gauge: air gap, measured on centerline of pole shoes, should be .0138″ to .0177″ (0.35 to 0.45 mm).

FIAT D 115/12/28/4 GENERATOR ASSEMBLY

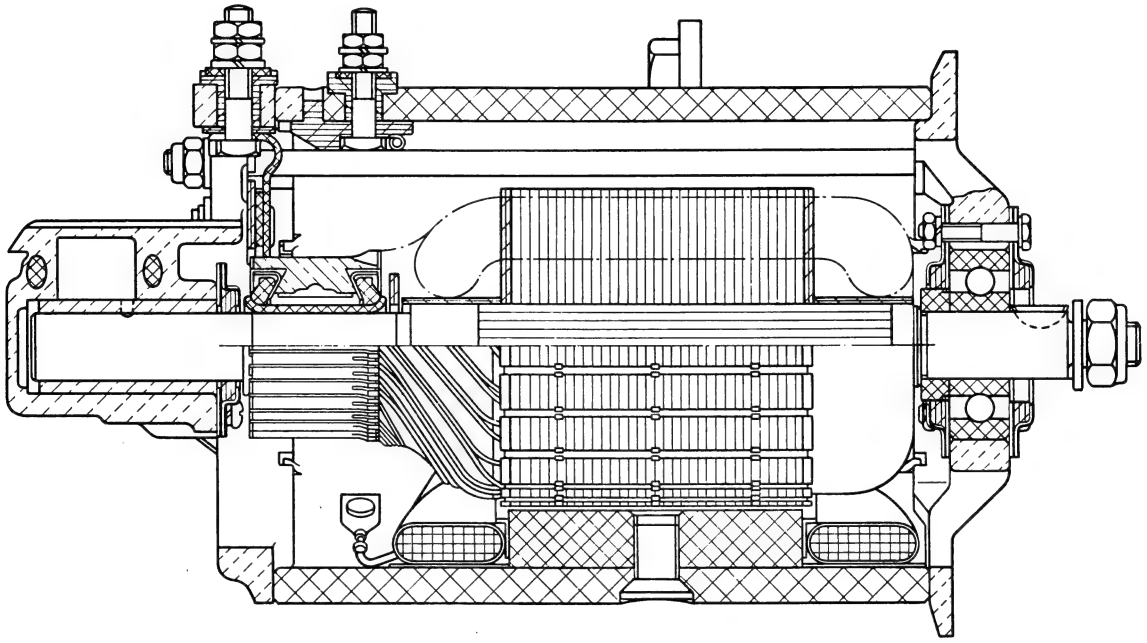


Fig. 194. - Longitudinal section view of generator.

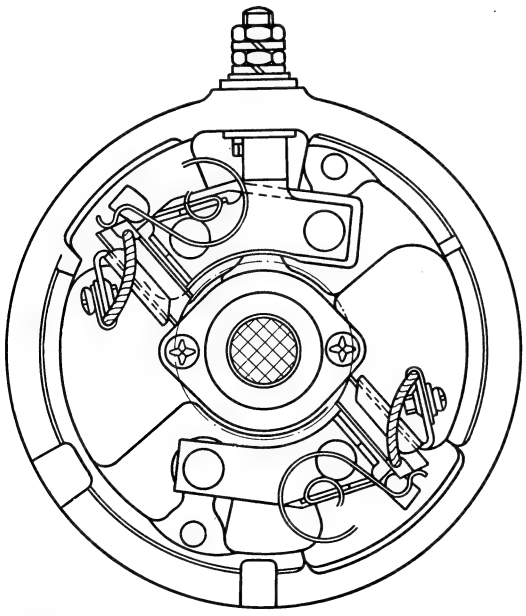


Fig. 195. - Generator section view across armature shaft, and view of commutator end head.

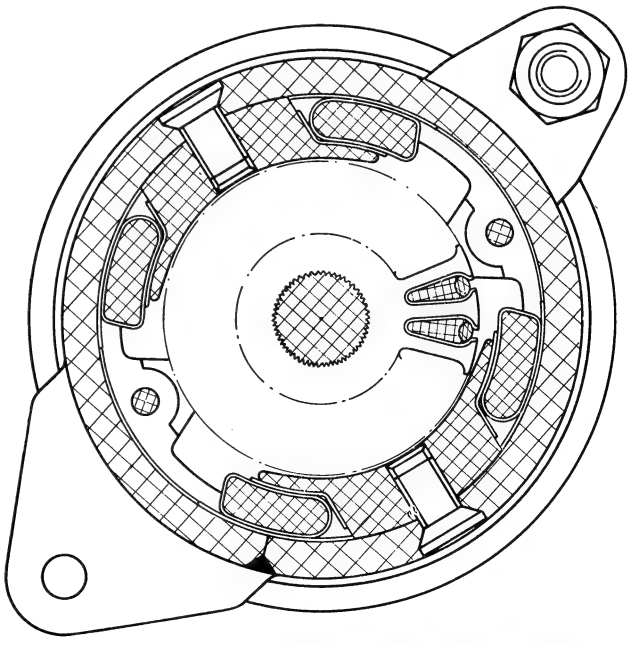


Fig. 196. - Generator section view across frame, pole shoes and windings.

GENERATOR SPECIFICATIONS

Type — 1500 Cabriolet	FIAT D 115/12/28/4
Type — 1600 S Cabriolet	FIAT D 115/12/28/4 C
Nominal voltage	12
Maximum continued operation power	400 Watts
Maximum continued operation amperage (ammeter limit)	28
Maximum amperage	35
Maximum power	500 Watts
Poles	2
Field winding	shunt
Regulator unit	GN 2/12/28
Initial charging speed at 12 Volts (68° F - 20° C)	1,400 ± 50 r.p.m.
28 A maximum output delivery speed at rated voltage and 68° F - 20° C temp.	2,550 ± 100 r.p.m.
35 A maximum output delivery speed at rated voltage and 68° F - 20° C temp.	2,900 ± 150 r.p.m.
Maximum steady speed	10,200 r.p.m.
Rotation, drive end	clockwise
Drive ratio (new belt), engine-to-generator	1-1.95
Pole shoe I. D.	2.7834″ to 2.7854″ (70.70 to 70.75 mm)
Armature O. D.	2.7499″ to 2.7519″ (69.85 to 69.90 mm)
Brush part number — 1500	4042681
Brush part number — 1600 S	4061933
Minimum speed for battery charging, with lights off:	
— engine, about	740 r.p.m.
— car in fourth gear — 1500	12.1 m.p.h. (19.5 km/h)
— car in fourth gear — 1600 S	11.8 m.p.h. (19 km/h)
Bench Testing Data.	
— Testing generator as a motor (at 68° F - 20° C):	
Feed voltage	12
Current draw	6 ± 0.5 Amperes
Speed	1,200 ± 100 r.p.m.
— Output test Amperes/revolutions at 68° F - 20° C:	
Steady voltage	12
Speed — for about 45 minutes	3,750 r.p.m.
Speed — for about 15 minutes	7,500 r.p.m.
Speed — or for one hour 45 minutes	4,500 r.p.m.
Current delivery to resistor (at 14 Volts)	28 ± 0.5 Amperes
After bringing generator to operating temperature by running it at the above specified speed and time rates, read the values of the current output at every generator speed increment, at Volts 12 steady (see fig. 193).	
— Ohmic resistance test:	
Armature resistance (at 68° F - 20° C)	0.13 ± 0.01 Ohms
Field winding resistance (at 68° F - 20° C)	$7 \pm \frac{1}{0.3}$ Ohms
Mechanical Characteristics Test Data.	
Load of springs on new brushes	27.16 ± 1.23 oz (0.725 ± 0.035 kg)
Maximum commutator out-of-round	.0004″ (0.01 mm)
Mica undercut depth	.0394″ (1 mm)
Lubrication.	
Drive end head ball bearing	FIAT MR 3 grease
Commutator end head lubricator	FIAT PROT. B oil

GENERATOR REGULATOR

Generator regulator type GN 2/12/28 consists of three units: voltage regulator, current regulator and cutout relay. Such units being separate, the assembly is designated as a three-core regulator.

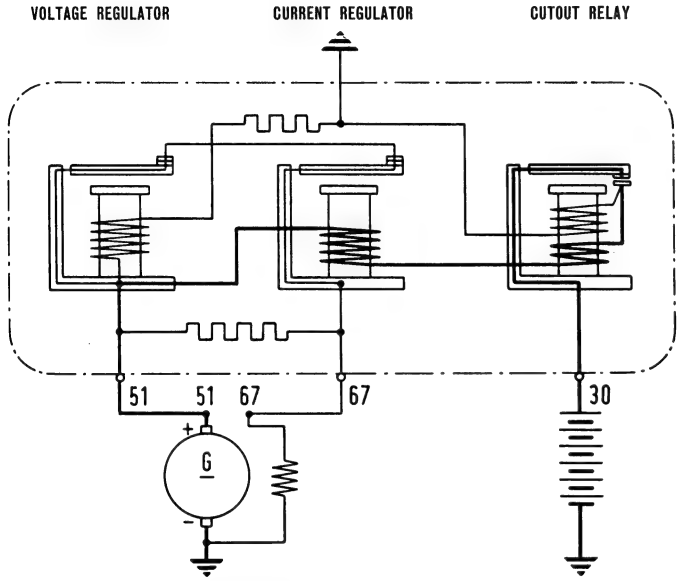


Fig. 197. - GN 2/12/28 regulator wiring diagram.

CAUTION - Whenever the regulator has been opened and kept open for repair or overhaul, it must be operated for a while, without cover, to allow the regulator to warm up. Fit the cover and tighten it on warm assembly, and make sure that the rubber gasket between cover and base is properly seated and provides adequate sealing. This eliminates the possibility of moisture building up inside a cold regulator, particularly on windings, when humidity is in the room. If any moisture is trapped in, when the regulator warms up in operation, moisture will evaporate and deposit on armature, thus causing highly detrimental oxidation of contacts.

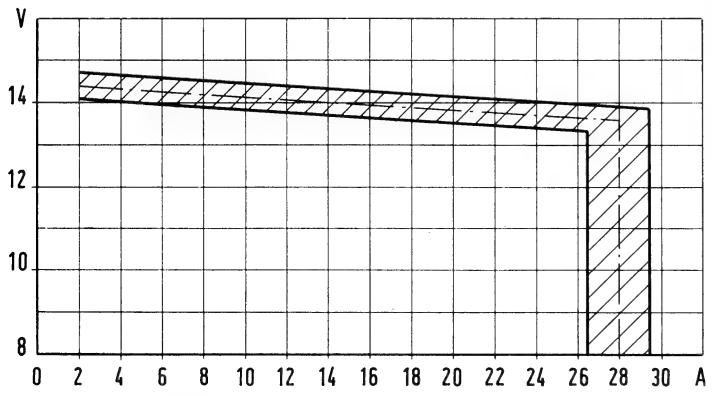


Fig. 198. - Regulator assembly GN 2/12/28.
Volt/Amp regulating pattern to battery. Room temperature: 122° ± 5° F (50° ± 3° C). Generator speed: 4,500 r.p.m.

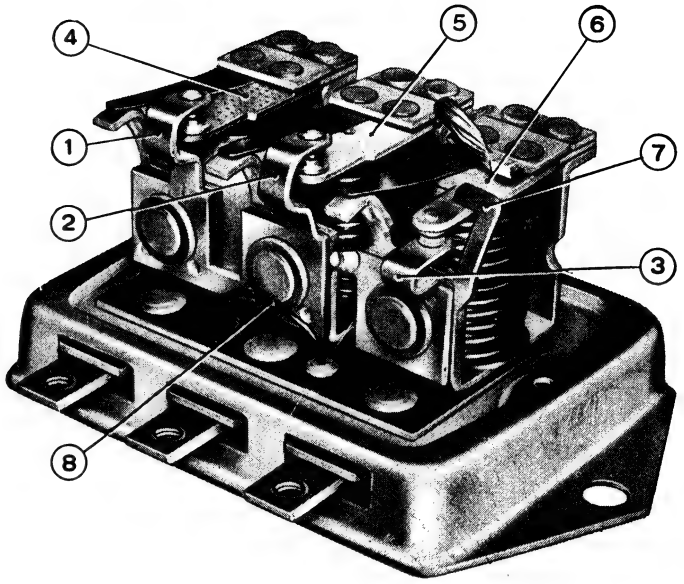


Fig. 199. - Regulator assembly GN 2/12/28.
View from cutout relay side.

1. Voltage regulator stationary contact carrier arm - 2. Current regulator stationary contact carrier arm - 3. Cutout stationary contact carrier arm - 4. Voltage regulator armature - 5. Current regulator armature - 6. Cutout armature - 7. Cutout armature stop - 8. Voltage regulator series resistor cable.

NOTE - It is dangerous to turn in radio interference suppression condensers of any capacity between:

- **— terminal 67 and ground;**
- **— terminal 67 and 51, both on generator and regulator.**

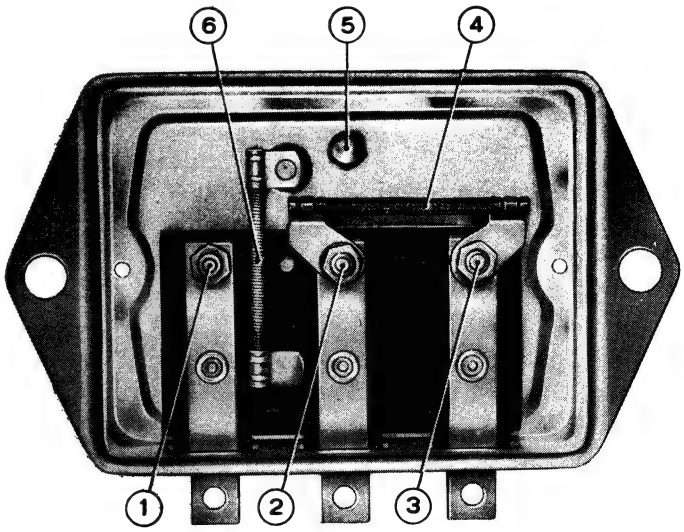


Fig. 200. - Regulator assembly GN 2/12/28.
Bottom view.

1. Cutout fixing nut - 2. Current regulator and regulating resistor fixing nut - 3. Voltage regulator and regulating resistor fixing nut - 4. Regulating resistor - 5. Soldering on base of cutout and voltage regulator shunt winding - 6. Voltage regulator series resistor.

FIAT GN 2/12/28 GENERATOR REGULATOR SPECIFICATIONS

Cut-out Relay.	
Supply voltage for thermal stabilization:	
— initial regulator operating temperature 59° to 68° F (15° to 20° C)	16.5
— initial regulator operating temperature 68° to 95° F (20° to 35° C)	15
Closing voltage	12.6 ± 0.2
Voltage-contact stroke variation, below	1 V/mm
Reverse amperage, not above	16
Air gap, closed contacts	.0138″ (0.35 mm)
Contact gap	.0177″ ± .0023″ (0.45 ± 0.06 mm)
Voltage Regulator.	
Battery (test bench)	50 Amp/hr
« Half-load » amperage	14 ± 2
Setting voltage after thermal stabilization, room temperature 122° ± 5° F (50° ± 3° C), for 30 minutes, half-load on battery	14.2 ± 0.3
Supply voltage for thermal stabilization	15
Air gap	.0390″ to .0437″ (0.99 to 1.11 mm)
Current Regulator.	
Regulated amperage on battery as inspected under steady current conditions, after 30 minute-operation in room at 122° ± 5° F (50° ± 3° C)	28 ± 1.5
Voltage, regulated current inspection	13
Air gap	.0390″ to .0437″ (0.99 to 1.11 mm)
Regulating Resistor	105 ± 6.5 Ohms
Voltage Regulator Series Resistor	17 ± 1 Ohms

STARTING MOTOR

The starting motor is of the over-running clutch type: FIAT E 100-1,5/12 Var. 1.

Motor drive through a solenoid actuated from the ignition switch.

The armature rotates on oilless bronze bushings.

End heads are fastened to the frame by two thru-bolts passing in the space between pole shoes.

The commutator and both brushes may be reached after removing the cover band, fastened by a screw and nut.

The pinion, rigidly attached to the overunning clutch, is operated by a solenoid via a yoke lever.

The solenoid is located on drive end head.

NOTE - On assembly of field winding, which should be pre-heated up to some 122° F (50° C) to make it slightly flexible for easier seating, tighten down pole shoe retaining screws. This way it will be possible to restore initial air gap between pole shoes and armature.

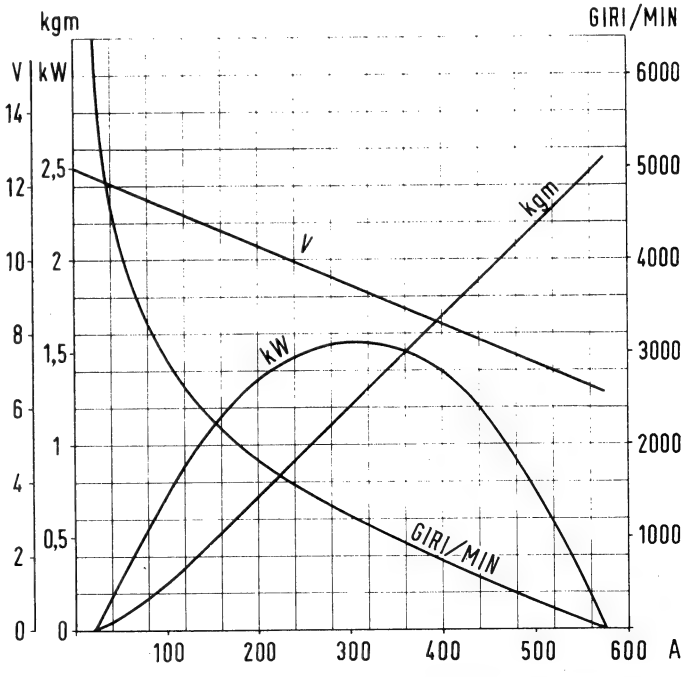


Fig. 201. - FIAT E 100-1,5/12 Var. 1 starting motor curves.

48 Amp/hr battery (at 20 hr discharge rate), fully charged - Electrolyte temperature: 68° F (20° C) - R.p.m., no load: 9,000.

GIRI/MIN = r.p.m.

STARTING MOTOR FIAT E 100-1,5/12 Var. 1

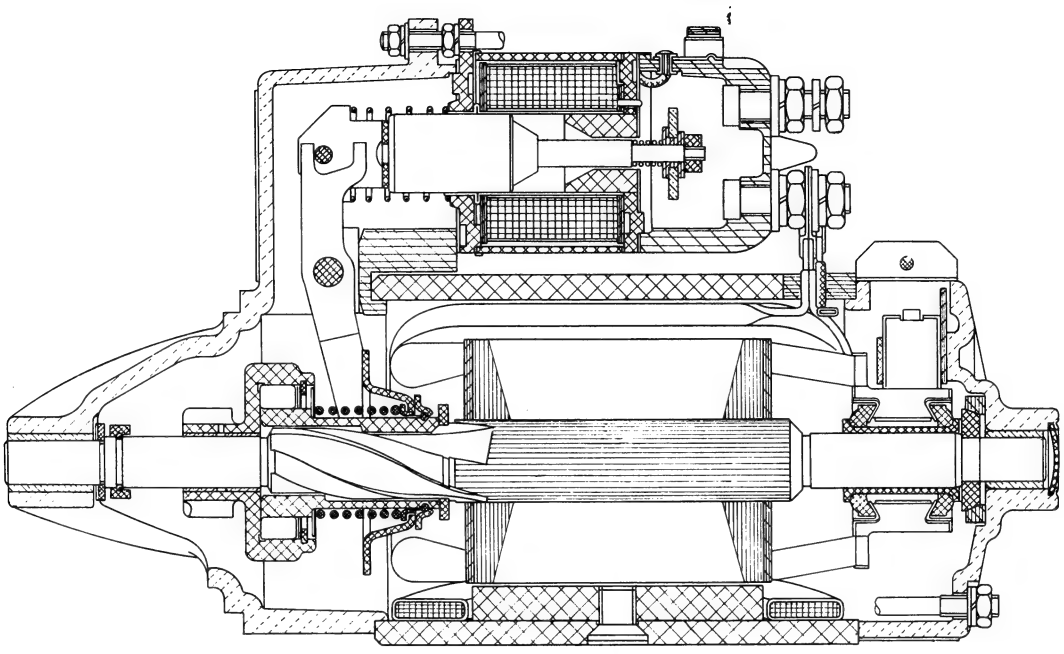


Fig. 202. - Longitudinal section view of starting motor.

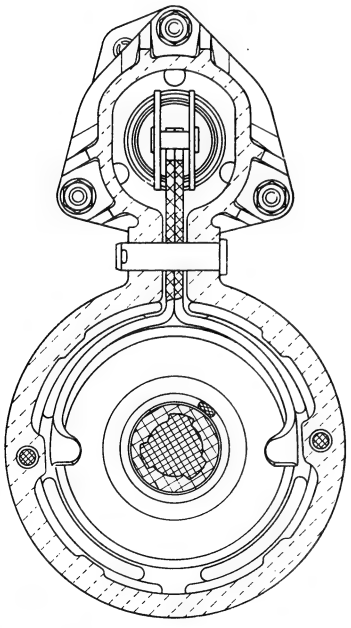


Fig. 203. - End section view across pinion drive.

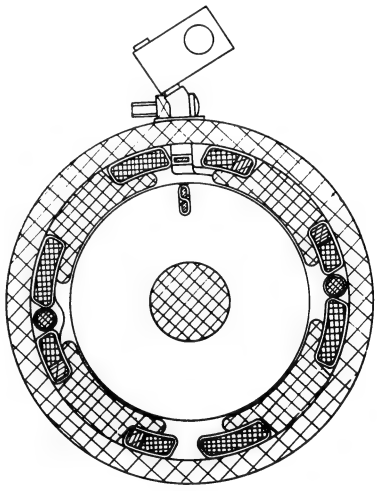


Fig. 204. - Section view across pole shoes and field winding.

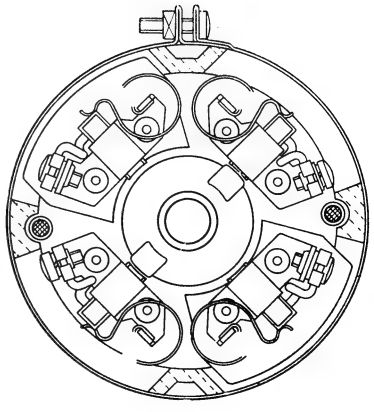


Fig. 205. - End section view across commutator end head with view of brushes.

STARTING MOTOR SPECIFICATIONS

Type	FIAT E 100-1.5/12 Var. 1
Voltage	12
Nominal power	1.5 kW
Rotation, pinion end	clockwise
Pole shoes	4
Field winding	combination series and shunt
Drive	overrunning clutch
Pole shoe I.D.	2.6693″ to 2.6760″ (67.80 to 67.97 mm)
Armature O.D.	2.6358″ to 2.6378″ (66.95 to 67.00 mm)
Brushes: part No.	4045771
Starter pinion-to-flywheel ring gear ratio	12 to 1
Control	solenoid
Bench Testing Data.	
— Operation test (at 68° F - 20° C):	
Amperage	300
Torque developed	8.68 ± .36 ft.lbs (1.2 ± 0.05 kgm)
Speed	1,200 ± 50 r.p.m.
Voltage	9.3
— Stall torque test (at 68° F - 20° C):	
Amperage	575
Voltage	6.4 ± 0.3
Torque developed	18.4 ± .7 ft.lbs (2.55 ± 0.1 kgm)
— No-load test (at 68° F - 20° C):	
Amperage, not above	20
Voltage	12.3
Speed	6,000 ± 300 r.p.m.
— Solenoid coil resistance, at 68° F (20° C)	0.354 to 0.454 Ohms
— Inner resistance, on starting, at 68° F (20° C)	0.009 to 0.01 Ohms
— Shunt field winding resistance, at 68° F (20° C)	8.5 to 8.9 Ohms
— Series field winding resistance, at 68° F (20° C)	0.0037 to 0.0038 Ohms
Mechanical Specifications Test.	
— Spring pressure on brushes (not worn)	2.2 ± .22 lbs (1 ± 0.1 kg)
— Armature shaft end play	.0039″ to .0276″ (0.1 to 0.7 mm)
— Mica undercut	.0394″ (1 mm)
— Overrunning clutch efficiency: static torque to draw pinion into slow rotation, not above	.78 in.lbs (0.9 kgcm)
— Solenoid core stroke	.5039″ to .6220″ (12.8 to 15.8 mm)
— Solenoid contact stroke	.4220″ to .5524″ (10.72 to 14.03 mm)
Lubrication.	
— Drive unit inner splines	Jota 2/M grease

IGNITION DISTRIBUTOR

This unit includes, in addition to centrifugal automatic advance, low tension circuit breaker, condenser and high tension distributor, a vacuum control and a static advance adjuster (only for engine 115 C.005 - 1500).

Both above mechanisms have been designed to vary ignition advance angle by properly rotating breaker contact plate of low tension circuit.

Firing order	1-3-4-2
Static advance:	
— 1500 Cabriolet	10°
— 1600 S Cabriolet	0° ± 1°
Manual adjustment of static advance:	
1500 Cabriolet	± 5°
Automatic advance to engine:	
— 1500 Cabriolet	21°
— 1600 S Cabriolet	33°
Vacuum advance to engine: 1500 Cabriolet	15°

Vacuum Control (1500 Cabriolet).

This is an automatic mechanism operating at low engine speed with part open throttle upon depression of accelerator pedal. It starts in well in advance of centrifugal control which is actuated only at high engine speed.

Vacuum for control operation is promoted by engine suction downstream throttle valve. The control mechanism (5, fig. 210) consists of an outer case enclosing a rubber diaphragm which at one end is connected to contact plate through a link and at the other end is subjected to vacuum in carburetor being connected to vacuum control through a rubber hose.

Maximum vacuum rate is registered under part throttle operation when the throttle is at the suction hole. Vacuum decreases as the throttle is opening to a greater extent until, with wide open throttle valve, the vacuum control is completely inoperative and is replaced by centrifugal control, which starts in as engine speed is rising.

Static Advance Adjuster (Octane Selector) (1500 Cabriolet).

This mechanism has been designed to vary static advance setting of distributor shaft, according to octane rating of fuel used, by rotating the breaker contact plate. As a matter of fact, when low octane fuel is used, the initial breaker cam setting can be brought down by 5° if the breaker contact plate is rotated in the shaft turning direction. Conversely, with high octane fuel, the initial breaker cam advance can be raised up by 5° if the breaker contact plate is rotated in the opposite direction.

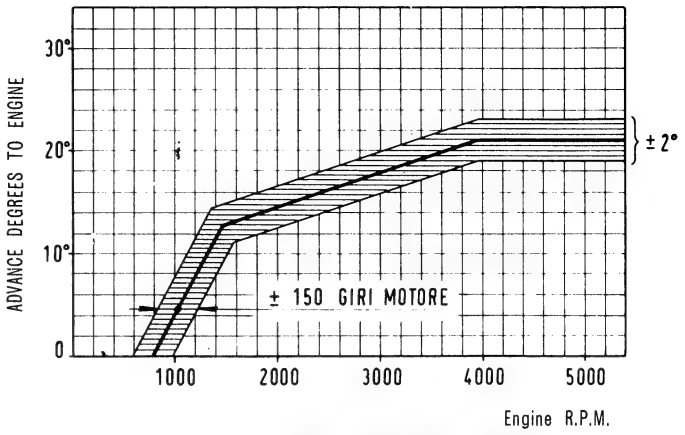


Fig. 206. - Diagram of ignition distributor automatic advance versus engine 115 C.005 (1500 Cabriolet).
Giri motore = Engine r.p.m.

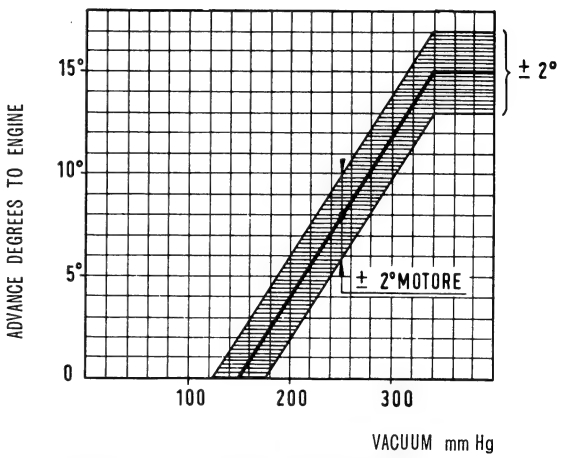


Fig. 207. - Diagram of ignition distributor vacuum advance versus engine 115 C.005 (1500 Cabriolet).
Motore = Engine.

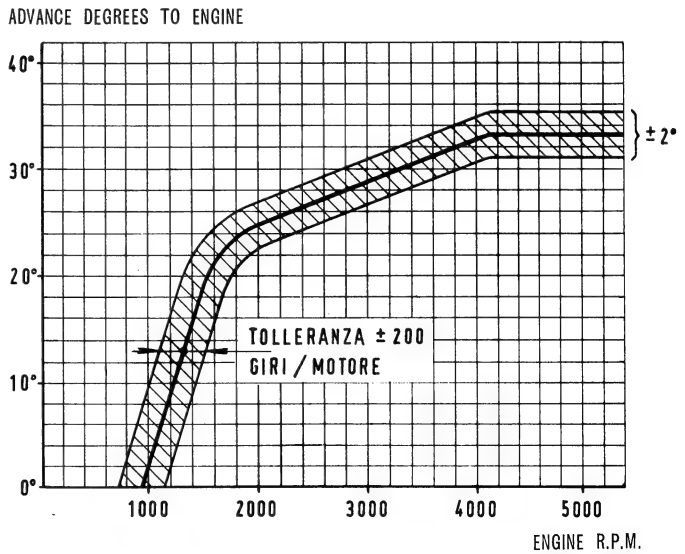


Fig. 208. - Diagram of ignition distributor automatic advance versus engine 118 B.000 (1600 S Cabriolet).
Tolleranza ± 200 giri/motore = Tolerance ± 200 r.p.m.

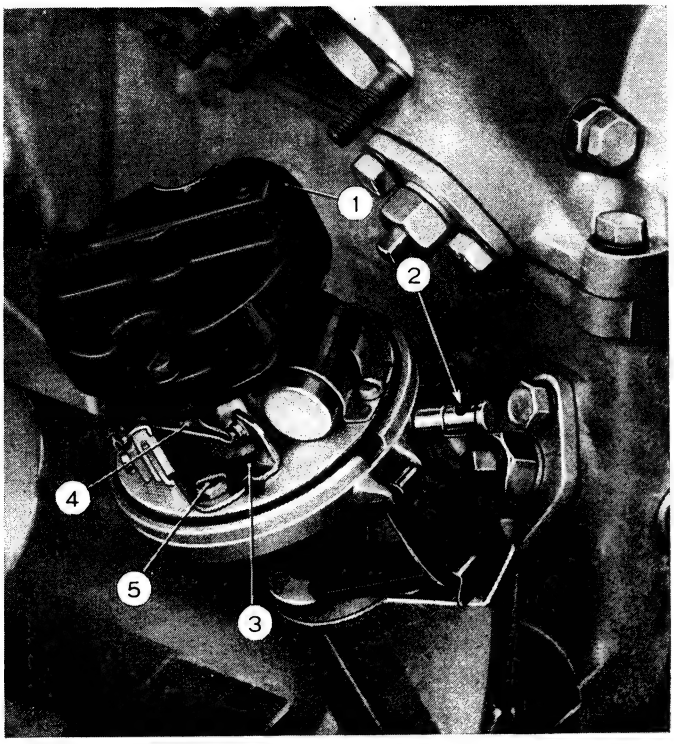


Fig. 209. - Ignition distributor, without cap, in place on engine 118 B.000.

1. Rotor - 2. Oiler - 3. Breaker contact plate - 4. Breaker arm - 5. Plate adjusting screw.

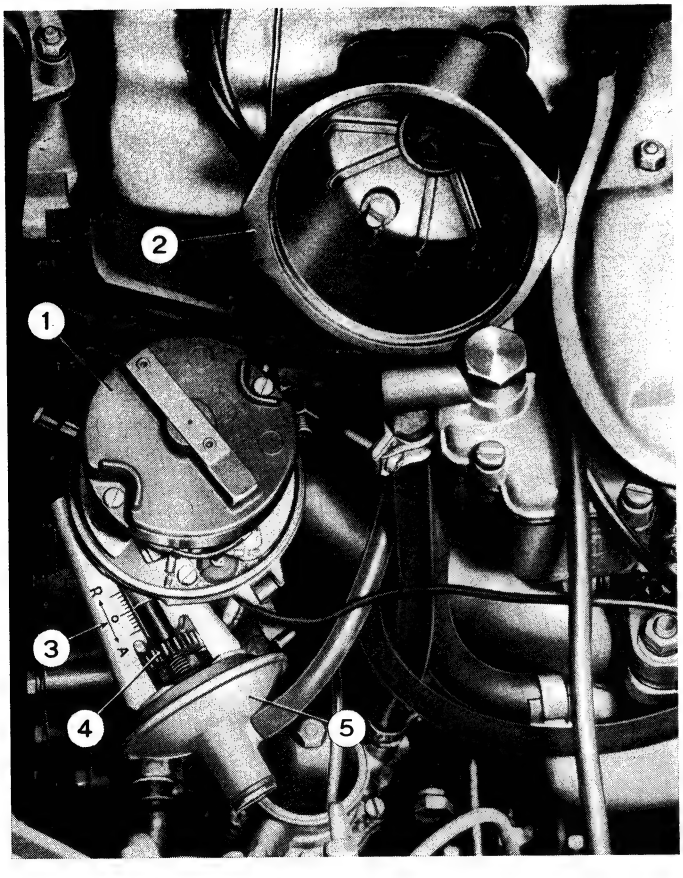


Fig. 210. - Ignition distributor in place on engine.

1. Rotor - Distributor cap - 3. Octane selector graduation scale - 4. Octane selector ring - 5. Vacuum advance.

Breaker contact plate rotation is controlled by a serrated ring (4, fig. 210) being fitted between distributor body and vacuum control.

This serrated ring can be rotated a full turn in either direction corresponding to a 10° aggregate setting range of the static spark advance, as follows: five advance degrees if the ring is turned in a manner to move the shaft notch toward letter A, five retard degrees if the ring is turned in a manner to move the shaft notch toward letter R; letters are stamped on ring support. When the serrated ring is in normal advance setting position, or with $10° \pm 1$ static advance, the shaft notch should be lined up with the « 0 » mark on ring support.

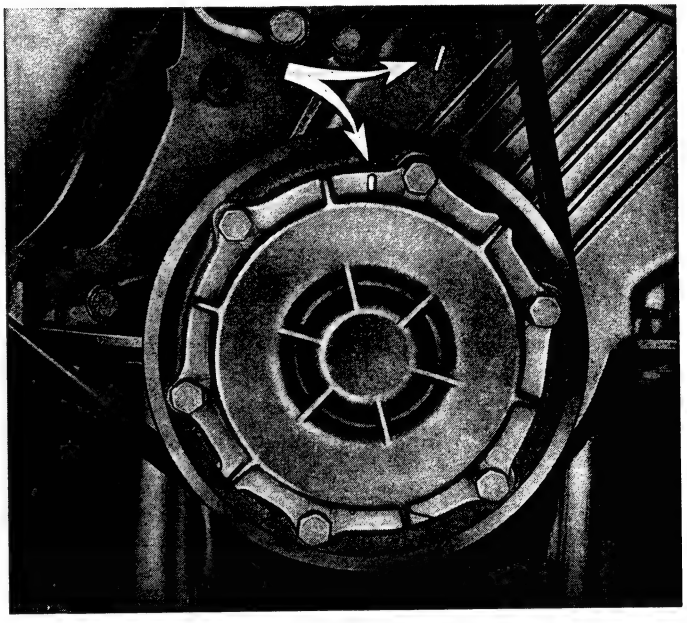


Fig. 211. - Timing ignition.

Arrows show the relative position timing marks should be given for correct distributor setting.

The mark on centrifugal filter cover should be positioned some 1/2 in. (13 mm) ahead of mark on timing gear cover.

Ignition Timing.

If the camshaft has been removed or the ignition distributor lifted out for overhaul, it will be necessary to carry out the ignition timing as follows:

— Make sure that cylinder No. 1 is in the compression stroke, that is both valves are closed. Rotate the crankshaft to such a position as the mark on centrifugal filter cover is:

  — 1500: 1/2″ (13 mm) approx. ahead of the mark embossed on the timing gear cover (fig. 211);

  — 1600 S: indexed with the corresponding mark on crankcase.

— Remove the distributor cap and turn the drive shaft manually, so that the rotor points toward the contact for firing in cylinder No. 1 (the matching numbers with cylinders are marked on cap). In this position breaker contacts are about to part (check first that maximum contact gap is as specified, namely .0165″ to .0189″ - 0.42 to .048 mm).

— Without disturbing the distributor shaft from this position, set the distributor on to its mounting on engine, by inserting the shaft on the toothed end of the drive gear. On installing the distributor (1500 only), exercise care that the vacuum advance is facing toward the outside of the engine, to avoid that it may interfere with other engine parts.

— Secure the distributor to its engine mounting, fit the cap and see that distributor cables are connected with the spark plugs.

NOTE - Ignition timing can be checked more quickly on engine 115 C.005 by using the equipment Ap. 5030 (in conjunction with adapter Ap. 5030/7), which allows of extending the inspection to the automatic advance.

IGNITION SYSTEM SPECIFICATIONS

Ignition Distributor.	1500	1600 S
Vacuum advance	15° ± 2°	—
Static advance	10° ± 1°	0° ± 1°
Manual advance	± 5°	—
Centrifugal automatic advance	21° ± 2°	33° ± 1°
Breaker contact pressure	19.4 ± 1.76 oz (550 ± 50 gr)	
Contact gap	.0177″ ± .0012″ (0.45 ± 0.03 mm)	
Terminal-to-ground insulation at 500 Volts d.c., above	10 MΩ	
Condenser capacity at 50 to 100 Hz	0.20 to 0.25 μF	
Condenser insulating resistance at 212° F (100° C) and 100 Volts d.c., above	1 MΩ/μF	
Distributor shaft bushing lubricant, through fitting, and drive shaft lubricant	FIAT engine oil	

Ignition Coil.			
Maker's code	BE200B	Z-TK12A17	G52S
Primary winding ohmic resistance at 68° ± 9° F (20° ± 5° C)	3.1 to 3.4 Ohms	3.1 to 3.4 Ohms	2.9 to 3.2 Ohms
Secondary winding ohmic resistance at 68° ± 9° F (20° ± 5° C)	6,700 to 8,300 Ohms	7,200 to 8,000 Ohms	7,200 to 8,000 Ohms
Ground insulating resistance at 500 Volts d.c., not below	50 MΩ	50 MΩ	50 MΩ

Spark Plugs.	**Marelli**	**Champion**	**AC-Delco**
1500:			
Type	M 14-19 (CW 240 LP)	M 14-19 (N 9 Y)	M 14-19 (44 X L)
Thread diam. and pitch (metric)	M 14 x 1.25	M 14 x 1.25	M 14 x 1.25
Point gap	.0197″ to .0236″ (0.5 to 0.6 mm)	.0197″ to .0236″ (0.5 to 0.6 mm)	.0197″ to .0236″ (0.5 to 0.6 mm)
1600 S:			
Type	M 14-19 (CW 230 LPS)	M 14-19 (N 9 Y)	
Thread diam. and pitch (metric)	M 14 x 1.25	M 14 x 1.25	—
Point gap	.0256″ to .0295″ (0.65 to 0.75 mm)	.0197″ to .0236″ (0.5 to 0.6 mm)	

AIMING HEADLIGHTS

Headlights should be aimed with the car **at no-load** and complying with the following preliminary conditions:

— Check tires for pressure specifications to suit moderate speed.

— Locate the car on a level floor, 16' 5" (5 m) apart from an opaque, white screen in the shade and make sure that the car centerline is at right angles to the screen face.

— Jounce the car both sides to set suspensions.

1500 Cabriolet.

Headlights are fitted with an **asymmetrical low beam**; this beam only must be focussed as follows:

1) Draw two vertical lines a-a on the screen. These lines should be equally spaced from the perpendicular to the car longitudinal axis and $45\,^{43}/_{64}$" (116 cm) apart (A), which distance corresponds to the headlight interaxis.

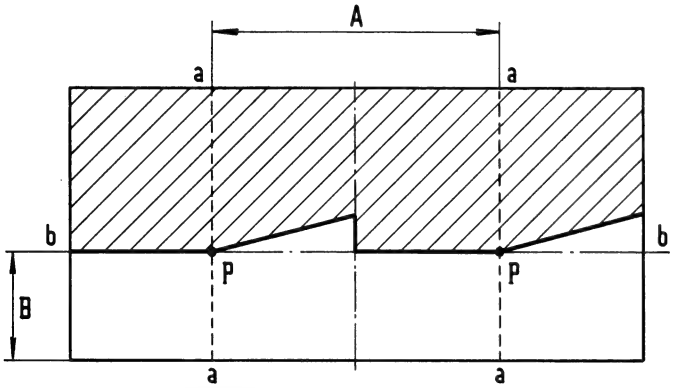


Fig. 212. - Headlight aiming diagram - 1500 Cabriolet.

A = $45\,^{43}/_{64}$" (1160 mm) - B = C — $1\,^{37}/_{64}$" (40 mm), new vehicle B = C — $1\,^{3}/_{8}$" (35 mm), settled vehicle - C = Ground clearance of headlight center.

2) Draw a horizontal line b-b on the screen, at the following distance from ground:
B = C — $1\,^{37}/_{64}$" (4 cm), new vehicles or vehicles with suspensions renewed;
B = C — $1\,^{3}/_{8}$" (3.5 cm), settled vehicles;
where C corresponds to the ground clearance of headlight center measured on aiming.

3) To aim headlights, switch on the low beam and work on two adjusting screws (the upper one for vertical corrections and the side one for horizontal corrections) until the following conditions are obtained:

— the horizontal separation line between the unlit and lit areas should be on line b-b;

— the upward slanting (some 15°) separation lines should start from the meeting points of vertical lines a-a with the horizontal line b-b.
A maximum outward shift of the meeting point P of 1° 30' (= $5\,^{1}/_{8}$" - 130 mm), is permitted.

NOTE - A vehicle is settled in practice when it has run the mileage specified for the first free service.

1600 S Cabriolet.

This car is equipped with dual headlights, the inner pair issuing the high beam only and the outer pair issuing both beams: low and high.

Proceed as follows:

1) Draw two pairs of vertical lines a-a and a_1-a_1 on the screen. These lines should be equally spaced from the perpendicular to the car longitudinal axis and $46\,^{1}/_{16}$" (117 cm) (A), $32\,^{7}/_{8}$" (83.5 cm) (A_1) apart, which distances correspond to the interaxes of the two headlight pairs.

2) Draw two horizontal lines b-b and b_1-b_1 on the screen, at the following distances from ground:
B = C — 19/32" (1.5 cm), new vehicles, vehicles with suspensions renewed or settled vehicles;
B_1 = C — $1\,^{37}/_{64}$" (4 cm), new vehicles or vehicles with suspensions renewed;
B_1 = C — $1\,^{3}/_{8}$" (3.5 cm) settled vehicles;
where C corresponds to the ground clearance of headlight center measured on aiming.

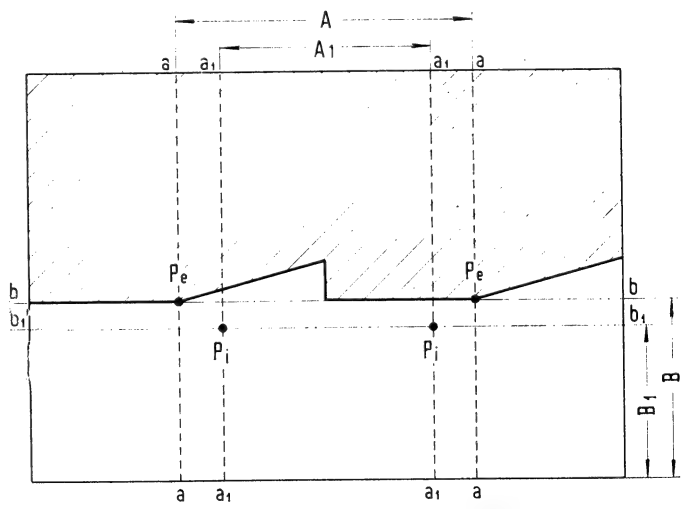


Fig. 213. - Headlight aiming diagram - 1600 C Cabriolet.

A = $46\,^{1}/_{16}$" (1170 mm) - A_1 = $32\,^{7}/_{8}$" (835 mm) - B = C — 19/32" (15 mm), new vehicle and settled vehicle - B_1 = C — $1\,^{37}/_{64}$" (40 mm), new vehicle - B_1 = C — $1\,^{3}/_{8}$" (35 mm), settled vehicle - C = Ground clearance of headlight center.

3) Switch on the low beam and to aim the **outer headlights** work:
   — on the upper screw which adjusts the light pool vertically;
   — on the side screw which adjusts the light pool horizontally;

   until the following conditions are obtained:
   — the horizontal separation line between the unlit and lit areas should be on line b-b;
   — the upward slanting (some 15°) separation lines should start from the meeting points P_e of vertical lines a-a with the horizontal line b-b.

4) Switch on the high beam and to aim the **inner headlights** work:
   — on the upper screw which adjusts the light pool vertically;
   — on the side screw which adjusts the light pool horizontally;

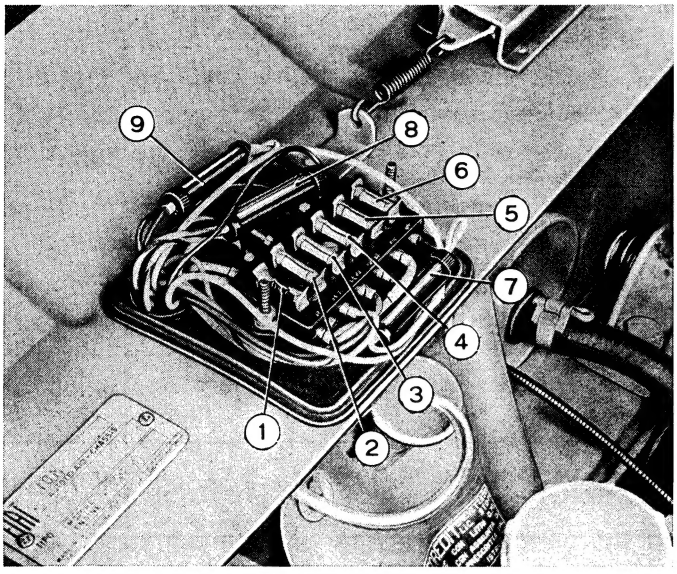
   until the following conditions are obtained:
   — the centerpoint of the zone of highest light intensity (hot spot) should fall on meeting points P_i of vertical lines a_1-a_1 with the horizontal line b_1-b_1.

NOTE - A maximum outward shift of the meeting points P_e and P_i of 1° 30' (= 5 1/8" - 130 mm), is permitted.

FUSES

1500 Cabriolet.

Fig. 214	FUSES	PROTECTED CIRCUITS
1	No. 30 (16 A)	Map light. - Horns. - Trouble light receptacle. - Cigar lighter. - Electric clock.
2	No. 15/54 (8 A) (with ignition on)	Magnetic cooling fan. - Fuel gauge and reserve supply indicator. - No-charge indicator. - Low oil pressure indicator. - Temperature gauge. - Heat indicator.
3	No. 56/b2 (8 A) (with ignition on)	Right-hand low beam.
4	No. 56/b1 (8 A) (with ignition on)	Left-hand low beam.
5	No. 30/3 (8 A) (with ignition on)	Left-hand high beam and indicator.
6	No. 30/2 (8 A) (with ignition on)	Right-hand high beam.
7	8 A (separate fuse - with ignition on)	Wiper motor. - Heater electrofan. - Stop lights. - Direction signal lights and indicator. - Instrument lights.
8	8 A (separate fuse - with ignition on)	Right-hand parking light. - Left-hand tail light. - Right-hand license plate light. - Engine compartment lights. - Cigar lighter spot light.
9	8 A (separate fuse - with ignition on)	Left-hand parking light. - Parking light indicator. - Right-hand tail light. - Left-hand license plate light. - Deck light.



The electric system of both 1500 and 1600 S Cabriolet is protected by eight 8-Ampere fuses and one 15-Ampere fuse (green) (fig. 214).

Before replacing a burnt fuse, trace the cause of blowing referring to the wiring diagram for a guide to the circuits protected by the fuse concerned. For quicker reference, the circuits each fuse has under control are tabulated on pages 133 and 134.

Unprotected circuits: battery charge, ignition and starting.

Fig. 214. - Fuses.

1. Fuse No. 30 - 2. Fuse No. 15/54 - 3. Fuse No. 56/b2 - 4. Fuse No. 56/b1 - 5. Fuse No. 30/3 - 6. Fuse No. 30/2 - 7. 8. 9. Fuses in separate fuseholders.

1600 S Cabriolet.

Fig. 214	FUSES	PROTECTED CIRCUITS
1	No. 30 (16 A)	Map light. - Horns. - Trouble light receptacle. - Cigar lighter. - Electric clock.
2	No. 15/54 (8 A) (with ignition on)	Fuel gauge and reserve supply indicator. - No-charge indicator. - Temperature gauge. - Electric fuel pump. - Magnetic cooling fan. - Heat indicator and its relay switch.
3	No. 56/b2 (8 A) (with ignition on)	Right-hand low beam.
4	No. 56/b1 (8 A) (with ignition on)	Left-hand low beam.
5	No. 30/3 (8 A) (with ignition on)	Left-hand headlights and indicator.
6	No. 30/2 (8 A) (with ignition on)	Right-hand headlights.
7	8 A (separate fuse - with ignition on)	Windshield wiper. - Heater electrofan. - Stop lights. - Direction signal lights and indicator. - Instrument lights.
8	8 A (separate fuse - with ignition on)	Right-hand parking light. - Left-hand tail light. - Right-hand license plate light. - Engine compartment lights. - Cigar lighter spot light.
9	8 A (separate fuse - with ignition on)	Left-hand parking light and indicator. - Right-hand tail light. - Left-hand license plate light. - Deck light.

LIGHTING SYSTEM SPECIFICATIONS

	1500	1600 S
Headlights	two	four (*)
Double filament bulb:		
— high beam filament	45-Watt	
— low beam filament	40-Watt	
Front parking and direction signal lights.		
Double filament bulb:		
— parking signal filament	5-Watt	
— direction signal filament	20-Watt	
Side direction signal lights	3-Watt	
Tail, direction signal and stop lights with reflector lens	two	
Direction signal bulb	20-Watt	
Double filament bulb:		
— tail signal filament	5-Watt	
— stop signal filament	20-Watt	
Rear license plate light	one	
No. 2 globular bulbs	5-Watt	
Engine compartment light.		
No. 2 bulbs with switch turning on automatically on hood opening	5-Watt	
Deck light.		
No. 1 bulb with switch turning on automatically on deck lid opening	5-Watt	
Map light under dashboard.		
No. 1 cylindrical bulb	3-Watt	
Outer lighting control	master switch on instrument panel	
Front light shift	lever switch under steering wheel	
Direction signal control	lever switch under steering wheel	
Cigar lighter spot light:		
No. 1 tubular bulb	3-Watt	
Instrument illumination.		
Tubular bulbs for:		
— fuel gauge and temperature gauge	3-Watt	—
— electric clock	3-Watt	
— speedometer-odometer	3-Watt	
— tachometer-temperature gauge and oil gauge	—	3-Watt
Warning lights.		
Tubular bulbs for:		
— direction signal indicator	3-Watt	
— no-charge indicator	3-Watt	
— fuel reserve supply indicator	3-Watt	
— parking light indicator	3-Watt	
— high beam indicator	3-Watt	
— heat indicator	3-Watt	
— low oil pressure indicator	3-Watt	—

(*) The inner pair of headlights issues the high beam only while the outer pair issues both the low and high beams.
1500 Cabriolet - U.S.A. version fitted with emergency light circuit starting from Ch. No. 044038 - Spare Parts No. 1432872.

ELECTRIC SYSTEM ACCESSORIES SPECIFICATIONS

Heat indicator	red light
Oil pressure:	
— 1500 — low pressure indicator	red light
— 1500 — light glowing pressure	3.6 to 10.7 psi (0.25 to 0.75 kg/cm²)
— 1500 — standard pressure	56.9 to 64 psi (4 to 4.5 kg/cm²)
— 1600 S — pressure meter	gauge
— 1600 S — light glowing pressure	10.7 to 14.2 psi (0.75 to 1 kg/cm²)
— 1600 S — standard pressure	85.3 psi (6 kg/cm²)
No-charge indicator	red light
— Initial charging speed	740 r.p.m.
— Intial charging speed in overdrive — 1500	12.1 mph (19.5 km/h)
— Intial charging speed in overdrive — 1600 S	11.8 mph (19 km/h)
Temperature gauge	electric
Fuel reserve supply indicator	red light
— Reserve supply	4 to 6.2 G.B. qts - 4.8 to 7.4 U.S.qts (4.5 to 7 lt)
High beam indicator	blue light
Parking light indicator (*)	green light
Blinking turn indicator (*)	green light
Flashing Direction Signal Circuit.	
Number of flasher unit cycles per minute under a nominal 43 Watt aggregate load:	
— at a nominal 12-Voltage, room temperature 68° F (20° C)	78 ± 8
— at a tension 1.25 times the nominal one (15 Volts), room temperature 104° F (40° C), not above	100
— at a tension 0.8 times the nominal one (9.5 Volts), room temperature — 4° F (— 20° C), not below	45
Windshield Wiper Unit	double arm
Sweeps per minute, dry glass, 14-Voltage	52 to 66
Wiper motor bench test:	
— Supply voltage	14
— Stall torque	.72 ft.lbs (10 kgcm)
— Stator overheating temperature, not above	120° F (50° C)
- Speed	52 to 66 r.p.m.
- Current draw, not above	3 Amperes
— Starting torque (locked shaft), warm, 14-Voltage, not below	7.23 ft.lbs (1 kgm)
Wiper blade pressure on windshield glass	14.1 to 19.4 oz (400 to 550 gr)
Wiper arm tilting angle	100°
Windshield washer	double-nozzle
Liquid used: Water and FIAT D.P./1 cleaner mixture (concentrated solution) — pure water	.66 G.B. qts - .79 U.S. qts (0.75 kg)
Liquid used: Water and FIAT D.P./1 cleaner mixture (concentrated solution) — solution	.6 oz (17 gr) summer 1.2 oz (34 gr) winter
Air Conditioning Electrofan.	
No-load speed (without vane), 12-Voltage, room temperature 68° ± ± 9° F (20° ± 5° C)	5,500 to 6.500 r.p.m.
Corresponding current draw	0.9 to 1.3 Amperes
Starting torque (locked rotor), 12-Voltage, room temperature 68° ± 9° F (20° ± 5° C)	.673 ± .043 oz.lbs (775 ± 50 gcm)
Corresponding current draw	5.2 ± 0.2 Amperes
Armature winding ohmic resistance at 68° ± 9° F (20° ± 5° C)	0.55 ± 0.05 Ohms
Field winding ohmic resistance at 68° ± 9° F (20° ± 5° C)	1 ± 0.1 Ohms

(*) Light brightness can be adjusted by turning in or out the indicator knob.

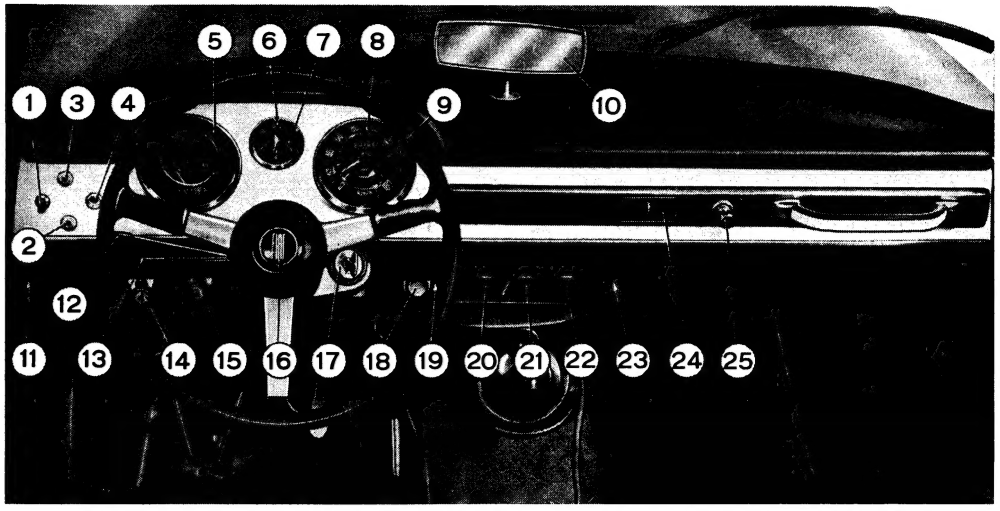


Fig. 217. - Instruments and controls FIAT 1500 Cabriolet.

1. Outer light master switch - 2. Direction signal light indicator - 3. Parking light indicator - 4. Heat indicator - 5. Cluster (see fig. 218) - 6. Clock hand setting knob - 7. Electric clock - 8. Speedometer-odometer - 9. High beam indicator - 10. Rear view mirror - 11. Hood catch control lever - 12. Outer lighting change-over switch - 13. Direction signal light switch - 14. Carburetor choke knob - 15. Manual accelerator knob - 16. Horn button - 17. Key-type switch for ignition, warning lights and starting (controls also the anti-theft device) - 18. Windshield washer pump - 19. Windshield wiper switch - 20. Instrument light switch - 21. Electrofan switch - 22. Map light switch - 23. Trouble light receptacle - 24. Ash receiver - 25. Electric cigar lighter.

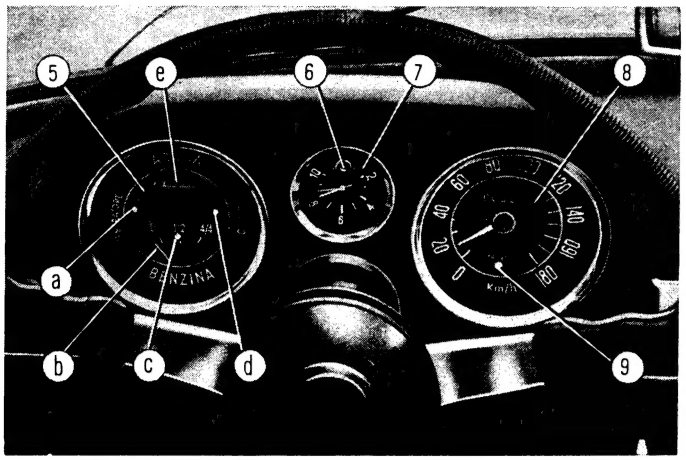


Fig. 218. - Detail of instruments - FIAT 1500 Cabriolet.

5. Cluster - a. No-charge indicator - b. Fuel gauge - c. Reserve supply indicator - d. Low oil pressure indicator - e. Temperature gauge - 6. Clock hand setting knob - 7. Electric clock - 8. Speedometer-odometer - 9. High beam indicator.

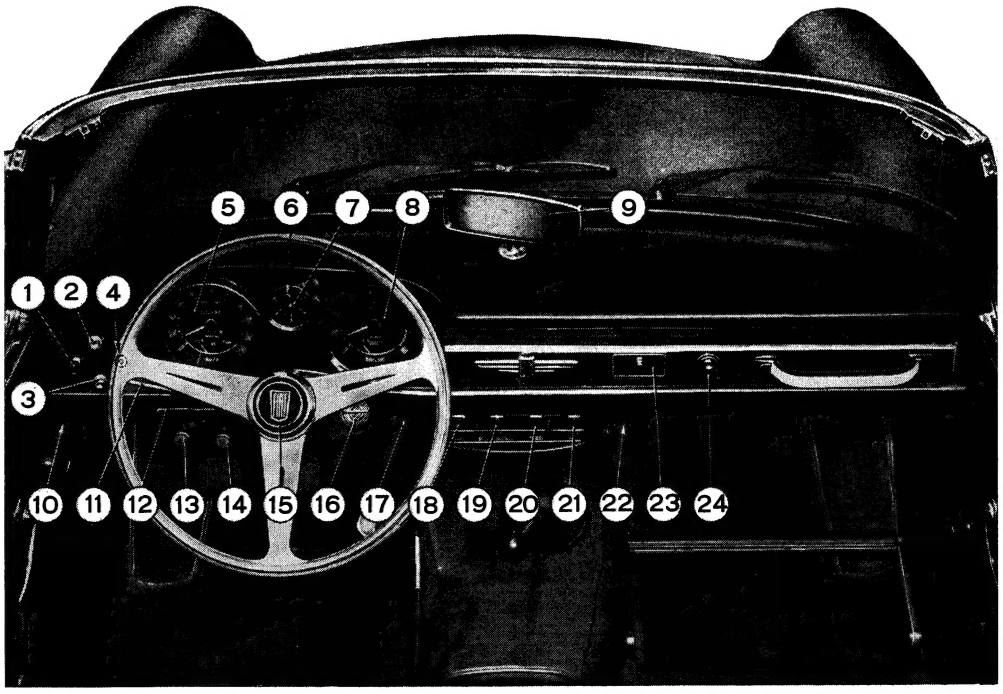


Fig. 219. - Instruments and controls FIAT 1600 S Cabriolet.

1. Outer light master switch - 2. Parking light indicator - 3. Direction signal light indicator - 4. Heat indicator - 5. Cluster incorporating: speedometer, no-charge indicator, high beam indicator, total and trip odometer, fuel gauge, reserve supply indicator - 6. Clock hand setting knob - 7. Electric clock - 8. Tachometer, incorporating also: oil gauge and temperature gauge - 9. Rear view mirror - 10. Hood catch control lever - 11. Outer lighting change-over switch - 12. Direction signal light switch - 13. Carburetor choke knob - 14. Manual accelerator knob - 15. Horn button - 16. Key-type switch for ignition, warning lights and starting (controls also the anti-theft device) - 17. Windshield washer pump - 18. Windshield wiper switch - 19. Instrument light switch - 20. Electrofan switch - 21. Map light switch - 22. Trouble light receptacle - 23. Ash receiver - 24. Electric cigar lighter.