



**WORKSHOP MANUAL  
FOR V7 SPORT - 750 S - 850 T**



## Introduction

Purpose of this manual is to give the necessary instructions for overhauling and carrying out repairs in a rational way.

All data herein contained are meant to give a general knowledge on the main checking operations to be made when overhauling the different groups.

To this end, the manual contains many illustrations, drawings, diagrams and tables to assist in the stripping, checking and assembling operations.

This manual will also be a guidance to anybody who wishes to familiarize with the manufacturing characteristics of the various component parts of the V7 Sport. The knowledge of these will be an essential factor for performing a good job.

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• **NOTE** - The terms «right» and «left» used in the text are to be considered as seen by the rider astride the machine.

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## **IDENTIFICATION DATA**

(See fig. 4)

Each machine is identified with a serial number which is impressed on the frame down tube and on the L/H crankcase.

This number appears also in the certificate of conformity and it is the only one valid for all legal purposes for the identification of the machine.



## INDEX

MAIN FEATURES .....	6	SEAL EFFICIENCY CHECK .....	46
SPECIFIC WORKSHOP TOOLS .....	8	REAR FORK .....	47
NUTS AND BOLTS TORQUE LOADING .....	11	REAR SUSPENSION .....	48
REMOVAL OF THE ENGINE-GEARBOX UNIT FROM THE FRAME .....	15	FRONT SUSPENSION AND STEERING .....	49
STRIPPING THE ENGINE UNIT .....	15	WHEELS AND BRAKES .....	51
OVERHAULING THE ENGINE UNIT .....	17	FRONT WHEEL BRAKING CIRCUIT (DISC BRAKE) ..	55
USEFUL DATA - CRANK MECHANISM PARTS .....	22	BALL AND ROLLER BEARINGS .....	60
TIMING .....	23	FRAME .....	61
TIMING PARTS DATA .....	26	ELECTRICAL EQUIPMENT .....	62
ENGINE LUBRICATION .....	27	IGNITION SYSTEM .....	65
ENGINE ASSEMBLING .....	29	ELECTRIC HORNS .....	69
CARBURATION .....	31	LIGHTING EQUIPMENT .....	70
ENGINE BRAKE TEST .....	33	CONTROLS AND ACCESSOIRES .....	72
CLUTCH .....	34	LUBRICATION AND MAINTENANCE CHART .....	74
GEARBOX .....	36	WIRING DIAGRAM .....	75
REAR WHEEL DRIVE .....	43	ADDITIONS AND CHANGES FOR 850-T MODEL .....	76

# MAIN FEATURES

## V7 SPORT - S

### ENGINE

Cycle:	4 stroke
Number of cylinders:	2
Cylinders disposition:	«V» type, 90°
Bore:	82.5 mm (3.247")
Stroke:	70 mm (2.756")
Displacement:	748.4 cc (45.66 cu.in.)
Compression ratio:	9.8 to 1
Max output:	53 HP at 6300 r.p.m.
Cylinder heads:	in light alloy, hemispherical, with special cast iron inserted seats
Crankshaft:	steel construction
Journal bearings:	AL-TIN alloy
Connecting rods:	steel construction with AL-TIN alloy thin wall bearings
Piston:	in light alloy

### Valve gear

OHV, push rod operated via the camshaft.

### Ignition

By battery with double contact breaker - automatic advance.

- Initial advance (fixed): 39°
- Automatic advance: 13°
- Total advance: 26°
- Contact breaker gap: 0.37-0.43 mm (.014-.017")
- Spark plugs: n. 240 for normal riding (points gap 0.6 mm = .023")  
n. 275 for continued use at high speeds (points gap 0.5 mm = .019")

### Fuel feed

Gravity from the tank - 2.5 W electrovalve controlled or in an emergency from a reserve tap on the R/H side of the machine.

### Carburetors

2 Dell'Orto carburetors VHB 30 CD (right) and VHB 30 CS (left) with acceleration pump.

### Lubrication

Oil pressure 3.8-4.2 kg/cm<sup>2</sup> = 54-60 lbs sq.in.).

### Cooling

By air. Cylinder and cylinder heads are suitably finned.

### Clutch

Dry discs, flywheel driven Lever controlled from the handlebar.

### Starting

Electric starter with electromagnetic ratchet control and relay.  
Starter button on R/H handlebar half.

### Exhaust system

Twin pipes and mufflers.

### TRANSMISSIONS

#### Primary

By helical gears in oil bath - engine-gearbox ratio 1 to 1.235 (17/21).

#### Speed change

5 speeds, constant mesh gears, frontal engagement, cush-drive incorporated, foot controlled.

Internal gear ratios:

- low gear 1 to 2 (14/28)
- second gear 1 to 1.388 (18/25)
- third gear 1 to 1.047 (21/22)
- fourth gear 1 to 0.869 (23/20)
- high gear 1 to 0.750 (24/18)

#### Secondary

Constant speed double joint cardan shaft.

- Bevel set ratio (gearbox-wheel) 1 to 4.375 (8/35)

Overall gear ratios:

- low gear 1 to 10.806
- second gear 1 to 7.499
- third gear 1 to 5.657
- fourth gear 1 to 4.695
- top gear 1 to 4.052

### CYCLE PARTS

#### Frame:

tubular structure, duplex disassemblable cradle.

#### Suspensions:

telescopic front fork with hydraulic dampers. Rear swinging arm with externally adjustable springs.

#### Wheels

Spoked rims:

- Front WM 2/1.85 x 18"
- Rear WM 3/2.15 x 18"

#### Tyres

Michelin.

- Front 3.25 H 18 ribbed
- Rear 3.50 H 18 studded

**Tyre pressures:**

- solo
  - front 2.00 kg/cm<sup>2</sup> = 28 lbs
  - rear 2.30 kg/cm<sup>2</sup> = 33 lbs
- with pillion
  - front 2.00 kg/cm<sup>2</sup> = 28 lbs
  - rear 2.50 kg/cm<sup>2</sup> = 35.5 lbs

• **NB.** - The above tyre pressures are for normal cruising speed. If using the machine at constant high speed or on motorways, the above pressures should be increased of 0.2 kg/cm<sup>2</sup> (2.8 p.s.i.).

**Brakes:**

- Front (V7 Sport):  
Four leading shoes double brake Ø 220 mm (8.66") 25 x 2 mm wide (.98 x .078") lever operated from the right handlebar with a 1.9 mm Ø (0.74) metal cable.
- Front (V750 S):  
Twin disc brake (disc Ø 300 mm) lever operated from the right handlebar through a master-cylinder and pipes from the master-cylinder to the twin control and from twin control to caliper.
- Rear:  
Twin leading shoes brake Ø 220 mm (8.66") 25 mm wide (.98") pedal operated from the right or the left of the machine.

**Over-all dimensions and weights**

- Wheelbase (fully loaded) 1.470 mts (57.8")
- Length 2.165 mts (85.2")
- Width 0.700 mts (27.5")
- Height 1.035 mts (40.7")
- Weight (in running order) 225 kgs (495 lbs)

**PERFORMANCES**

GEAR	MAX SPEED km/h
Low gear	76 = 47.5 m.p.h.
Second gear	110 = 68.7 m.p.h.
Third gear	146 = 91.2 m.p.h.
Fourth gear	179 = 111.8 m.p.h.
High gear	206 = 130 m.p.h.

Fuel consumption (CUNA regulations) 8.58 l.x 100 kms (32.8 m.p.g. imp. - 27.3 m.p.g. USA).

**FUEL AND OIL CAPACITIES**

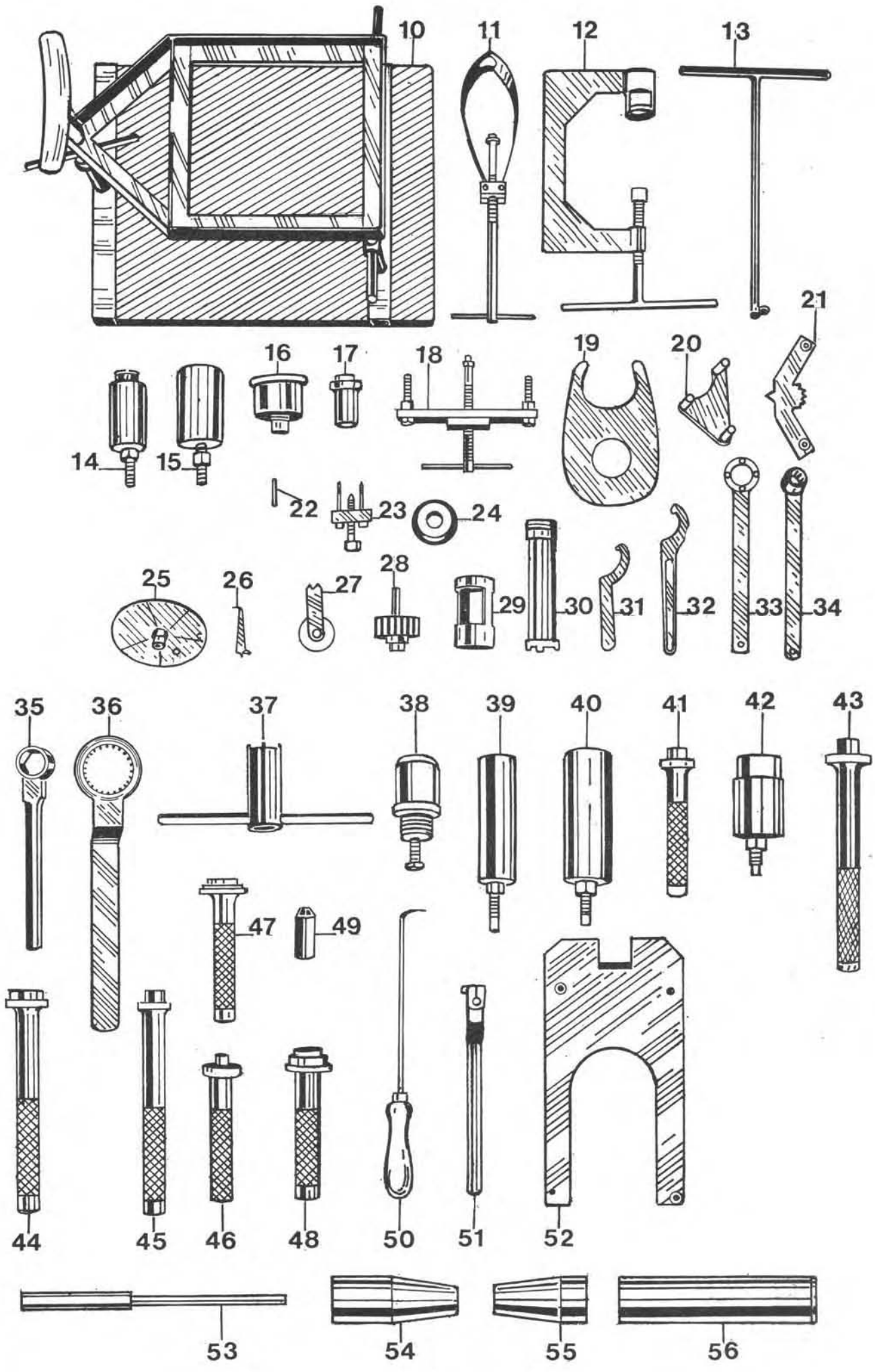
PART TO BE REPLENISHED	RECOMMENDATION	QUANTITY
Fuel tank	19 lts (4.17 gls imp. - 5 gls USA)	Petrol 98/100 NO «RM)
Reserve	2 lts (3 1/2 pints imp. - 4.2 pints USA)	
Sump	3.5 lts (6 pints imp. - 7.3 pints USA)	«Agip SINT 2000 SAE 10 W/50» or equivalent
Gearbox	0.750 lts (1 and 1/3 pints imp. - 1 and 3/4 pints USA)	«Agip F. 1 Rotra MP SAE 90» or equivalent
Rear drive box (Bevel gears)	0.360 lts (12 oz.) of which 0.020 Molikote type A	«Agip F. 1 Rotra MP SAE 90» or equivalent
Front fork dampers (each leg)	0.050 lts (1.8 oz.)	«Agip F. 1 ATF Dexron» or equivalent
Disc brake circuit (750 S model)		(Agip F. 1 Brake fluid» or equivalent

## SPECIFIC WORKSHOP TOOLS

(see fig. 5)

FIG. N.	REF. NUMBER	DESCRIPTION
10	14912400	Stand, engine support
11	26907800	Puller, piston pin
12	10907200	Tool, valve stripping and mounting
13	14927000	Wrench, dismantling and adjusting of twin contact breaker
14	12904700	Puller, taper bearing races in rear fork
15	12906900	Puller, roller bearing races in drive box
16	14927100	Tool, fitting of seal on flange with main journal, flywheel side
17	14927200	Tool, fitting of seal in timing cover
18	12913600	Tool flange removal, flywheel side
19	14912900	Tool, holdfast, timing gears (gear operated timing)
20	14927300	Tool, holdfast, camshaft gear, (chain operated timing)
21	12911801	Tool, holdfast, flywheel and starting gear
22	14906600	Tool, removal of alternator
23	32906302	Puller, oil pump gear (gear operated timing)
24	12912000	Tool, mounting of flange with seal on the crankshaft, flywheel side
25	14927400	Tool, for checking valve timing and ignition
26	14927500	Tool, arrow for checking valve timing and ignition
27	12913800	Tool, transfer of position marks on timing gear (gear operated timing)
28	12906500	Tool, clutch mounting
29	12905900	Tool, clutch shaft stripping
30	14927600	Wrench, removal of timing gear nut and driving pinion lockring
31	14922701	Wrench, damper adjusting
32	14927700	Wrench, exhaust pipes lockrings (on cylinder heads)
33	12905400	Wrench, notched, removal of lay shaft lockring
34	12907100	Tool, holdfast, layshaft and rear drive bevel gear
35	14905400	Tool, layshaft nut
36	14912800	Tool, inner clutch body to clutch shaft
37	14912600	Wrench, hooked, clutch body lockring to clutch shaft
38	14928500	Wrench, hooked, clutch shaft lockring
39	14913100	Puller, main shaft roller bearing in gearbox and clutch shaft in cover
40	14913700	Puller, outer roller bearing race for layshaft in gearbox
41	14929200	Punch, removal of clutch bearing in gearbox and layshaft bearing in cover
42	14907000	Puller, main shaft ball bearing in cover

FIG. N.	REF. NUMBER	DESCRIPTION
43	14928900	Punch, pressing of clutch bearing in gearbox and layshaft bearing in cover
44	14929100	Punch, pressing of roller bearing outer race for layshaft in gearbox
45	14928800	Punch, pressing of roller bearing for main shaft in gearbox and clutch shaft in cover
46	14929000	Punch, pressing of main shaft ball bearing in cover
47	14929400	Punch, pressing of seal for clutch shaft in gearbox
48	14929500	Punch, pressing in of layshaft seal
49	14928600	Tool, pressing in of layshaft bearing inner race
50	14929300	Tool, positioning of sliding muffs' forks
51	14928700	Tool, shifting of preselector
52	14929600	Stand, gear box support
53	14926400	Tool, removal of pump floater (disc brake)
54	14926500	Tool, fitting of floater special seal (disc brake) floater
55	14926600	Tool, fitting of gasket on floater (disc brake)
56	14926700	Tool, fitting of pump lockring (disc brake)
		<b>SPECIAL PRODUCTS</b>
	00010000	Teflon (923.499.909)
	00010100	Molycote Type «A»
	00010200	Devcon «F»
	00010400	Loctite 601 (804.585.601)





## NUTS AND BOLTS TORQUE LOADING

DESCRIPTION	PART N.	SPECIFICATIONS			TORQUE kgm	LOADING ft/lbs
		d mm	p mm	hex mm		
<b>CRANKCASE AND COVERS</b>						
Nut, short and long stud	92751103	10	1.5	17	4-4.5	29-32
Nut, push rod stud	13021900	10	1.5	10	4-4.5	29-32
Nut, stud bolts	92602208	8	1.25	13	2.5	18
Screw, journal bearing flange	98054425	8	1.25	13	3	22
Screw, cover and flange, flywheel side	98054425	8	1.25	13	3	22
Screw, short, cover securing	98620325	6	1	Allen 5	1	7
Screw, long, cover securing	98620335	6	1	Allen 5	1	7
Screw, cover securing	98620325	6	1	Allen 5	1	7
Cap, oil drain	12003701	20	1.5	22	5	36
Bolt, oil sump	98052340	6	1	10	1	7
Screw, oil breather tube	98054316	6	1	10	1	7
Oil filler cap	14004900	20	1.5	22	3	22
Screw, recovery pipe band	98054316	6	1	10	1	7
Bolt, hollow, oil rec. pipe	12116600	12	1.5	17	4	29
<b>CYLINDER HEAD AN CYLINDER</b>						
Screw, rocker spindle	98054312	6	1	10	0.6-0.8	4.2-5.7
Screw, rocker box cover	98620330	6	1	Allen 5	1	7
<b>CONNECTING ROD</b>						
Nut, self-locking, big end	92731090	9	1	14	4.6-4.8	33-35
Bolt, flywheel (10 K)	12067701	8	1.25	13	4.2	30
Bolt, slip ring	98054425	8	1.25	13	3	22
<b>VALVE GEARING</b>						
Screw, camshaft flange	92701187	18	1.5	26	15	108
Nut, camshaft gear						
<b>ELECTRICAL EQUIPMENT</b>						
Screw, Bosch starter motor	98052480	8	1.25	13	3	22
Screw, Bosch starter motor	98052490	8	1.25	13	3	22
Screw, Bosch starter motor	98052490	8	1.25	13	3	22
Screw, Marelli starter motor	98052475	8	1.25	13	3	22
Nut, Marelli starter motor	92602208	8	1.25	13	3	22
Nut, solenoid screw	92602206	6	1	10	1	22
<b>FUEL FEED</b>						
Screw, intake pipe	98620435	8	1.25	13	3	22
<b>LUBRICATION</b>						
Screw, short, oil pump	98108042	8	1.25	13	3	
Screw, long, oil pump	98022455	8	1.25	13	3	22
Screw, bottom filter plate	98024310	6	1	10	1	7
Screw, filter box securing	98020435	8	1.25	13	3	22
Screw, pipe securing	98054430	8	1.25	13	3	22
Bolt, hollow, oil delivery	95990037	8	1.25	13	1.5-1.8	10.5-16

d = diameter; p = pitch; hex = hexagon

DESCRIPTION	PART N.	SPECIFICATIONS			TORQUE kgm	LOADING ft/lbs
		d mm	p mm	hex mm		
<b>IGNITION</b>						
Bolt, generator	98620245	5	0.8	Allen 4	0.5	3.5
Bolt, breaker back plate	98052430	8	1.25	13	3	22
<b>ENGINE TO FRAME ITEMS</b>						
Nut, front bolt	92602312	12	1.25	19	8	58
Nut, rear bolt	92602312	12	1.25	19	8	58
<b>GEARBOX</b>						
Bolt, bearing retainer	98054316	6	1	10	1	7
Nut, layshaft securing	14219310	22	1	27	16-18	115-129
Bolt, breaker bracket	98054316	6	1	10	1	7
Oil filler cap	12002701	20	1.5	22	3	22
Oil level plug	95980610	10	1.5	17	2	14
Screw, lock plate	98054316	6	1	10	1	7
Screw, cover	98620325	6	1	Allen 5	1	7
Screw, cover	98620335	6	1	Allen 5	1	7
Nut, safety	14217410	16	1	24	7-8	50-57
<b>REAR DRIVE</b>						
Screw, bottom plate retaining	98622320	6	1	Allen 5	1	7
Plug, oil filler	12003701	20	1.5	22	3	22
Plug, oil level and drain	95980610	10	1.5	17		18
Nut, bearing retainer on bevel gear	12356700	25	1.5	36	18-20	129-144
Bolt, crown wheel	12356300	8	1.25	13	4.2	31
Bolt, flange securing	98054425	8	1.25	13	2.5	18
<b>FRAME</b>						
Screw, cradle to frame	98663630	12	1.25	Allen 10	8	58
Nut, cradle to frame screw	92602312	12	1.25	19	8	58
Bolt, stand securing	98052545	10	1.5	17	3.5	25
Nut	92602210	10	1.5	17	3.5	25
Screw, battery bracket	98054416	8	1.25	13	2.5	18
Nut	92602208	8	1.25	13	2.5	18
Nut, footrest screw	92602512	12	1.25	19	2	14
Screw, clamp	98062535	10	1.5	17	4.5	32
Cap nut, rear fork spindle	14547800	20	1	30	8	58
Bolt, tie rod to rear fork	98054520	10	1.5	17	4.5	32
Nut	92602210	10	1.5	17	4.5	32
Nut, rear drive box	92602208	8	1.25	13	3.5	25
Nut, rear fork screw	92602206	6	1	10	1	7
Nut, front fender screw	92602208	8	1.25	13	3	22
Screw, splash guard	98054320	6	1	10	1	7
Nut, self locking	92630106	6	1	10	1	7
Nut, rear fender tip	45403003	8	1.25	14	3	22
Screw, fender tip	98052355	6	1	10	1	7
Nut, self locking	92630106	6	1	10	1	7
Nut, rear seat bolt	92602208	8	1.25	13	3	22
Nut, self locking, tool box	92630106	6	1	10	0.3-0.5	2.5-3.5

d = diameter; p = pitch; hex = hexagon

DESCRIPTION	PART N.	SPECIFICATIONS			TORQUE kgm	LOADING ft/lbs
		d mm	p mm	hex mm		
<b>FRONT SUSPENSION</b>						
Bolt, bottom yoke securing	98662535	10	1.5	Allen 8	4.5	32
Bolt, top linking plate	98662535	10	1.5	Allen 8	4.5	32
Plug, top fork	14504500	29	1	32	12-15	86-108
Bolt, bottom cover	98622535	10	1.5	Allen 8	4.5	32
Screw, damper securing	14504800	8	1.25	13	3	22
Bolt, fork cover to wheel spindle	98660540	10	1.5	Allen 8	4.5	32
Screw, headlight lug	98620325	6	1	Allen 5	1	7
<b>REAR SUSPENSION</b>						
Nut, bottom	92603210	10	1.5	17	4.5	32
Bolt, top	98064416	8	1.25	13	3	22
<b>FRONT WHEEL AND BRAKE</b>						
Screw, front brake lever	98106022	6	1	10	1	7
Nut, tie rod	92602206	6	1	10	1	7
Screw, operating lever	98106022	6	1	10	1	7
Nut, wheel spindle	92603316	16	1.5	24	14-15	101-107
<b>REAR WHEEL AND BRAKE</b>						
Screw, central body securing	98108038	8	1.25	14	3	22
Nut, body screw	92605008	8	1.25	13	3	22
Nut	92603210	10	1.5	17	4	29
Screw, cam levers	98062325	6	1	10	1	7
Nut, tie rod	92603206	10	1.5	17	4.5	32
Nut, rear fork bolt	92602210	16	1.5	17	4.5	32
Nut, rear wheel spindle	92603316	10	1.5	24	14-15	101-107
<b>PEDALS AND CONTROLS</b>						
Screw, starter pin lever	98052325	6	1	10	1	7
Nut, joint adjusting	92602206	6	1	10	1	7
Screw, lever oper; rod	98052325	6	1		1	7
Screw, rod clamp	98622320	6	1	Allen 5	1	7
Screw, ball joint	98052325	6	1	10	1	7
Nut, ball joint screw	92630106	6	1	10	1	7
Screw, gearshift lever	98054425	8	1.25	13	3	22
Nut, gearshift screw	92602406	6	1	10	1	7
Screw, lever fulcrum	98620330	6	1	Allen 5	1	7
Nut, clutch lever	92602406	6	1	10	1	7
Screw, lever fulcrum	98620318	6	1	Allen 5	1	7
<b>STEERING - HANDLEBAR INSTRUMENTS</b>						
Bushing, steering clamping	14516600	25	1	32	17-18	122-129
Nut, self locking, steeringrod	92630106	6	1	10	1	7
Nut, steering damper rod	92630106	6	1	10		7
Bolt, handlebar	98660450	8	1.25	Allen 6	3	22
Bolt, panel securing	98662414	8	1.25	Allen 6	2.5	18

d = diameter; p = pitch; hex = hexagon

DESCRIPTION	PART N.	SPECIFICATIONS			TORQUE kgm	LOADING ft/lbs
		d mm	p mm	hex mm		
<b>ELECTRICAL EQUIPMENT</b>						
Nut, coil securing	92630106	6	1	10	0.3-0.5	2.5-3.5
Nut, regulator screw	92602206	6	1	10	1	7
Nut, rectifier screw	92602205	5	0.8	8	0.3-0.5	2.5-3.5
Nut, self locking, brackets	92602208	8	1.25	13	3	22
Nut, self locking, plate screw	92630106	6	1	10	1	7
Nut, lock plate	92630106	6	1	10	1	7
Nut, starter button	92602206	6	1	10	1	7
Nut, courtesy light bracket	92602206	6	1		1	7
<b>FUEL SYSTEM</b>						
Nut, tap connection	14105700	16	1	19	3	22
Bolt, tank securing	98062430	8	1.25	13	3	22
Nut, rubber buffer	92602206	6	1	10	1	7
<b>EXHAUST SYSTEM</b>						
Nut, muffler screw	92602208	8	1.25	13	3	22
Nut, band securing	92603206	6	1	10	1	7
Nut, securing screw	92603206	6	1	10	1	7
d = diameter; p = pitch; hex = hexagon						

## PRELIMINARY REMARK

During the dismantling operations, it is strongly recommended to keep the various assemblies well apart.

## REMOVAL OF THE ENGINE - GEARBOX UNIT FROM THE FRAME

By means of the wrench n. 14927700 (32 in fig. 6) undo the lockrings of exhaust pipes on cylinder heads and after loosening the screws fixing silencers to frame remove the exhaust pipe-silencer assemblies.

Place part n. 14912400 (10 in fig. 7) under the engine oil sump; remove the rods from rear brake and gear-shift levers; remove the cable from the clutch control

lever on the gearbox; disconnect all electric wirings; then slide off the engine-gearbox unit from the after undoing all fixing devices.

After removing the engine-gearbox from the frame, wash it down thoroughly in petrol before separating the engine unit from the gearbox.

## STRIPPING THE ENGINE UNIT

After separating the engine from the gearbox proceed as follows:

— place an oil tray under the engine, undo plug B in fig. 8, undo filler cap, and drain the oil from the sump.

Remove now:

— spark plugs;

— double contact breaker, after undoing retaining bolts with special wrench part n. 14927000 (13 in fig. 9) and removed the stop plate from the crankcase;

— clutch unit, unscrewing the bolts which secure the starter ring gear. Do this with the ring gear and holdfast tool part n. 12911801 (21 in fig. 10) and unscrew the bolts in a crossed order. After removing the ring gear, withdraw the driven plate, intermediate plate, driven plate, plate pressure cap, pressure plate and springs;

— alternator-generator after undoing the screw which retains it to the crankshaft and using tool part n. 14906600 (22 in fig. 11) to pull out the extractor, after removing its cover;

— timing cover after undoing its securing screws to the crankcase;

— camwheel securing nut to the camshaft using special wrench part n. 14927600 (30 in fig. 12) and flywheel holdfast tool n. 14912900 (19 in fig. 12);

— undo gear pump nut using the special wrench and tool 14927600 (30 in fig. 13). To withdraw the oil pump gear from its driving shaft use tool 32906302 (23 in fig. 14);

— unscrew the distributor gear lockring on the shaft using wrench n. 14927600 (30 in fig. 13) and fly-wheel holdfast tool 12911801 (21 in fig. 15);

— flywheel. After flattening the lock plates, unscrew the bolts which secure it to the crankshaft using tool 12911801 (21 in fig. 15) and a box spanner;

— cylinder head lubrication pipe after undoing its 3 securing screws;

— rocker box covers;

— rocker spindles;

— rocker arms, springs and washers. Undo nuts and remove adjusting screws from rockers;

— push rods;

— rocker arm supports after unscrewing the 4 nuts and bolts (each head) which secure cylinder and cylinder head to the crankcase;

— cylinder heads complete with valves. From these remove then the collets, top collars, outer springs, inner springs, bottom collars and shims, and finally slip out the valves. Use tool 10907200 (12 in fig. 16) to compress the springs;

— cylinders with gaskets;

— tappets from the crankcase housings;

— piston pin using puller n. 26907800 (11 in fig. 17) and after extracting the circlips;

— piston and from this the piston rings;

— oil sump and gasket after undoing its retaining bolts to the crankcase;

— oil pipe A after flattening the lock plates and undone the crankcase securing screws;

— the complete oil filter unit after undoing the 2 screws which secure it to the crankcase (fig. 18).

The filter unit comprises: body, gasket, wire gauze screen, plate, screws and washers;

- Oil pump after undoing its securing screws to the crankcase. The oil pump consists of: body, driving gear and driven gear;
- con-rod caps after undoing the securing nuts and withdrawn the bolts which secure them to con-rods. Slip out the con-rod caps from the bottom and the con-rod itself from the top of the crankcase. From the con-rod remove now the half bearings;
- camshaft after undoing the screws which secure the flange to the crankcase;
- flange complete with crankshaft journal, flywheel side after flattening the lockplate flaps and undo the screws which secure it to the crankcase. The flange is withdrawn from its housing in the crankcase by Means of tool 12913600 (18 in fig. 19);

- back out the crankshaft from the flange complete with bearing on the timing side;
- the flange c/ with main journal, timing side, after flattening the lock plates flaps and unscrewing the securing screws;
- oil pressure solenoid (F fig. 72).

#### **CHAIN OPERATED TIMING**

After placing holdfast tool n. 14927300 (20 in fig. 20) undo the driving gear to oil pump retaining nut, undo the pinion to crankshaft lockring by means of wrench n. 14927600 (30 in fig. 20) then the gear to camshaft retaining nut by means of wrench n. 14927600 (30 in fig. 21).

# OVERHAULING THE ENGINE UNIT

## ROCKER BOX COVERS - CYLINDER HEADS VALVES - VALVE SPRINGS

### ROCKER BOX COVERS

Ensure that contact surfaces are not bruised and there is no cast defect.

### INSPECTION AND OVERHAUL OF CYLINDER HEADS

Ensure that all cooling fins are in good condition and the joining surfaces not deformed. Remove all carbon deposits using a blunt scraper and a wire brush. Check valve seats and guides.

### INSPECTION OF VALVE GUIDES

Valve guides are pressed in their housings in the cylinder heads.

Removal and re-fitting is done with a round punch (See fig. 22).

Valve guides should be replaced when the play between valve stem and guide housing is excessive and such play does not disappear by fitting a new valve. After the guide is pressed into its housing (punch in fig. 23), ream the hole out to bring the internal diameter to the size indicated in fig. 24 — drwg. in fig. 25 — and coupling data table.

Negative allowance in pressing the guides in the head should be in between .046-.075 mm (.0018-.00295").

### VALVE - VALVE GUIDES COUPLING DATA

	VALVE GUIDE I/D	VALVE STEM	CLEARANCE
Inlet valve	8.000-8.022 mm (.3419-.3158")	7.972-7.987 mm (.3138-.3144")	0.013-0.050 mm (.0005-.0019")
Exhaust valve		7.965-7.980 mm (.3136-.3142")	0.020-0.057 mm (.0008-.0022")

### INSPECTION AND OVERHAUL OF VALVE SEATS

In order to ensure a perfect match with the valve, the seat needs to be ground in.

Inclination angle of the seats is  $45^{\circ} 30' \pm 5$  for both inlet and exhaust valves.

### INSPECTION OF VALVES

Check the play between stem and guide (see coupling data table and fig. 25).

Inclination angle of the valve head is  $45^{\circ} 30' \pm 5$ .

### CHECKING OF INLET AND EXHAUST VALVE OPENING (see fig. 26)

By each grinding of the valve seats on cylinder heads, check that the springs are compressed between mm  $35,7 \div 36$  after mounting of valves.

After reaching their maximum opening, the valves should have still a play of mm 1.-1.75 (.039-.068") before the inner spring compresses fully.

### INSPECTION OF VALVE SPRINGS

(see fig. 27)

#### OUTER SPRING

**Free length:** 52,5-52,6 mm (2.06-2.07")

**Valve closed:** 36 mm (1.417"), load  $29.5 \pm 3$  kgs (64 lbs.)

**Valve open:** 27 mm (1.06"), load  $45.5 \pm 3$  kgs (100 lbs.)

**Fully compressed:** 22.7-23.25 mm long (.893-.914")

**Free length:** 44.7-45 mm (1.759-1.771")

**Valve closed:** 31 mm long (1.22"), load  $16.7 \pm 3$  kgs (37 lbs.)

**Valve open:** 22 mm long (.866"), load  $27.75 \div 28.25 \pm 3$  kgs (61-62 lbs.)

**Fully compressed:** 19.75-20.25 mm (.778"-.796")

Spring flexibility can be checked with the instrument shown in fig. 28.

### MOUNTING OF SPRINGS AND VALVES ON CYLINDER HEAD

- fit the valve, pressed on head, into the guide;
- fit the retaining ring on the valve guide;

- fit following on the valve stem:
  - outer spring washers;
  - bottom plate;
  - inner spring;
  - outer spring;
  - top plate;
- place tool 10907200 (12 in fig. 16) on valve head and top plate, screw in the tool screw so to fit the

semi-cones. Repeat this operation for the other valve.

#### **ASSEMBLY OF CYLINDER HEADS**

Not to warp the cylinder head, tighten nuts and studs in a crossed sequence (see fig. 26) using a torque wrench loaded at 4-4,5 kgm.

By this assembly always replace gaskets and seals.



# CYLINDERS - PISTONS - PISTON RINGS

## CYLINDER WEAR

The cylinder bore should be measured at 3 different heights in a transversal and longitudinal directions. Dial gauge has to be previously set to zero on the slip ring (See fig. 30 and measurement chart fig. 31).

Should the chromium plated surface be worn down to more than 0,1 mm (.0039") or if any scoring or ovalization is detected, the cylinder should be replaced.

## SELECTION OF CYLINDER DIAMETER

CLASS «A»	CLASS «B»	CLASS «C»
82.500 mm (3.2480")	82.506 mm (3.2482")	82.512 mm (3.2484")
82.506 mm (3.2482")	82.512 mm (3.2484")	82.516 mm (3.2486")

• **NB.** - Cylinders must always be matched with pistons of same class.

## PISTONS

At the time the engine is overhauled, the piston crown and the piston rings slots should be cleaned of all carbon deposits before proceeding with the clearance checking operation.

If such clearance exceeds the limits indicated in the table, then the cylinders and pistons have to be replaced. For engine balancing, both pistons should be of same weight. The maximum permissible weight difference is 1.5 grams (.05 oz.) see fig.32.

The selection measurements indicated in the table must be taken at 35 mm (1.37") (see fig. 33 and drwg. fig. 34) from the piston base in an orthogonal sense to the piston pin axis.

Maximum permissible ovalization: 0,055-0.065 mm (.0021-.0025") less than selection size.

## SELECTION OF PISTON DIAMETER

CLASS «A»	CLASS «B»	CLASS «C»
82.458 mm (3.2463")	82.464 mm (3.2465")	82.470 mm (3.2467")
82.464 mm (3.2465")	82.470 mm (3.2467")	82.476 mm (3.2469")

• **NB.** - Pistons must always be matched with cylinders of same class.

## FITTING OF PISTON ON CON-ROD

Before re-fitting the piston on the con-rod heat it in an oil bath at about 60 °C (140 °F) in order to slightly dilate the hole and so make the introduction of the pin easier.

Clearance between piston pin and piston holes is from 0,06 mm (.0023") to a negative allowance of 0.004 mm (.00017").

## PISTON RINGS AND OIL SCRAPER

Each piston fits 4 rings (3 compression and one oil scraper).

When fitting the rings on the piston, pay attention to the end gap which has to be out of line with each other.

Check clearance between ring and slot in piston (See fig. 35). This clearance should be within the values indicated in section «Piston slots and ring height clearance».

Before fitting the rings on the piston it is necessary to insert them in the cylinder barrel to ensure that the gap clearance is as specified (See fig. 36 and section «Piston ring and oil scraper gap»).

## PISTON RINGS AND OIL SCRAPER PISTON SLOTS HEIGHT CLEARANCE

Top piston ring	0.030-0.062 mm (.0011-.0024")
Second piston ring	0.030-0.062 mm (.0011-.0024")
Third piston ring	0.030-0.062 mm (.0011-.0024")
Oil scraper	0.030-0.062 mm (.0011-.0024")

## PISTON RING GAP

Compression rings	0.30-0.45 mm (.012-.018")
Scraper ring	0.25-0.40 mm (.010-.016")

# CON-RODS - CRANKSHAFT - MAIN BEARINGS FLYXHEEL AND TIMING SIDES

## CON-RODS

When overhauling the con-rods, check the following:

- condition of small end bushings and bush-piston pin clearance;
- weight of con-rods;
- parallelism of the two axis;
- big end bearings.

Big end bearings are of thin wall type in antifriction alloy and so do not allow any adjustment. If scored, worn or seized, the bearing must be replaced.

In such case, the crankpin has to be reground. Before proceeding with this operation, it is necessary to measure diameter of same at major wear point (See fig. 45) in order to determine the class of the bearing to be replaced and the diameter to which the crankpin has to be ground.

«See tables «Thickness of big end bearings» and «Diameter of crankshaft pin».

## THICKNESS OF BIG END BEARINGS

ORIGINAL PRODUCTION BEARING	OVERSIZE		
	0.254 mm (.010")	0.508 mm (.020")	0.762 mm (.030")
from 1.537 mm (.06074")	1.664 mm (.06551")	1.791 mm (.0705")	1.918 mm (.0755")
to 1.543 mm (.0614")	1.670 mm (.06574)	1.797 mm (.0707")	1.924 mm (.0757")

## CRANKPIN DIAMETER

ORIGINAL DIAMETER	OVERSIZE BEARING		
	0.254 mm (.010")	0.508 mm (.020")	0.762 mm (.030")
from 43.893 mm (1.730")	43.729 mm (1.720")	43.475 mm (1.710")	43.221 mm (1.700")
to 43.994 mm (1.732")	43.740 mm (1.722")	43.486 mm (1.712")	43.232 mm (1.702")

## SMALL END BUSHING

The bushing is pressed in and its internal surface should be free of nick or scoring marks. If so, replace the bushing.

The old bush is removed from the small end with a suitable punch.

When re-fitting a new bush, ream out the internal diameter to bring it down to the sizes indicated in the following table (see fig. 37), after it has been pressed in.

I/D OF BUSHING AFTER PRESSING IN AND REAMING	PISTON PIN DIA.	PIN-BHUSING CLEARANCE
22.025 mm (.867")	22.000 mm (.86614")	0.021-0.045 mm (.00082-.0017")
22.045 mm (.8678")	22.004 mm (.86629")	

## CHECKING PARALLELISM OF AXIS

Before checking the con-rod, check if they are «square» or in other words ensure that both big and small end holes are parallel to each other.

Any eventual deformation can be rectified by means of fork lever set up on the con-rod as shown at fig. Maximum permissible offset of the small and big end axis measured at 200 mm (7.874") is  $\pm 0,10$  (See fig.3.9).

## FITTING OF CON-RODS ON CRANKSHAFT

When fitting the con-rod on the crankshaft, ensure that that the holes on the big ends for lubrication are in following positions (see B in fig. 40).

- left cylinder con-rod: upwards;
- right cylinder con-rod: downwards.

Bearing-crankpin assembly clearance goes from a minimum of 0.050 mm (.0019") to a maximum of 0.085 mm (.0032") (see drwg. fig. 48).

Con-rod-crankshaft clearance is 0.030-0.040 mm (.00118-.00157) (see fig. 41 drwg. fig. 48).

Fit the con-rod on the crankshaft and tighten the nuts using a torque wrench set at 4.6-4.8 kgm (33-35 ft/lbs) (see fig. 42).

Figure 43 shows the dismantled con-rod group.

For measurements see fig. 44.

**Remark:** by looking at the engine, clutch side, the milled surfaces (of con-rods and caps) must be on the same side (see A in fig. 40).

## Checking weight for engine balancing

The con-rods c/w nuts and bolts should be of same weight.

Maximum permissible difference: 3 grams (see fig. 38).

Static balancing of the crankshaft is obtained by applying a weight of 1.471-1.601 kgs (3<sup>1</sup>/<sub>4</sub>-3<sup>1</sup>/<sub>2</sub> lbs).

## CRANKSHAFT

Check crankpin and main shafts.

If only slightly scored, polish it with very fine carborundum.

If deeply scored or ovalized, the crankshaft should be re-ground and fitted with u/s big end bearings. The undersize range of big end bearings available is: 0.2 mm, 0.4 mm, 0.6 mm (.00787", .01574", .02362").

Crankpin bearing are supplied in the following sizes: 0.254 mm, 0.508 mm, 0.762 mm (.010", .020", .030"). Before re-grinding it is necessary to carefully determine the amount of wear (see fig. 45-46-47 drwg. fig. 48) of the crankpin and main shafts in order to decide the new diameter taking into account the available sizes and the necessary clearances.

Assembl clearances are:

- mainshaft-bearing, timing side 0.025-0.057 mm (.0098-.0022")
- mainshaft-bearing, flywheel side 0.030-0.068 mm (.00118-.0027")
- crankpin-bearing 0.050-0.085 mm (.0019-.0032")

When re-grinding the shaft, do not forget to restore the soulder relief radius which is 2-2.5 mm (.078-.090") for the crankpin, 3 mm (.118") for the mainshaft, flywheelside, and 1.5-1.8 mm (.058-.070") on the timing side.

#### DIAMETER OF MAINSHAFT, FLYWHEEL SIDE

ORIGINAL DIAMETER	UNDERSIZE		
	0.2 mm (.00787")	0.4 mm (.01574")	0.6 mm (.02362")
53.970 mm (2.1248")	53.770 mm (2.1169")	53.570 mm (2.1090")	53.370 mm (2.1013")
53.931 mm (2.1233")	53.751 mm (2.1162")	53.551 mm (2.1063")	53.351 mm (2.1004")

#### DIAMETER OF MAINSHAFT, TIMING SIDE

ORIGINAL DIAMETER	UNDERSIZE		
	0.2 mm (.00787")	0.4 mm (.01574")	0.6 mm (.02362")
37.975 mm (1.4951")	37.775 mm (1.4872")	37.575 mm (1.4793")	37.375 mm (1.4715")
37.959 mm (1.4944")	37.759 mm (1.4866")	37.559 mm (1.4787")	37.359 mm (1.4707")

#### I/D OF MAIN BEARING, FLYWHEEL SIDE

ORIGINAL DIAMETER	UNDERSIZE		
	0.2 mm (.00787")	0.4 mm (.01574")	0.6 mm (.02362")
54.000 mm (2.1260")	53.800 mm (2.1171")	53.600 mm (2.1102")	53.400 mm (2.1024")
54.019 mm (2.1267")	53.819 mm (2.1188")	53.619 mm (2.1109")	53.419 mm (2.1031")

#### I/D OF MAIN BEARING, TIMING SIDE

ORIGINAL DIAMETER	UNDERSIZE		
	0.2 mm (.00787")	0.4 mm (.01574")	0.6 mm (.02362")
38.000 mm (1.4961")	37.800 mm (1.4883")	37.600 mm (1.4803")	37.400 mm (1.4725")
38.016 mm (1.4967")	37.816 mm (1.4889")	37.616 mm (1.4809")	37.416 mm (1.4731")

#### FITTING OF THE FLYWHEEL ON THE CRANKSHAFT

By fitting the flywheel on the crankshaft ensure that the mark «A» (fig. 49) on the shaft is in line with the TDC arrow on the flywheel.

#### FLANGE COMPLETE WITH MAIN BEARING, FLYWHEEL SIDE

Check that all surfaces which contact the crankcase are smooth and free of scoring, also that the main bearing is not excessively worn (Check against table «I/D of main bearing, flywheel side»).

Ensure that all lubrication ducts are in line with those in the crankcase. Use tool 12912000 (24 fig. 50) for this operation.

This tool will allow easy introduction of the seal in the flange on the crankshaft without damaging the inner edge of the seal.

#### SEAL FOR FLANGE - FLYWHEEL SIDE

When overhauling, ensure that the seal is properly pressed into the flange and that the internal surface of the seal which works on the crankshaft is not crumbled or damaged. If so, replace the ring.

Use tool 14927100 (16 in fig. 51) for fitting the seal in the flange c./w. main bearing.

#### FLANGE COMPLETE WITH MAIN BEARING, TIMING SIDE

Check that the union faces to the crankcase are perfectly smooth and not scored. Also, that the main bearing is not excessively worn. (Check against data in «I/D of main bearing, timing side»).

#### TIMING COVER

Ensure it joining faces are dead smoot and free of scoring.

When overhauling, check that the seal is a proper fit in its housing and the cover and that its inner surface is not crumpled or damaged. Rplace as necessary.

Fitting of seal into the timing cover is made by means of tool n. 14927200 (17 in fig. 52).

#### CRANKCASE

Check that the joining surfaces of the main bearing carrying flange, the gearbox union faces to the engine block, and the timing cover union face are dead smooth and free from nicks or scoring.

Check the condition of tappet guide housings, if necessary ream out them (see fig. 53) using a drift for 1st or 2nd oversize as specified in table «Coupling data of tappets in crankcase housings».

## USEFUL DATA - CRANK MECHANISM PARTS (Manufacturing sizes)

Cylinder barrel dia. ....	82.500-82.518 mm	(3.247-3.248")
<hr/>		
Piston diameter:		
— selection dia. at 35 mm (1.377") from piston base .....	82.476-82.458 mm	(3.247-3.246")
<hr/>		
Piston pin hohsing .....	22.000-22.006 mm	(.8661-.8663")
<hr/>		
Piston pin diameter .....	22.000-22.004 mm	(.8661-.86634")
<hr/>		
Main shaft dia., flywheel side .....	53.970-53.951 mm	(2.1248-2.1240")
<hr/>		
Main shaft dia., timing side .....	37.975-37.959 mm	(1.4951-1.4944")
<hr/>		
I/D of main bearings c/w flange:		
— flywheel side .....	54.000-54.019 mm	(2.1260-2.1268")
— timing side .....	38.000-38.016 mm	(1.4961-1.4967")
<hr/>		
Undersize range of main bearings available as spare parts .....	0.2 mm (.00787"), 0.4 mm (.01574"), 0.6 mm (.02362")	
<hr/>		
Crankpin diameter .....	47.130-47.142 mm	(1.9016-1.8559")
<hr/>		
Original width of con-rod bearings .....	1.537-1.543 mm	(.0606-.0608")
<hr/>		
Undersize range of big end bearings available as spare parts ...	0.254 mm (.010"), 0.508 mm (.020"), 0.762 mm (.030")	
<hr/>		
I/D of small end bushing (after pressing in) .....	22.025-22.045 mm	(.867-.8678")
<hr/>		

## TIMING

Timing data (referred to the clearance of 0,5 mm between rocker and valve) are the following (see fig. 54).

### Inlet:

- opens 40° before TDC
- closes 70° after BDC

### Exhaust:

- opens 63° before BDC
- closes 29° after TDC

- Normal rocker clearance (cold engine);
- inlet and exhaust 0.22 mm (.8661").

### CAMSHAFT (See fig. 55)

The steel construction camshaft is located in the crankcase and is carried at both ends in suitable housings machined in the crankcase. The camshaft is gear driven directly by the crankshaft. Valves are operated by push rods, rockers, and tappets. Tappets guides are machined directly in the crankcase.

### DIAMETER OF CAMSHAFT BEARINGS AND HOUSINGS IN CRANKCASE

	CAMSHAFT JOURNALS	HOUSING IN CRANKCASE	FITTING CLEARANCE
Timing side	46.984-47.000 mm (1.814-1.850")	47.025-47.050 mm (1.8511-1.8529")	0.025-0.066 mm (.0009-.00035")
Flywheel side	31.894-32.000 mm (1.259-1.259")	32.025-32.050 mm (1.2607-1.2623")	0.025-0.066 mm (.0009-.00035")

### TAPPETS

(See fig. 56)

Ensure that the tappet surface contacting the cam on the shaft is dead smooth.

Possible slight scoring or roughness on the surface can be remedied with fine carborundum. Ensure that the rod seat is not nicked or scorred. The following table indicates fitting clearances and available oversizes.

### COUPLING DATA OF TAPPETS AND GUIDES IN CRANKCASE

	I/D OF GUIDE HOUSINGS	O/D OF TAPPETS	FITTING CLEARANCE
Original	22.021-22.000 mm (.8669-.8661")	22.000-21.979 mm (.8661-.9046")	0 ÷ 0.042 mm (0-.0016")
Oversize	0.05 mm (.0019")	22.071 ÷ 22.050 (.8668-.8680")	0 ÷ 0.042 mm (0-.0016")
	0.10 mm (.0039")	22.121-22.100 mm (.8708-.8700")	0 ÷ 0.042 mm (0-.0016")

### PUSH RODS

(See fig. 57)

Check straightness and that their contacts end are quite smooth. If necessary, replace the rods.

### ROCKER ARMS AND SPINDLES

(See fig. 58)

When overhauling this group, it is necessary to closely check the rocker-spindle clearance against the date given in the following table.

If necessary, replace either the rocker bush or the spindle, or both.

All contact surfaces must be dead smooth.

For timing assemblies (see fig. 57).



## COUPLING DATA FOR ROCKER ARMS AND SPINDLES

I/D OF ROCKER ARMS BUSH AFTER PRESSING IN AND MACHINING	DIA. OF ROCKER ARM SPINDLE	FITTING CLEARANCE
15.032 ÷ 15.059 mm (.5981-.5929")	14.983 ÷ 14.994 mm (.5899-.5903")	0.038 ÷ 0.076 mm (.0015-.0029")

### TAPPET CLEARANCE ADJUSTMENT

(See fig. 59)

This operation should be carried out with great care in order that the prescribed timing diagram is not altered.

Don't forget that excessive clearance will cause noisy valve operation while no clearance will prevent the valves from closing completely and so damage the seats.

Adjustment is made as shown in the figure on a COLD ENGINE.

- Undo nut «A» and screw in or out bolt «B»;
- using a feeler gauge (C) part n. 12909090, adjust until both the inlet and exhaust rockers have a clearance of 0.22 mm (.00886");
- finally lock nut A keeping a fast hold on screw B.

### TIMING THE VALVES (gear driven timing)

Remove the rocker box covers and give tappets a provisional clearance of 0.5 mm (.019").

Rotate the flywheel until the arrow on the same coincides with the center of the projection on the crankcase flange, clutch side.

This will indicate that piston is at TDC with both valves closed and the engine at the end of the compression stroke (See A in fig. 60).

Apply a special degree plate to the flywheel, securing it by means of the crankcase bolts.

The TDC mark on the plate should coincide with the arrow on the flywheel and the center of the jut on the crankcase flange (See A in fig. 60).

Turn the flywheel anticlockwise to bring the flywheel arrow in correspondence with A.S. (exhaust valve opening) which is 117° after TDC (See B in fig. 60). Fit the distributor gear on camshaft key and using a screwdriver turn the camshaft anticlockwise until the rocker arm on right cylinder head touches the exhaust valve.

Fit now the camwheel on the camshaft and find the position where one of the slots in this wheel is in correspondence with the hole on the camshaft to allow the stop dowel to be inserted without moving the crankshaft or the camshaft.

At the end of this operation, mark the 2 teeth on the camwheel, the tooth of the distribution gear which engages them, and the slot in the camwheel in which the dowel has been inserted (See A and B in fig. 51). Tighten camwheel securing nut and distributor gear lockring using wrench n. 14927600 (30 in fig. 12-13) and tool 14912900 (19 in fig. 12-13) and adjust tappet clearance of both inlet and exhaust valves to 0.22 mm (.0086").

Check timing and if all is correct the exhaust valve should start opening when the flywheel arrow is opposite mark A.S. (exhaust valve opening) of the left cylinder n. 2 at 117° after TDC.

Detail of tappets, pushrods, semi cones, springs and collars are shown in fig.

• **NB.** - If replacing the distribution gear and the camwheel without removing the engine from the frame and valve timing has to be re-set, this should be done with the tool specially designed for this purpose which will allow the reference marks on the old gear and wheel to be transferred exactly on the new gears.

- Remove the gears to be replaced;
- insert pin of tool 12913800 (27 in fig. 62) in the marked flywheel slot;
- undo screw A on this tool and rotate arm B until the notch on the same gets in between the 2 marked teeth. The screw down screw A Remove tool from the gear to be replaced and apply it to the new gear. Now insert the tool pin in each of the 5 camwheel slots until the notch on arm B will comprise perfectly 2 teeth.

At this stage mark these two teeth comprised in the arm notch with paint, also the slot in which the tool pin is inserted.

To mark the tooth of the new distribution gear it is sufficient to copy it from the old gear «C» by counting the number of teeth from keyway D.

After the teeth and the slot have been marked, fit the gear on crankshaft and camwheel on camshaft, inserting the pin in the marked slot.

Now tighten the gear securing nut and lockring and rotate the engine to ensure that the marked tooth on the distribution gear engages the two marked teeth on the camwheel.

### TIMING THE VALVES (chain driven timing)

This type of timing is easier. It is only necessary, by fitting of the gear group with mounted chain, to ensure that the mark on the crankshaft pinion is in line with the mark on the camwheel (see A in fig. 63).

### CHECKING VALVE TIMING WITH THE ENGINE INSTALLED ON THE ENGINE

To check valve timing with the engine assembled on the machine, proceed as follows:

- remove spark plug;

- remove rocker box covers and set tappet clearance at 0.5 mm (.019");
- undo the screws which secure the alternator cover and remove the cover;
- remove the rubber plug from the opening in the gearbox;
- turn the flywheel so as to bring the L/H side cylinder piston at TDC (observe from the slot in the gearbox that «S» is in correspondence with «1» traced at the center of the slot boss (See fig. 65);
- undo the bolt securing the alternator to the crankshaft;
- fit on timing cover special sector n. 14927500 (26 in fig. 64) with arrow «A» in a central position;
- position the degree plate with reference marks part n. 14927400 (25 in fig. 64) on the alternator making sure that mark PMS (TDC) on the plate is opposite arrow A of the previously fitted sector

before bolting this to the generator and crankshaft;

- turn the bolted up plate anticlockwise so as to bring mark AS (exhaust valve opening) of cylinder opposite arrow A on the sector.

At this stage, if the operation has been correctly carried out the exhaust valve of the right cylinder should start to open.

After ensuring that the exhaust valve opens in the specified position, re-set tappet clearance to 0.22 mm (.0086") and:

- remove the sector from the timing cover and the degree plate from the alternator;
- refit the generator-alternator on the crankshaft tightening its securing bolt to the specified torque loading;
- refit the alternator cover on timing cover;
- refit rocker box covers.

## TIMING PARTS DATA (Manufacturing sizes)

I/D of camshaft housing in crankcase:

— flywheel side .....	32.025-32.050 mm	(1.2607-1.2617")
— timing side .....	47.025-47.050 mm	(.18511-1.8523")

Diameter of camshaft journals:

— flywheel side .....	31.984-32.000 mm	(1.2591-1.2598")
— timing side .....	46.984-47.000 mm	(1.8497-1.9504")

Diameter of tappet guides .....	22.021-22.000 mm	(.8669-.8661")
---------------------------------	------------------	----------------

O/D of original tappet .....	22.000-22.979 mm	(.8661-.8652")
------------------------------	------------------	----------------

Tappet oversize range .....	0.05-0.10 mm	(.0019-.0039")
-----------------------------	--------------	----------------

I/D of rocker arm holes .....	15.032-15.059 mm	(.5918-.5929")
-------------------------------	------------------	----------------

Diameter of rocker arm spindles .....	14.983-14.994 mm	(.5899-.5903")
---------------------------------------	------------------	----------------

I/D of inlet and exhaust guide housing .....	14.000-14.018 mm	(.5512-.5519")
--	------------------	----------------

O/D of inlet and exhaust valve guides manufacturing parts spare parts .....

14.064-14.075 mm	(.5537-.5541")
14.107-14.118 mm	(.55541-.55545")

I/D of inlet and exhaust valve guides (after pressing in) .....	8.000-8.022 mm	(.3149-.3158")
---	----------------	----------------

Dia. of inlet valve stem .....	7.972-7.987 mm	(.3138-.3144")
--------------------------------	----------------	----------------

Dia. of exhaust valve stem .....	7.965-7.980 mm	(.3136-.3142")
----------------------------------	----------------	----------------

Dia. of inlet valve head .....	40.8-41.0 mm	(1.606-1.614")
--------------------------------	--------------	----------------

Dia. of exhaust valve head .....	35.8-36.0 mm	(1.409-1.417")
----------------------------------	--------------	----------------



# ENGINE LUBRICATION

The oil sump acts as an oil tank and contains 3.5 liters of oil.

Lubrication is by pressure through a spur gear pump for suction and delivery while recovery is by gravity. The pump is gear driven directly by the crankshaft. The oil is sucked directly from the sump, is cleaned by a wire gauze filter, and forced on through suitable ducts machines in the crankcase.

The delivery circuit is provided with a warning light which indicated insufficient oil pressure and a relief valve for pressure regulation.

The oil is sent through the main bearings to the camshaft and from here, through suitable ducts, to the con-rod bearings.

It then comes out from these and is projected by centrifugal force to all other engine parts.

The cylinder heads are lubricated through a suitable pipe.

The engine lubrication system incorporates the following parts:

- oil pump;
- oil cleaner;
- oil pipe with relief valve;
- pipe to breather;
- recovery pipe from breather;
- pipe to cylinder heads;
- recovery pipe from heads and pressure discharge at breather;
- breather unit;
- exhaust pipe, oil and pressure from breather;
- oil pressure solenoid.

## OIL DELIVERY PUMP

(See fig. 66)

It is of parallel spur gear type and is secured to the bottom L/H side of the crankcase. It incorporates a driving gear coupled with the crankshaft distribution gear.

## INSPECTIONS AND CHECKS

In case of improper operation of the oil pump, the following should be closely checked:

- Depth of gear. Should be 15.983 ÷ 15.994 mm (.6293 ÷ .6897").
- Gear housings in pump body. Should be 16.000 ÷ 16.027 mm .6299 ÷ 6309") (See fig. 67).

If not within the above sizes, the parts should be replaced.

It is also important to check the O/D of the gears is not more than 25.993 ÷ 25.980 mm (1.0233 ÷ 1.0227") and the I/D of the housing in the pump body 26.000 ÷ 26.033 mm (1.0236 ÷ 1.0249") (See fig. 67).

Back lash between pump gear shafts (11.994 ÷ 11.983 mm = .4722-.4717") and housing of the pump body should be within 0.006 ÷ 0.035 mm (.00023 ÷ .00137"). Back lash between gears on pump shafts (mm 25.980 ÷ 25.993) and housing on the pump body (mm

26.000 ÷ 26.033) should be within mm 0,007 ÷ 0,053 (see fig. 67 and 68).

## OIL DELIVERY PUMP (CHAIN OPERATED)

(See fig. 69)

It is of helicoidal gear type, the driving gear is mounted on two roller bearings «Durkopp Naf 10 x 22 x 20» which are lodged in the pump body.

## INSPECTIONS AND CHECKS

(See fig. 70)

In case of improper operation of the oil pump, the following should be closely checked:

- Depth of gear. Should be 13,973 ÷ 14,000 mm.
- Depth of housings in pump body. Should be 14,032 ÷ 14,075 mm.

If not within the above sizes, replace the parts.

The following sizes are also to be checked:

- O/D of gears, within 26,250 ÷ 26,290 mm;
- D/ of housings in pump body, within 26,340 ÷ 26,390 mm;
- O/D of roller bearing race (Durkopp Naf 10 x 22 x x 20) within 21,989 ÷ 22,002;
- D/ of housing in pump body, within 21,972 ÷ 91,993 mm;
- I/D of roller bearing race (Durkop Naf 10 x 22 x x 20) within 9,990 ÷ 10,002.

If not within the above sizes, replace the parts.

Back lash:

- driven gear shaft (9,985 ÷ 10,000) and housing in pump body (10,013 ÷ 10,035): within 0,013 ÷ 0,050 mm;
- roller bearing outer race (21,989 ÷ 22,002) and housing in pump body (mm 21,972 ÷ 21,993): within 0,004 and negative clearance 0,020; (mm 21.972 ÷ 21.989) within in 0,004 and negative 0,030;
- roller bearing inner race (9,990 ÷ 10,002) and pump driving shaft (mm 9,985 ÷ 10,000): within 0,017 and negative clearance 0,010;
- gears on pump driving shafts (26,250 ÷ 26,290 mm) and housings in pump body (mm 26,340 ÷ 26,390) within: mm 0,050 ÷ 0,140.

## OIL CLEANER

The wire gauze oil cleaner is located in a central position at the bottom of the crankcase (B in fig. 18) and is directly connected to the oil pump.

When overhauling, the filter should be completely stripped down, washed in petrol and dried off with compressed air. Ensure the gauze is not damaged and, if necessary, replace it.

The filter consists of (see fig. 71):

- wire gauze;
- filter body;
- securing bolts and screws;
- bottom plate.

## OIL PIPING

Clean these these thoroughly with petrol and blow through with an air jet.

## OIL PRESSURE RELIEF VALVE

It is mounted in the oil delivery pipe (see A in fig. 18) and is calibrated to give a delivery pressure of 3.8-4.2 kg/cm<sup>2</sup> (54-60 lbs/sq.in.).

If pressure exceeds this calibrating, this valve opens by setting pressure within the fixed limits.

It is strongly recommended not to tamper this device which is calibrated in the factory.

To check oil pressure proceed as follows:

- undo the oil pressure solenoid (F. in fig. 72);
- screw in a reading meter in its lodging;
- start the engine and check if pressure is 3.8-4.2 kg/cm<sup>2</sup> (54-60 lbs/sq.in.);
- if pressure is higher or lower, remove the valve from the oil delivery pipe (A in fig. 18) and adjust it as follows:
  - lower pressure: fit another plate 12150700;
  - higher pressure: remove one or more plates.

## OIL BREATER UNIT

(See fig. 72)

It consists of a box incorporating a diaphragm retained against the breather tube by a previously loaded spring.

Breather tube (B), oil return from breater to crankcase (C), oil vent pipe from cylinder head (E), and oil vent pipe to the outside (D) are connected to the box by rubber tubes and retaining bands.

Purpose of the oil breather is to discharge excess pressure and oil mist and it comes into action whenever the relief valve opens in order to restore the pressure to the specified limit.

If the motorcycle is not used for some time, it is possible that eventual foreign matter present in the oil may have deposited on the relief valve causing this to stick with consequent improper operation of the breather and oil leakages from it.

Accordingly, before using the vehicle again, it is a good practice to check that everything is in good order, proceeding as follows:

- remove fuel tank;
- remove support screw;
- slacken both pipe retaining bands;
- back out the breather unit from the left hand side;
- check that the breather valve in this works properly (To do this use a rod introduced in the central pipe of the breather).

If this valve should be stuck, free it by means of the rod and then wash out the inner section with petrol, drying off with compressed air to prevent oxidation of the valve and its sticking again to the vent tube from the engine.

All parts are then re-assembled in a raverse order.

## OIL PRESSURE SOLENOID

(See F in fig. 72)

It is connected by cables to the warning light in the control panel and serves to indicate insufficient oil pressure in the circuit.

If this indicator lights up when riding it means that the oil pressure in the circuit is below the specified limits and in such case the machine should be immediately stopped and the oil circuit checked in order to find the fault and remedy it before re-starting.

## CHECKING THE OIL LEVEL

(See fig. 73)

Every 300 ÷ 500 km check the level of oil by means of the oil filler dipstick (welded to cap A). If the level is lower add oil of the same quality and features.

For this checking turn the cap A with dipstick by one turn.

## CHANGING THE ENGINE OIL

(See fig. 73)

After the first 300 ÷ 500 km and later on every 3000 km a. change the oil in the oil sump. This change has to be carried out by a warm engine. Before filling let the previous oil completely drain.

«A» oil filler cap. (the welded dipstick has two notches, one for min. and one for max. level);

«B» oil drain magnetic cap.

Necessary quantity: l. 3.5 of oil «Agip SINT 2000 SAE 10W/50».

## ENGINE ASSEMBLING

After inspections, checks and eventual replacements, all engine parts should be thoroughly cleaned in petrol and the engine re-assembled as follows:

- secure timing side flange c/w main bearing by means of bolts and lock plates. After tightening, the lock plate flaps should be bend down on the bolts;
- insert crankshaft in timing side flange c/w main bearing and fit the flywheel side flange with bearing on the crankshaft, securing it to the crankcase by means of bolts and lock plates. Bend the flaps of these latter down on the bolt sides. For this operations use tool 12912000 (24 in fig. 50);
- insert camshaft in its housing in crankcase and then bolt down the camshaft support flange to crankcase;
- fit the con-rods c/w big end bearings on crankshaft, con-rod caps also complete with bearings, and secure them to the crankshaft by means of bolts, lock plates and nuts. Refer to chapter «Con-rods», paragraph «Fitting up of con-rods on crankshaft»;
- screw down oil pump on crankcase;
- connect oil cleaner with gasket to oil pump by means of 2 screws;
- connect oil pipe (see «A» in fig. 18) complete with relief valve and gaskets to crankcase by means of bolts and lock plates. After tightening bolts, bend down the plate flaps on the bolts;
- secure oil sup to crankcase after assembling the oil draig plug with a new gasket;
- fit piston c/w rings (drwg. fig. 34) on con-rods. To introduce the pin in the piston and in the small end bushing use tool n. 26907800 (see 11 in fig. 17) after having heated up the piston, as specified. Finally fit the circlips;
- insert tappets in their housings in the crankcase;
- position new gasket between crankcase and cylinder;
- fit cylinder over the long bolts. Lubricate the piston crown and cylinder liner in order to obtain easier fitment;
- insert new gaskets between cylinders and cylinder heads;
- fit cylinder heads on stud bolts;
- secure rocker arms upports to cylinder heads by means of nuts and bolts. See paragraph «Assembling of heads on cylinders. Fit new sealing rings»;
- insert push rods in tappets;
- fit rocker arm springs and washers on supports and then insert the spindles. Secure thes to the supports by means of bolts and washers;
- secure cylinder head oil pipe with the hollow bolt and gaskets;
- secure flywheel to the crankshaft with bolts and lock plates using a torque wrench set up at kg/m 4.2 and after having set up on the crankcase stud tool n. 12911801 (21 in fig. 15). Do not forget to bend down the lock plate flaps on the bolt faces at the end of this operation;
- fit Woodruff key and distribution gear on crankshaft, timing side;
- fit camwheel, making sure that its marked slot matches with the camshaft slot in order to introduce the stop pin and that the two marked teeth on the cam wheel engage the marked tooth on distribution gear. To tighten nut securing cam wheel to camshaft use ring gear and flywheel holding tool n. 14912900 (19 in fig. 12) and wřend. 14927600 (30 in fig. 12);
- tighten the engine pinion lockring on the shaft using holdfast tool n. 14912900 (19 in fig. 13) and special wrench n. 14927600 (30 in fig. 13) bend down one lock plate flap on the lockring;
- fit the driving gear on the oil pump driving shaft, to lock the nute use holdfast tool 14912900 (19 in fig. 13);
- secure timing cover to crankcase, inserting new gasket. Tighten the screws in a crossed sequence in securing timing cover to crankcase;
- adjust tappet clearance (see paragraph «Tappet clearance adjustment»);
- fit generator-alternator securing it to the crankshaft with its screw;
- fit alternator flywheel on the crankshaft and lock it by means of its proper screw;
- insert electric connections on the clamps;
- secure double contact breaker to crankcase by means of wrench n. 14927000 (13 in fig. 9);
- adjust contact breaker gaps and check ignition timing (see paragraphs: «Checking and adjustment of the double contact breaker» - «Ignition timing»);
- connect oil pressure solenoid to crankcase (see F in fig. 72);
- fit alternator cover;
- fit new gaskets between cylinder heads and rocker box covers, secure rocker box covers with Allen screws tightening in a coossed sequence;
- fit oil breather on crankcase and pipes on breather;
- pour 3.5 liters of «Agip SINT 2000 SAE 10W/50» through the filler orifice on the crankcase and seal with the plug with dipstick for oil level control;
- For assembling the clutch assembly and starter motor ring gear on the flywheel see paragraph «Clutch unit».

### **FITTING THE DISTRIBUTION GEAR ASSEMBLY (CHAIN DRIVEN TIMING) ON: CAMSHTFT, CRANKSHAFT, OIL PUMP DRIVING SHAFT**

Proceed as follows:

- fit chain on gears as specified in fig. 63;
- fit gear on camshaft taking care that the hole of the same inserts into the shaft pin; the engine pinion on the crankshaft and the other gear on the oil pump driving shaft;

- ensure that the chain guide matches the chain well, if not so adjust it;
- screw in the nut securing driving gear on camshaft and lock the nut by means of wrench 14927600 (30 in fig. 21) after placing the holdfast tool n. 14927300 (20 in fig. 21).

After fitting this assembly and before re-fitting the timing cover on the crankcase, check (by proper turning of the crankshaft) that the marks on the camshaft driving gear and the one on the engine pinion are in line (see A in fig. 63).  
If so, the engine is properly timed.



# CARBURATION

Engine is gravity fed from the tank by 98/100 regular octane petrol.

Petrol passes through an electrovalve or a tap then through the pipes of the four-way adaptor and from here to the carburetor connections.

## FUEL TANK

Capacity 19 liters (5.4 US gls., 4 $\frac{1}{4}$  gls. imp.) including a reserve of about 2 liters (about  $\frac{1}{2}$  US gl. or  $\frac{3}{8}$  imp. gls.). The tank is cradle mounted on the frame over the power unit.

It is secured to the frame by bolts and rubber buffers. The filler cap on top of the tank is provided with a vent hole and it is well to periodically check that this hole is not clogged up as it would seriously upset carburation.

Under the tank there are:

- at the L/H rear end (as seen from sitting in the seat) an electrovalve. This is actuated and so feeds fuel when the key in the ignition switch is on position «2» (See fig. 74);
- at the R/H side (as viewed from one sitting in the saddle) a tap which is used for the reserve fuel and is opened only in an emergency or in case of failure of the electrovalve. This tap should be opened every now and then to ensure of its proper operation.

This tap has three positions (see fig. 75).

- «A» open (vertical).
- «R» reserve (horizontal - see «R» on the tap).
- «C» closed (horizontal - see «C» on the tap).

## PLUG ON THE FUEL TANK

(See fig. 76)

To open this plug press the control button («A»).

## CARBURETTORS

This model fits 2 Dell'Orto carburetors type VHB 30 CD (right) and VHB 30 CS (left).

Carburetors have dual control: a throttle twist grip one on the R/H handlebar and an easy starter lever on the left on the left carburetor and on the right for the right carburetor, for starting from cold.

## CARBURETTOR SETTING

Choke	30 mm dia.
Throttle valve	40
Atomizer	265
Main jet	142
Pilot jet	50
Easy starter atomizer	80
Taper needle	V 9 (2nd. notch)
Floater	10 grams

Idling screw open from 2 to 2 and  $\frac{1}{4}$  turns for the left carburetor and  $2\frac{1}{4}$  to  $2\frac{3}{4}$  turns for the right carburetor.

## ADJUSTING THE CARBURATION

(See fig. 74)

This adjustment must always be made on a warm engine, after checking that the inlet and exhaust valve clearance is correct.

Proceed as follows:

### 1. Checking synchronization of throttle valves

This operation is done with the inlet sleeve disconnected from the carburetors and turning the throttle grip, keeping the fingers on the carburetor slides in order to determine if these open by the same amount and at the same time. If one valve opens before the other, this can be corrected by means of the cable tensioner on each carburetor (see «C» in fig. 74) acting on these until by turning the throttle both valves open simultaneously.

### 2. Adjusting idling speed

Through screws «D». Screwing these in reduces the flow of petrol, and viceversa increases it. To adjust drive screws «D» fully home and then unscrew them from 2 to  $2\frac{1}{2}$  turns for the L/H carburetor and  $2\frac{1}{4}$  to  $2\frac{3}{4}$  turns for the R/H carburetor.

With the engine running at about 1000-1200 r.p.m., disconnect one of the plug leads and turn screw «D» of the opposite cylinder carburetor in or out on the position which will give the best idling speed, i.e. when the revs are slightly increasing.

The same operation should be repeated on the opposite carburetor. This will give correct idling speed and prevent possible poppings or spit backs.

**ENGINE REVOLUTIONS: due to the characteristics of this engine, idling adjustment should never be done with the engine running at less than 1000 r.p.m.**

### 3. To obtain a good idling speed, operate as follows:

Disconnect the R/H cylinder plug lead, start the engine and ensure that it stops after firing 4 or 5 times. If it dies out sooner or later, adjust idling screw «E» to the point where the engine stops after it has fired 4 or 5 times.

Repeat this operation on the R/H cylinder, with the left hand plug lead disconnected. If all is well, the engine should stop after firing 4-5 times. If not, adjust screw E as above until it does so. Finally, re-connect the L/H cylinder plug lead.

4. Refit the rubber sleeve on the carburetor pipes.

## ADJUSTING THE CARBURATION BY MEANS OF A «VACUUM METER»

(See fig. 74)

1. Adjusting idling screws on carburetors.

Through screws «D». Screwing these in reduces

the flow of petrol and viceversa increases it.

To adjust drive screws «D» fully home and then unscrew them from 1½ to 2 turns for the L/H carburettor and from 2 to 2½ turns for the R/H carburettor.

2. Remove the two caps «G» from intake tubes and fit there the two pipes of the «Vacuum meter».
3. Adjusting idling speed by acting on throttles (by a warm engine).  
Start the engine with throttle control twist grip fully closed, and get about 800 ÷ 900 revs/min. by means of throttle adjusting screws «E» (see fig. 74). Check that the two columns or indicators on the dial of the «Vacuum Meter» are lined up, if not so get this condition by acting on the above screws.
4. Adjust position of screws «D» (see fig. 74 to obtain the highest possible revs/min. Re-check then the position of the columns or indicators of the «Vacuum meter», if necessary repeat operation n. 3.
5. Synchronizing the carburettors.  
After idling speed adjustment, get the carburettor synchronization by proceeding as follows:  
Start the engine and gradually open twist grip taking care that the two columns or indicators of the «Vacuum meter» are lined up, if not get them in line by means of screws «C» for throttle control cables. After this checking ensure that the two cables at inserting the screws «C» have a play of 1 ÷ 1,5 mm.
6. This checking carried out, remove the «Vacuum Meter» and re-fit the two caps «G».

## STARTER CONTROL

(See fig. 74)

The easy start control lever, by a cold engine, is located right on the right carburettor and left on the left carburettor.

- «A» Starting position.
- «B» Running position.

## STRIPPING OF CARBURETTOR

(See fig. 77)

Remove:

- screw (1);
- withdraw easy starter assembly (2) and from this valve gasket (3);
- undo idling screw (4) with spring (5);
- undo throttle slide adjusting screw (6) with spring (7);
- undo mixture chamber cover screw (8); with washers (9);
- remove control cable adjusting screw cap (10);
- undo cable adjusting screw (11) with counternut (12);
- remove mixture chamber cover (13) with gasket (14) and slide return spring (15);
- withdraw throttle slide (17) complete with taper needle stop spring (16) and taper needle (18);
- withdraw the carburettor retaining sleeve on pipe (20) after slackening screw (22) and nut (19);
- withdraw insulator (21) from the carburettor body;
- undo the bowl securing plug (31) with gasket (30) and from the plug remove the accelerator pump which consists of: pump body (23), plunger (24), ball (25), valve seat (26), spring (27), jet holder (28) and main jet (29);
- after slackening the screws, remove chamber (42) with gasket (43);
- slide pin (42) and floater (41) out of the chamber;
- unscrew the atomizer (34);
- unscrew easy starter jet (32) complete with seal (33);
- withdraw needle (36) from its seat;
- undo adaptor securing screw from pipe (39) and washer (40);
- remove adaptor (37) with filter (38).

After stripping, all parts should be thoroughly cleaned in a petrol bath and dried off with compressed air. All ducts in the carburettor body should also be blown through with air, as well as all jet orifices.

## AIR INTAKE

It is formed by a rubber sleeve fitted on the carburettor intakes.

# ENGINE BRAKE TEST

After overhauling, an engine should be suitably run-in and bench tested for output.

## SETTING UP OF ENGINE ON THE BENCH

Position the engine on the test bench and connect exhaust pipes, fuel lines and electric cables. Couple flywheel to the hydraulic brake shaft and proceed with the test.

## TESTING PROCEDURE

After starting the engine, closely check if:

- there are any oil or fuel leakages from the connections or pipings;

- oil circulation is regular and pressure is as specified ( $3.8-4.2 \text{ kgs/cm}^2$  (54-60 lbs/sq. in.));
- in case of irregularities, stop the engine and remedy before proceeding further.

During the initial period of the test, the engine lacks elasticity and shows a notable resistance to rotation and this is due mainly to the friction of parts that need sometime to bed down.

This is particularly experienced on engines that have had pistons, con-rod bearings and main shaft bearings replaced and the main shafts and crankpin reground.

Under the circumstances it will be necessary to give to the engine the following running in cycle:

- total running in period 4 hours of which 5 minutes at peak revs.

After running in, if no irregularity is observed, the engine is ready to have its output checked and consequently be assembled on the machine.

# CLUTCH

Twin driven plates, dry tye (See fig. 78).

The clutch includes the following parts:

- 8 springs pheripherically set up inside the flywheel in suitable housings;
- externally toothed pressure plate with housing for pressure cap;
- internally toothed driven plate covered with friction material;
- externally toothed intermediate plate;
- internally toothed plate with frictional material;
- cap located in the pressure plate slot.

The clutch unit is housed inside the flywheel and is retained bl the starter motor ring gear secured to the flywheel by means of bolts and toothed washers. Ring gear is driven directly by the starter motor gear.

## REMOVAL OF CLUTCH ASSEMBLY

Remove the gearbox unit from the engine, unscrew 8bolts securing the ring gear to the flywheel and withdraw driven plate, intermediate plate, driven plate, pressure cap, spring pressure and springs (use hold foost tool 12911801 [21 fig.10] and proper wrench).

## CHECKING CLUTCH SPRINGS

(See fig. 79)

Ensure all springs are in perfect efficiency and not unloaded.

Springs compressed to 20 mm (.7874") should give a load of 21-21.5 kgs (46-49 lbs.).

Springs compressed to 17 mm (.6692") should give a load of 28.7-29.7 kgs (63.2-65.4 lbs.).

## CHECKING PRESSURE PLATE

Ensure that this plate is not nicked on the surfaces engaging the pressure cap and that the surface that surface which contacts the driven plate is perfectly flat, otherwise noisy clutch operation will ensue. Check also if the engaging teeth inside the flywheel are in good condition.

## CHECKING DRIVEN PLATES

Width of each new plate including lined section is 8 mm (.3149"). Replace the plates any time it is worn down to less than 7.5 mm (.2953").

## CHECKING INTERMEDIATE PLATE

Check flatness of the surface contacting the driven plates or else clutch operation will be noisy. Check also condition of engaging teeth inside the flywheel.

## CHECKING STARTING RING GEAR

Check that the surface contacting the driven plate is dead flat or else clutch operation will be noisy. The teeth engaged by the starter motor pinion should also be checked for scoring or nicks. If necessary, replace the ring gear.

## CLUTCH ASSEMBLY OPERATION

The flywheel is externally stamped with an arrow which besides indicating TDC, is also a reference mark for assembling the clutch pressure plate.

Correct clutch assembly is carried out as follows:

- insert the 8 springs in their housings on the flywheel, and fit the pressure plate making sure that the punched tooth on this plate enters in the keyway on the flywheel in correspondence with the arrow stamped on its periphery;
- set up tool 12906500 (28 in fig. 10) on the crankshaft, screwing it down just sufficiently to allow the correct positioning of the internal driven plate, the intermediate plate, external driven plate and the ring gear. Then screw down tightly the bolts which secure the rin ggear to the flywheel. To prevent the flywheel from rotating when tightening these bolts, use tool 12911801 (21 in fig 10) set up on the crankcase stud bolts.

## CHECKING CLUTCH CONTROL CABLE

Ensure the cable is not damaged and the inner wire not broken.

## CHECKING CLUTCH OPERATING LEVER ON GEARBOX

Check condition of the lever dowel, and adjuster screw.

## CHECKING OPERATING LEVER RETURN SPRING

Ensure it has not lost its load or is deformed.

## OUTER BODY

Check surface contacted by the lever dowel. If worn or deeply scored, replace the body.

## THROWOUT BEARING

Ensure all ball are in perfect state. If not, replace the bearing.



### **INNER BODY**

Inspect the surface contacted by the bearing balls. If worn, replace.

### **INTERMEDIATE TUBE IN CLUTCH SHAFT**

Replace it if worn.

### **PRESSURE PLATE ROD**

Check for deformation or scoring. Replace as necessary.

### **PRESSURE PLATE ROD CAP**

Ensure that the part inserted in the pressure plate is not unduly damaged. If so, replace the cap.

### **OUTER BODY SEAL RING**

If crumbled or has lost its elasticity, replace the seal.

### **CLUTCH ADJUSTMENT**

(See fig. 80)

When play at the handlebar lever is more or less than 4 mm ( $\frac{1}{8}$ " ), the clutch should be adjusted as follows:

— Slacken thumb screw A and screw in or out adjusting screw A to bring the play to the correct distance. Thumb screw should now be locked. If this distance is less, the clutch may slip, causing abnormal wear of the plates and irregular engine operation.

If it is more, the plates will not disengage completely, thus causing noisy gearshifts.

This adjustment can also be made by slackening nut D and acting on adjuster C which are bolted on the R/H side of the gearbox.

For adjusting the lever on the gearbox see chapter «Adjusting of clutch control lever on gearbox» (fig. 112).

## GEARBOX

(See fig. 81 and 82)

The gearbox is bolted to the engine block and incorporates constant mesh gears with frontal engagement.

Engine-gearbox ratio: 1 to 1.235 (17-21)

Internal gear ratios:

— Low gear	2	to 1	(14-28)
— 2nd gear	1.388	to 1	(18-25)
— 3rd gear	1.047	to 1	(21-22)
— 4th gear	0.869	to 1	(23-20)
— High gear	0.750	to 1	(24-18)

### GEARSHIFT PEDAL

(See fig. 83)

The gearbox is fitted with a positive stop gear change pedal located on the R/H side of the machine. Gear selections are made by pressing or raising the pedal.

Low gear is selected by raising the pedal and the higher gears by pressing on it. The neutral position is in between 1st and 2nd gear and to locate this it is necessary to first shift back to low gear and then by slight pressure (half a stroke) to find the free position. Starting from frame number VK-14000 it can be mounted on left or right side of the motorcycle.

### STRIPPING THE GEARBOX ON THE BENCH

As a first operation drain the oil by unscrewing plug C, level plug A, and filler plug B (see fig. 84).

In order to dismantle the gear box of all components, set it up on support n. 14929600 (52 in fig. 86) and secure this in a vice.

Now remove:

- gear selector operating lever;
- speedo drive;
- loosen layshaft securing nut using tool 12907100 (34 in fig. 85) to hold the layshaft fast and tool 14905400 (35 in fig. 85) to unscrew the nut;
- withdraw the speedo drive gear paying particular attention to the ball which acts as a lock key;
- clutch operating lever from gearbox;
- lever return spring, outer retainer, throwout bearing, inner clutch body, and clutch operating rod.

### REMOVAL OF TRANSMISSION COVER

To remove the cover it is first necessary to put the **gearbox in the neutral position**. Undo the Allen head securing screws and using a hide mallet tap the cover to allow it to be separated. When slipping out the layshaft from its bearing, make sure not to mislay the speedo gear shim.

### REMOVAL OF GEARBOX COMPONENTS SELECTOR FORK, SLIDING SLEEVE AND HIGH SPEED GEAR

Remove:

- forks selector rod;
- high speed selector fork;
- high speed sliding sleeve;
- high speed gear from layshaft;
- high speed gear from main shaft complete with roller cage and bush;
- this done, by the aid of a pointed rod force the stop pin down into its housing( turn the bushing to the right or left and move the gear complete with roller cage and bushing to a position near the shaft hole. Place then the L/H thumb on the spring loaded stop pin to prevent this from shooting away and at the same time withdraw the gear-cage-bushing assembly with the right hand. Finally, remove stop pin and spring from the drilling in the main shaft.

### SELECTOR DRUM

Unscrew the oil breather plug from the top of the gearbox and remove the spring. (The oil breather plug has also the function of retaining the pawl which acts as a stop on the selector drum. This pawl will remain in its housing in the gearbox and can only be removed after the complete gearbox has been stripped).

- undo the securing screws and slip off the neutral indicator solenoid from its housing in the gearbox;
- withdraw the gear selector drum complete with rod, paying particular attention to the position of the shims;
- withdraw the rod from the drum.

### LAYSHAFT

(See «1» in fig. 107)

Take off the complete layshaft from the gearbox, and from this remove:

- sealing ring from shaft at the gearbox cover end;
- low speed gear, roller cage and bushing;
- sliding sleeve for 1st and 2nd speed;
- nut at the 4th speed gear side;
- roller bearing;
- adjusting washers;
- fourth speed gear with roller cage and bushing;
- sliding sleeve for 3rd and 4th speed;
- fixed sleeve on shaft;
- shim;
- third speed gear with roller cage and bushing;
- second speed gear with roller cage and bushing.

## MAIN SHAFT

(See «2» in fig. 107)

Slide out the shaft from the gearbox. All gears on this shaft are fixed except the high speed gear which is floating on its roller bearing and the high speed sliding muff which together with the bush retaining stop pin and spring have already been removed.

When taking off the main shaft pay attention to the position of the shims and bronze ring.

The main shaft inner bearing race is dismantled from the gearbox by means of special tool n. 14928500 (38 in fig. 88).

## CLUTCH SHAFT

(See «3» in fig. 107)

Using tool 14912800 (36 in fig. 86) and hooked wrench 14912600 (37 in fig. 86) and after flattening the ears of the safety washer, remove the fixed clutch body retaining ring from the clutch side and then the fixed body itself.

When dismantling the fixed clutch body observe the position of the seal between body and bearing and the seal in the shaft groove.

Slide out the clutch shaft from the bearing and, if necessary, use a hide mallet to lightly tap it, making sure not to mislay the oil scoop between shaft and bearing.

## REMOVING THE CLUTCH SHAFT COMPONENTS

Using puller 14928500 (38 in fig. 89) withdraw the inner race of the roller bearing and the spacer nut. Set up the complete shaft in a vice and using puller 12905900 (29 in fig. 90) compress the spring to the point where the cush drive plate retainers can be slipped off.

Then remove:

- cush plate;
- spring;
- sliding muff;
- intermediate gear.

## REMOVING THE BEARINGS FROM THE GEARBOX

If the bearings have been assembled with loctite, as follows:

- Place the complete gearbox unit in an oven and heat up to 150-160 °C (300-350 °F);
- extract the mainshaft roller bearing using puller 14913100 (39 in fig. 91);
- slide out the outer race of the main shaft roller bearing using puller 14913700 (40 in fig. 92);
- remove the clutch shaft seal;
- unscrew the lockplate securing screws;
- remove lock plate;
- remove clutch shaft bearing using punch 14929200 (41 in fig. 93).

## REMOVING THE GEARBOX COVER COMPONENTS SELECTOR ASSEMBLY

Using a hide mallet, tap off the selector assembly from the gearbox cover. This group consists of:

- selector return spring;
- spring guiding pin;
- selector drum operating pawls;
- pawl return springs.  
To separate the pawls from the selector it is necessary to use the special 3 mm (.11") to take off the retaining pins from the selector body;
- after loosening the locknut, remove the selector adjusting screw from the gearbox cover.

## BEARINGS

If fitted with loctite, these bearings are removed as follows:

- put the transmission cover in an oven and heat up to 150-160 °C (300-350 °F);
- using puller 14907000 (42 in fig. 94) withdraw the mainshaft ball bearing and remove the clutch shaft roller bearing using puller 14913100 (39 in fig. 95);
- remove the layshaft seal;
- unscrew the lockplate securing screws;
- remove lockplate;
- remove layshaft bearing using tool 14929200 (41 in fig. 96).

# CHECKING AND OVERHAULING OF GEARBOX COMPONENTS

## GEARBOX AND COVER

Check for any cracks, also if the union faces are undamaged and the bosses threads not stripped.

## SEALS

Whenever these are removed from their housings, it is best to change them in order to assure perfect tightness.

## BALL AND ROLLER BEARINGS

Check their condition and ensure they are not too slack in their housings. All rolling surfaces should show up very smooth as well as the balls and rollers. If there are any doubts about the efficiency of a bearing, it is best to replace it. (See section «Ball and Roller Bearings»).

## MAIN SHAFT

Check wear of the shaft gear teeth and if unduly worn, replace the shaft.

## HIGH SPEED GEAR ON MAIN SHAFT

Check for wear of its teeth and if necessary replace the gear.

## HIGH SPEED GEAR BUSHING

Ensure the surface contacted by the rollers is quite smooth, also the surface of the inner grooves. If scored or nicked, replace the bushing.

## HIGH SPEED BUSHING RETAINER

Replace the retainer if scored or nicked.

## SPRING FOR HIGH SPEED GEAR RETAINING BUSH

If deformed or has lost its efficiency, replace it. Spring should have a load of 1.40 kgs  $\pm$  5 (3.1 lbs.) when compressed to 8 mm (.031").

## LAYSHAFT

Should show up very smooth at its contact surfaces. If scored or the threaded portions are stripped, replace the shaft.

## SLIDING SLEEVE

Check smoothness of all sliding surfaces and ensure that the front engaging dogs are undamaged.

## GEARS ON LAYSHAFT

Check teeth wear, also wear of the engaging dogs. The teeth contact surface should be quite smooth and free from scoring or nicks. In any such case, the gears should be replaced.

## ROLLER BEARING SECURING NUT ON LAYSHAFT

Make sure it is not stripped or damages or else change the nut.

## BUSHING FOR THE ROLLER CAGE FOR 1st, 2nd, 3rd, AND 4th SPEED GEARS ON LAYSHAFT

Check that the surface contacted by the cages is not scored or nicked. Replace the bushings if not perfectly smooth.

## CAGES FOR 1st, 2nd, 3rd, AND 4th SPEED GEARS ON LAYSHAFT

Ensure that all the rollers are in perfect state. If not, replace the cages.

## SLIDING SLEEVE OPERATING FORKS

Make sure that all workin surfaces are dead smooth and not worn to such an extent as to have lost their original hardness. Also that the pawls workin in the drum splines are not unduly worn. In any such case, replace the forks.

## GEAR SELECTOR DRUM

Check wear of the drum grooves contacted by the gear selector forks, also wear of the holes where the selector gear stop pawl operates. Check also the stud bolts contacted by the pawls. If worn replace the drum.

## SELECTOR DRUM CARRYING RODS AND GEARSHIFT FORKS

Check straightness of the carrying rods and that they are not damaged at the surface contacted by the forks. If so, replace the rods.

**CLUTCH SHAFT**

Inspect grooves, threaded sections, and slots. If worn or damaged, replace the shaft.

**INNER BODY RETAINING LOCKRING TO CLUTCH SHAFT**

Ensure that the threaded portion is undamaged or else replace the retainer.

**SAFETY WASHER FOR FIXED BODY RETAINER**

Ensure the flaps of the washer are still in good state and replace as necessary.

**SEAL BETWEEN CLUTCH FIXED BODY AND BEARING ON CLUTCH SHAFT**

If crumbled or no longer efficient, change the seal.

**INNER CLUTCH FIXED BODY ON SHAFT**

Check if any teeth are broken or worn. All teeth surfaces should be dead smooth. In either case, replace the body.

**CUSH PLATE RETAINER ON CLUTCH SHAFT**

If deformed, scored or nicked, replace the retainer.

**CUSH SPRING PLATE ON CLUTCH SHAFT**

Needs no maintenance except that its inner grooves must be smooth.

**CUSH SPRING ON CLUTCH SHAFT**

Check if not deformed or if it has lost elasticity. When compressed to 37 mm (1.45") this spring should give a load of 190 kgs (308 lbs.).

**COUPLING SLEEVE ON CLUTCH SHAFT**

Check smoothness of the internal splines and wear at the engaging end.

**IDLE GEAR ON CLUTCH SHAFT**

Should not show excessive wear of the teeth. Teeth contact surfaces and inner grooves should be quite smooth. If not, replace the gear.

**GEAR SELECTOR ASSEMBLY**

Make sure that the pawls slide freely in their seats in the body.

If not, remove the spring loaded pins with suitable pins of 3-4 mm diameter (.11-.15") which allows the pawls and pins to be slipped out. Using then a 10 mm dia. (.39") reamer, bore out the pawl housings, clean out with an air jet, lubricate the housing and refit spring and pawls, securing them to the selector body by means of flexible pins.

**PAWL ON SELECTOR BODY**

Make sure its contact surface is dead smooth, especially the rounded section which operates on the splined drum. This section should never have sharp ends and if necessary smooth out with a fine cut file.

**SELECTOR PAWL RETURN SPRING**

Check its efficiency and if cracked or deformed, replace the spring.



# ASSEMBLING THE GEARBOX ON THE BENCH

After all parts have been inspected, checked, or replaced, the gearbox unit is assembled as follows:

## BEARINGS IN GEARBOX AND COVER

As a first operation, the bearing housings and races should be thoroughly cleaned with a solvent, preferably trichloroethylene). Using a loctite soaked brush, smear lightly the outer races and the bearing housings in gearbox and cover. Make sure that no loctite enters into the balls and/or rollers. The bearings to be fitted with loctite are:

- clutch shaft bearing in gearbox;
  - layshaft bearing in gearbox;
  - layshaft bearing in gearbox cover.
- Use green loctite n. 601 (n° 00010400) GREEN.

## PRESSING OF BEARINGS IN THE GEARBOX HOUSINGS

- After smearing with loctite, the clutch shaft bearing is pressed into its housing by means of punch 14928900 (43 in fig. 97);
- the outer layshaft bearing is pressed in by the aid of punch n. 14929100 (44 in fig. 98);
- main shaft bearing is pressed in with punch 14928800 (45 in fig. 99).

## PRESSING OF BEARINGS IN GEARBOX COVER HOUSINGS

- After smearing with loctite, press the layshaft bearing in its housing by the aid of punch 14928900 (43 in fig. 100);
- the mainshaft bearing is pressed in with punch 14929000 (46 in fig. 101), after being smeared with loctite;
- the clutch shaft bearing is pressed in with punch 14928800 (45 in fig. 102).

After pressing the bearings into their housings, leave them to rest for about 12 hours to allow the loctite compound to dry up completely before proceeding with re-assembly of the gearbox components.

## ASSEMBLY OF THE CLUTCH SHAFT BEARING RETAINERS IN GEARBOX AND LAYSHAFT BEARING RETAINERS IN GEARBOX COVER (See part n. 14213003 in fig. 111)

If not perfectly adherent to the races, it will be necessary to spot-face or mill away the projecting ribbings to allow perfect adherence. The threaded portion of the retainer bolts should be smeared with green loctite n. 601 (n° 00010400) GREEN before tightening.

## FITTING OF THE GEABOX SEALS FOR CLUTCH SHAFT AND SEALS IN COVER FOR LAYSHAFT AND SELECTOR SHAFT

The seal for the clutch shaft in the gearbox is fitted by means of punch 14929400 (47 in fig. 103).

The seal for the layshaft in the gearbox cover is fitted by means of punch 14929500 (48 in fig. 104).

The seal for the selector shaft is inserted in its housing in the gearbox cover.

## FITTING OF THE SELECTOR ASSEMBLY IN GEARBOX

As a first operation, it is necessary to re-assemble the springs and pawls securing them to the selector body by means of flexible pins. Fit then the spring guiding pin, selector return spring, and insert the complete gear selector unit in its housing on the gearbox cover.

## INSTALLATION OF THE COMPLETE GEARSHIFT UNIT IN THE BOX

Assembly of the various components in the box is made as follows: main shaft fitting the main shaft in the gearbox it should be shimmed so as to obtain a distance of 167.1-167.2 mm (6.578-6.582") between the bearing in the box and the bearing in the cover (see fig. 105).

This distance is obtained by the use of shims which are available in the following sizes: 2, 2.1, 2.2 and 2.4 mm (0.78, .082, .086, .094") (see fig. 105).

The shims are fitted on the shaft at the gearbox end interposing a bronze ring between them.

The actual production fits a throwout bearing n. 92258525 (instead of the bronze ring) and a washer (see fig. 105) between bearing and main shaft in order to get the measure (167.1 ÷ 167.2).

At the end of this operation, press in the roller bearing inner race on the shaft at the gearbox and by the aid of special tool part n. 14928600 (49 in fig. 106).

## LAYSHAFT

Before proceeding with this operation it is necessary to re-fit the sliding sleeves and gears as follows:

### On shaft at gearbox end (shaft n. 14213000)

- insert the 2nd speed gear bushing on the shaft making sure that the bushing head faces the gearbox cover;
- roller cage for 2nd speed gear on bushing;
- 2nd speed gear on cage with front engagin dogs turned towards the gearbox cover;
- 3rd speed bushing on shaft with its head facing the 2nd speed gear;
- roller cage for 3rd speed gear on bushing;

- 3rd speed gear on roller cage with front dogs towards gearbox;
  - shim between 3rd speed gear and fixed sleeve;
- (shaft n. 14213001)
- insert the 2nd speed gear bushing on the shaft making sure that the bushing head faces the gear box cover;
  - roller cage for 2nd speed gear on bushing;
  - 2nd speed gear on cage with front engaging dogs turned towards the gearbox cover;
  - shim between 3rd speed and 2nd speed gear;
  - 3rd speed bushing on shaft facing the sliding muff;
  - roller cage for 3rd speed gear on bushing;
  - 3rd speed gear on cage with front engaging dogs turned towards the gear box;
  - fixed sleeve on shaft;
  - fixed muff, ensuring that the stepped down end is facing the 3rd speed gear;
  - sliding muff for 3rd and 4th speed engagement, ensuring that the stepped down end faces the 3rd speed gear;
  - bushing for the 4th speed gear on shaft;
  - roller cage on bushing;
  - 4th speed gear on shaft, ensuring that the front engaging dogs face the sliding muff.

#### On the shaft gearbox cover end

Assemble:

- 1st and 2nd speed engaging sleeves;
- bushing for 1st speed gear with its head facing the 2nd speed gear;
- roller cage in first speed gear bushing;
- 1st speed gear on roller cage;
- seal in shaft groove;
- high speed gear with stepped down end fitted on the seal ring.

#### SHIMMING OF LAYSHAFT

- Fit adjusting washer at the 4th speed gear side and add shims until between these and the high speed gear there is a distance of 144.7-145.2 mm (5.692-5.715").  
This distance is normally obtained by the addition of 2 to 4 shims (see fig. 107);
- fit roller bearing on shaft at the 4th speed gear side;
- tighten nut on layshaft at the 4th speed gear side and then hammer on the nut tang with a chisel in correspondence with the shaft groove in order to form a stop for the nut.  
Fit now the complete layshaft in the gearbox.

#### GEAR SELECTION FORKS AND SELECTOR DRUM

- Fit the 1st, 2nd, 3rd, and 4th speed selector forks on the layshaft sliding sleeves;

- fit the splined selector drum complete with rod in its housing on the gearbox together with a spacer. Looking through the orifice in the ratchet pawl it should be ascertained that one of the 6 holes in the drum is in axis with the pawl hole.  
If not, the spacer should be replaced with a larger or smaller one until both holes in the pawl and the drum are dead straight with each other;
- insert the fork fingers in the drum grooves. To position these in the grooves use special tool part n. 14929300 (50 in fig. 108). Fit the dowel in the gearbox drilling, spring and plug, screwing it in provisionally.  
Insert the fork retaining rod into the fork holes. Assemble the neutral indicator unit on the gearbox ensuring that the blade contacts button in the drum. Secure this indicator to the gearbox with screws and washers.

#### CLUTCH SHAFT

First of all it is necessary to assemble the following parts on the shaft:

- idle gear with its engaging teeth facing the gearbox cover;
- coupling sleeve with its engaging dogs facing the idle gear;
- spring;
- cush spring plate;
- using special tool 12905900 (29 in fig. 90) positioned on the spring pressure plate, compress the spring until the 2 retainers can be inserted;
- spacer nut;
- roller bearing inner race in gearbox cover using special tool 14928600 (49 in fig. 109).

On the shaft at the gearbox end fit now:

- seal in its groove on the shaft;
- oil scoop between shaft and gearbox bearing;
- complete shaft in bearing and on the retaining ring in the gearbox.

#### ASSEMBLY OF THE HIGH SPEED GEAR AND COUPLING SLEEVE ON THE MAIN SHAFT

Proceed as follows:

- Fit roller cage and high speed gear on bushing;
- insert cage-gear-bush assembly in the splined section of the main shaft until it is near the hole drilled in the shaft;
- introduce spring in the shaft drilling and position stop pin on top of the spring;
- with the left hand thumb keep the pin pressed down and with the right hand push bushing with cage and gear right in;
- turn the bushing to the right or left until the stop pin clicks into one of the 6 splines of the bush;
- fit high speed engaging sleeve with selector fork on the shaft, then the fork on the rod, inserting the fork finger in the groove on the splined drum.

## ASSEMBLY OF GEARBOX COVER

- Fit the retaining washer on the drum together with one or more shims;
- position the drum in the free position (neutral);
- fit a new cover-gearbox union gasket;
- assemble the gearbox cover tapping it lightly with a hide mallet to ensure all shaft seat properly in their housings.

• **NB.** - When the gearbox cover complete with selector unit is re-assembled, ensure that the selector drum is set at the neutral position as otherwise the selector pawls might not enter freely in the two slots indicated by the arrows (see fig. 87).

- Screw 4 cover screws in lightly;
- insert the shim, speedo gear and its stop ball on the layshaft;
- fit up provisionally the layshaft securing nut;
- mount tool 14928700 (51 in fig. 110) on the selector shaft;
- adjust the gearshift control by means of screw A, after having undone locknut B in fig. 110;
- check gear engagement by changing up and down and feeling for the neutral position. If gear-shifting presents some difficulty, take the gearbox cover down again and remove or add some shims between drum and gearbox if the problem is difficulty in first and third gear engagement, and between gearbox cover and drum if 2nd and 4th gears do not engage smoothly.

Shim sizes available for this operation are: 0.6, 0.8, 1, and 1.2 mm (.023, .031, .039, .047") (see fig. 111).

When this operation has been done, re-fit the cover as above described and check again if all gears engage properly.

If so, lock the layshaft nut tightly using tool 14905400 (35 in fig. 85) and layshaft holding tool 12907100 (34 in fig. 85).

After tightening this nut, hammer it with a chisel in correspondence of the shaft groove to lock it completely.

Tighten the cover securing screws and remove the tool previously fitted on the selector shaft. Insert the operating lever in the selector shaft and tighten its securing screws.

Lock tightly the oil breather plug which is also the retainer of the spring and stop pin on the gearbox.

## REFITTING INNER BODY AND CLUTCH UNIT ON SHAFT

Assemble:

- bearing-inner body seal;
- inner body;
- safety washer;

- inner body locking nut on clutch shaft. Tighten this using tool n. 14912800 (36 in fig. 86) and hooked wrench 14912600 (37 in fig. 86);
- bend one ear of the safety washer in one of the locknut grooves.

## REFITTING THE COMPLETE CLUTCH UNIT ON THE MAIN SHAFT AND GEARBOX COVER

Re-fit:

- small rubber tube in shaft;
- inner body;
- throwout bearing on inner body;
- outer body fitted with seal on gearbox cover;
- complete operating lever on gearbox cover with adjusting screw and locknut and securing with cotters and pins;
- lever return spring in its housing in gearbox cover.

## FITTING THE GEAR BOX COMPLETE WITH GEARS AND SHAFTS ON THE ENGINE UNIT

- Fit the gearbox on the stud bolts of the engine, taking care that the clutch inner body perfectly matches the two clutch driven plates, previously mounted, and the rod perfectly inserts into its housing on the spring plate bush;
- screws in nuts on stud bolts and screws.

## ADJUSTING THE CLUTCH OPERATING LEVER ON THE GEARBOX

- screw in or out screw «B» after loosening counter nut «A».

The correct distance to be obtained from the gearbox cover to the center of the round slot which retains the cable terminal (see «C» in fig. 112) is as follows:

## FILLING UP THE GEARBOX

(See fig. 84)

- mm 75 a. by clutch lever on gearbox n. 14090201 (rear brake control by cable);
- mm 65 a. by clutch lever on gearbox n. 14090201 (rear brake control by tie rod).

Fit plug C on the gearbox and introduce 0.750 liters (1 and  $\frac{3}{4}$  US pints) of Agip F. 1 Rotra MP SAE 90 through filler plug B.

Correct oil level is when it starts seeping through level plug A.

Re-fit plugs A and B.



## REAR WHEEL DRIVE

Universal double joint «Gleason» type bevel gear rear drive. The double joint is fitted on rear swinging fork bearing at one end of which is fitted the gearbox layshaft and at the other the drive shaft located inside the R/H arm of the rear fork.

Drive shaft and bevel gear pinion are keyed on the sleeve. Pinion teeth engage directly the crown teeth of the bevel set which through an internally toothed sleeve, drives the rear wheel.

Bevel gear set ratio (gearbox-wheel):

$$Z = 83/5 \quad 1 : 4,375$$

Overall gear ratio:

— low gear	1 : 10,806
— 2nd gear	1 : 7,499
— 3rd gear	1 : 5,657
— 4th gear	1 : 4,695
— high gear	1 : 4,052

### STRIPPING OF REAR WHEEL DRIVE

First drain the drive box oil by removing drain plug and gasket (C in fig. 113) located at the bottom of the same and then proceed to strip as follows.

With the engine-gearbox unit assembled on the machine remove:

- rear wheel (See «Removal of rear wheel»);
- unscrew the 4 nuts with toothed washers and back out drive box complete with sleeve and drive shaft;

- drive shaft from sleeve and the 2 circlips from the shaft;
- sleeve from bevel pinion;
- gasket and oil seal from drive box;
- using tool n. 12907100 (see 34 in fig. 113/1) and special wrench remove lockring which secures the bevel pinion;
- remove bearing housing, and from housing extract bevel pinion, both bearings, shims and distance piece;
- housing-drive box gasket and seal ring;
- unscrew the 8 bolts securing flange to drive box, after flattening lock plates;
- complete flange and from same seal ring and ball bearing;
- two gaskets (one between flange and shim and one between shim and drive box);
- shim;
- internally toothed sleeve for rear wheel coupling c/w bevel crown;
- from toothed sleeve, after flattening the lock plates and undoing the 8 securing bolts, remove bevel gear crown;
- remove bearing stop screw and plate;
- roller bearing cage and inner race;
- roller bearing race using puller 12906900 (15 in fig. 114);
- roller bearing cage retaining ring;
- oil seal from drive box;
- filler plug B from drive box and level plug A c/w gaskets (see fig. 113).

Stripping down of universal double joint, rubber protections and securing bands is only possible after the engine-gearbox unit or the rear fork are removed.

## INSPECTION AND OVERHAUL

### DRIVE BOX

- Check for any cracks in the casing;
- ensure the bearing housing is not damaged or scored;
- ensure union faces are perfectly smooth;
- check efficiency of the seal ring. Replace if crumbled or has lost its elasticity;
- fit new gaskets.

### DRIVE BOX FLANGE

Ensure that:

- flange is not cracked;
- union faces are not scored or nicked;
- bearing and seal housings are not scored or nicked;
- efficiency of seal. Replace if damaged or crumbled.

### DISTANCE SHIMS

Are available in 6 different sizes:

0.8 - 0.9 - 1 - 1.1 - 1.2 - 1.3 mm (.031 - .035 - .039 - .043 - .047 - .051").

Check that union faces are not scored or nicked.

### INTERNALLY TOOTHED SLEEVE FOR REAR WHEEL COUPLING

Ensure the surface supporting the ball bearings is faultless and dead smooth and the internal teeth undamaged.

### BEVEL GEAR SET

The bevel set consists of a pinion and a crown wheel. Ensure teeth of these are not chipped or excessively

worn. Pinion shank should be free of scoring and the splines dead smooth.

#### **CAGE RETAINING RING**

Ensure contact surface is dead smooth and not worn. Replace as necessary.

#### **REAR WHEEL-DRIVE BOX DISTANCE PIECE**

Check integrity of all contact surfaces.

#### **BEARING HOUSINGS**

Ensure all coupling surfaces and the bearing housings are not scored or worn. The gasket should always be changed.

#### **BEARING SPACER**

Ensure that its contact surfaces are not damaged.

#### **BEARING-SPACER SHIMS**

Are available in 2 sizes: 0.1 and 0.15 mm (.0039-.0059"). Check flatness and wear. Replace as necessary.

#### **BEVEL GEAR SHIMS**

Are available in 3 sizes: 1-1.2-1.5 mm (.039-.047-.059").

#### **LOCKRING FOR BEVEL PINION**

Replace by fitting.

#### **SEALS**

Check if still efficient. If crumbled or have lost their elasticity, replace.

#### **DRIVE SHAFT-PINION SLEEVE**

Inspect internal splines. If chipped or heavily scored, replace the sleeve.

#### **DRIVE SHAFT**

Splines should be in perfect state. If chipped or marked, replace the shaft.

#### **DOUBLE CARDAN JOINT**

Ensure the internal splines are dead smooth and free from chipping or scoring. Check that the articulation is not too slack or has hardened excessively. If necessary, replace the joint.

#### **GAITER RETAINING BAND**

Must not show any crack. If have lost their elasticity, replace.

#### **RUBBER GAITER**

If no longer efficient, replace the gaiter.

#### **BALL BEARINGS AND TAPER ROLLER BEARINGS**

Check if still in good condition and have not slacked excessively. All races should be dead smooth and even. Ensure the balls and rollers show up bright all over their surface. Replace the bearings if not quite sure of their perfect efficiency.

#### **ASSEMBLING OF REAR WHEEL DRIVE**

To assemble rear wheel drive operate in the following sequence:

- insert rear wheel-drive box distance piece;
- press oil seal in drive box;
- fit cage retaining ring;
- fit roller bearing outer race;
- fit roller bearing cage and inner race;
- secure bearing stop screw and plate;
- secure bevel crown to internally toothed sleeve by means of bolts and lock plates (after tightening bolts don't forget to bend down lock plate flaps);
- press ball bearing and seal ring in box flange;
- fit new gasket on drive box and flange. Shim between gaskets;
- secure flange to box by means of bolts and lock plate (lock plate flaps must be bent down **after** the bevel gear set is adjusted);
- fit into bearing housing: front bearing, distance piece, shims and rear bearing;
- fit spacer and adjusting washers on bevel pinion and insert pinion shank into bearing housing, tightening the castellated nut, using proper wrench and holdfast tool n. 12907100 (34 in fig. 113/1). After locking the nut, use a drift to tap on one of the nut slots in order to form a safety jut;
- fit housing with bevel gear on the stud bolts of the drive box and ensure that the teeth of pinion and crown are properly adjusted. (See «Contact check and adjustment of bevel gear teeth»);
- screw in the screws securing flange to drive box and bend down lock plate flaps;
- fit ball bearing on fork, securing it by circlip;
- finally, insert double joint in rear fork ball bearing

and fit gaiters over oint, securing them by band on fork side only. Front side of gaiters will be assembled on the frame.

**Remark:** By assembling of the drive box take care that oil passages on housing, gasket and fork flange are lined up (see fig. 115).

### ASSEMBLING REAR WHEEL DRIVE TO R/H ARM OF REAR FORK

To assemble the rear wheel drive on the rear fork, operate as follows (see fig. 115):

- after positioning circlips in drive shaft grooves, insert shaft into double joint and shaft bevel drive sleeve;
- insert splined portion of bevel pinion (A) into sleeve (B);
- screw up/lightly the 4 bolts and washers (C), securing drive box (E) to rear fork arm (D). Then insert rear wheel spindle (F) through L/H side arm of rear fork and inside drive box. Tighten 4 bolts (C) and withdraw spindle (F).

### LUBRICATIONS

(See fig. 113)

Quantity of oil required:

- 0.360 liter (12.07 oz USA) of which 0.340 liters (11.4 oz.) of Agip F. 1 Rotra MP SAE 90 and 0.020 liters (.67 oz.) of Molykote oil type «A».

### CONTACT CHECK AND ADJUSTMENT OF BEVEL GEAR TEETH

Give bevel gear set a pinion-crown clearance of 0.10-0.15 mm (.0039-.0059") (see fig. 115) and before checking teeth contact make sure that the plane formed by the outer surfaces normal to the generating pitch line (see A in fig. 116) is in perfect correspondence.

Teeth contact check is carried out as follows:

- smear crown teeth with lead oxide and then rotate pinion keeping crown braked so that rotation will take place under load and contact marks will appear on the painted surface of the crown gear. Contact is correct when marks left by the pinion teeth on the crown teeth are even all along the flank (see fig. 117).

Contact between the teeth could be incorrect and the following instances might arise:

- 1** Excessive contact at bottom of tooth flank (see fig. 118). This means that the pinion is too deep into the crown. Withdraw pinion and reduce adjusting shims.
- 2** Excessive contact at tooth bottom (see fig. 119). This means that the crown is too near to pinion. Get crown far from pinion and increase adjusting shims.
- 3** Excessive contact at tooth crest (see fig. 120). This means that pinion is too far apart from the crown. Approach pinion to crown, decreasing adjusting shims.
- 4** Excessive contact at top land (see fig. 121) this means that crown is too far apart from pinion. Approach it by increasing shims.

After each of the above operations it will be necessary to re-set pinion crown clearance at correct distance.

# CHECKING SEAL RING EFFICIENCY AND CASTING BLOWS IN ENGINE-UNIT, GEAR BOX, DRIVE BOX

## ENGINE UNIT

### Checking seal ring efficiency on crankshaft, flywheel side (see fig. 122)

Oil the outer ring surface and connect the compressed air duct to the pipe «A», place one hand on the ring and blow compressed air at 4 kg/cm<sup>2</sup> checking if there are bubbles on the ring surface. Should bubbles be detected between shaft and seal ring too, this may not depend on a poor efficiency of the seal ring but on a score in the crankshaft. To make sure of this, turn the crankshaft and repeat the above test, should bubbles be still detected it will be necessary to check the crankshaft.

If after this checking there are still oil leakages, ensure that there is no casting blow.

### Checking casting blows (See fig. 122)

Fill oil in the sump, connect the compressed air duct to the pipe «A», place one hand on the crankshaft seal ring, flywheel side, and blow compressed air at 4 kg/cm<sup>2</sup> seeing that no oil leaks from outer casting surface.

## GEAR BOX

### Checking seal ring efficiency on clutch shaft (See fig. 123)

Same as by engine-unit, compressed air is blown through the pipe «B».

### Checking casting blows (See fig.123)

Same as by engine-unit, compressed air is blown through the pipe «B».

## DRIVE BOX

### Checking seal ring efficiency on the drive box cover (See fig. 124)

Same as by engine-unit, compressed air is blown through the valve of tool «C». (This tool can be obtained from a used rear fork arm by welding a plate with a tyre inner tube valve on the arm top).

### Checking casting blows (See fig. 124)

Same as by engine-unit, compressed air is blown through the valve of tool «C».

## REAR FORK

### REMOVAL OF REAR FORK

After removing the wheel and the rear drive unit, proceed as follows:

- loosen locknuts on pins spindles of fork support;
- loosen fork spindles by a screwdriver;
- slide off spacer and seal rings on fork;
- remove the roller bearings, use puller 12904700 (14 in fig. 125) for outer races;
- remove spring ring and ball bearing.

### INSPECTING THE REAR FORK

Ensure that the rear fork has no abnormal bending, and defective welding; check the conditions of bear-

ing housings and smoothness of contact surface with drive box. Check measures according drwg. in fig. 126.

### RE-ASSEMBLING OF REAR FORK

The rear fork is reassembled as follows:

- press both taper roller bearings in their housing;
- fit seal and spacer rings;
- fit fork on frame and screw in spindles of fork support;
- adjust the rear fork by acting with a screwdriver on spindles (see fig. 127) until a free playless swinging of the fork;
- tighten locknuts on spindles.

# REAR SUSPENSION

## STRIPPING FROM FRAME

Unscrew nuts and remove suspensions from bosses on frame, rear fork and drive box.

## CHECK AND OVERHAUL

Check suspension efficiency. If not normal, and provided this is not due to imperfect operation of the shock absorbers, check the condition of springs.

1 Turn the bottom spring securing sleeve on position 1. This is obtained by rotating the sleeve around the damper body until mark 1 on the body coincides with mark 1 on the revolving sleeve.

2 Compress the spring to the point where the top spring plate can be backed out and then remove the spring.

## ASSEMBLY OF SPRINGS ON SHOCK ABSORBERS

3 Extend the damper rod fully and check that the spring adjusting sleeve is in position «1» and then fit the spring on the damper body.

4 Compress the spring to the point where the top plate can be inserted.

## CHECKING DATA FOR THE REAR SUSPENSIONS

(See fig. 128)

Free length of spring is  $277 + 0,5$  mm (10.90").

When compressed by 40 mm (1.57")

(assembly length 237 mm [9.33"])

should give a load of kgs 49.9 (109.8 lbs).

When compressed by 125 mm (4.92")

(length 152 mm = 5.98")

should give a load of 154.5 kgs (418 lbs).

The spring fitted on the damper has 3 lengths according to the position of the sleeve (machine at standstill w/o pillion).

Position 1 = 237 mm (9.33")

Position 2 = 229.5 mm (9.07")

Position 3 = 222 mm (8.74")

## REAR SUSPENSION DAMPER

(See fig. 129)

Maximum opening  $320 \pm 2$  mm (11.88")

Closed lightly  $243 \pm 2$  mm (9.56")

Closed fully 235 mm (9.25")

Travel  $77 + 8$  mm (3.03") bottoming,  
total 85 mm (3.34").

## ADJUSTING THE SHOCK ABSORBERS

The shock absorbers are adjusted as follows:

1 Remove external spring.

2 Extend the damp errod fully, push rubber return bush downwards (see A in fig. 130). Should this be stuck to the counternut, free it by means of a screw-driver, making sure not to damage the chromed damper rod.

3 Unscrew counternut under the eyelet (do this by placing the top eyelet in a vice), then remove the eyelet, counternut and rubber bushing (see B in fig. 131).

4 Re-fit counternut and eyelet on the damper rod, depress rod fully and keeping it in this position turn to the left until it reaches the adjusting system (see fig. 132). Do not force too much when forcing to the left as if there is some resistance this means that the adjustment is at the end of its stroke (point «O») from where the various damper adjustment start.

5 The available adjusting space available is 2 and  $\frac{1}{4}$  turns from point «O».

## ADJUSTMENT

Keeping the rod pressed down, turn to the right by the required number of turns (This operation is made easier if the starting point is marked).

For the first adjustment we recommed a rotation of not more than  $1\frac{1}{2}$  turns (see fig. 132).

6 Move the rod vertically for about 2 mm (without rotating it) so as to release the adjusting system.

7 Re-fit the rubber bushing on the damper rod (after having undone and removed the counternut and the top eyelet) and then the counternut and toy eyelet. This done, tighten the counternut on the eyelet.

## CAUTION

In re-fitting the spring don't forget to put back the rubber stop bush as otherwise the damper will not operate properly.

Both dampers must be adjusted by a similar number of turns.

## ADJUSTING THE REAR DAMPER IN THE 3 POSITIONS

In addition to the normal position (I), the damper spring can be adjusted on positions II and III by moving the adjusting sleeve (B) with wrench A (31 in fig. 133) in the standard tool kit in direction of the arrow to compress the spring and viceversa to extend it, bringing mark II or III on the revolving sleeve opposite mark I on the bottom eyelet.



## FRONT SUSPENSION AND STEERING

To remove front wheel, handlebar, instrument panel, and front fork from the frame, proceed as follows:

### DISMANTLING

- Remove the assembly wheel-front fender (see Chapter «Wheels»);
- remove control group and fender;
- undo screws and remove light, horn and turn light switches;
- disconnect the steering damper and remove it after undoing its securing nut;
- undo both the headlight securing bolts to the fork cover lugs and disconnect cables from the headlight terminal. Remove headlight;
- undo screws and remove both front turn light indicators;
- undo thumb screws on speedo and rev-counter cables;
- undo speedometer, rev-counter and indicator lights panel screws and remove all these parts;
- undo screws on the instrument panel studs and remove panel;
- undo top fork plugs and lift out the top linking plate;
- loosen fork lugs and semi-handlebars clamp screws and remove these from the fork members;
- undo bottom yoke securing nut and slip out the complete fork assembly from the frame lug and from this the outer bearing races.

### DISMANTLING OF FRONT FORK COMPONENTS

- Undo the screws which secure the bottom yoke to the fork tubes and remove bottom yoke;
- set up the bottom fork cover in a vice and undo the screw which secures the rod to the fork covers. Withdraw fork tube from cover and from tube remove the rod spring and fork damper;
- using a pair of pliers remove the rod end seal and slip off:
  - bottom cap;
  - spring;
  - unscrew rod from damper and remove damper;
- from the bottom cover remove:
  - gaiters;
  - seal securing circlip;
  - seals;
  - oil drain bolt.

The other fork leg is similarly dismantled.

### OVERHAUL OF TELESCOPIC FRONT FORK (See fig. 134).

### FORK ROD

Check that the chrome plated section of the fork rod which slides in the bottom cover is in good condition and free from scoring.

Ensure the rod is perfectly straight and the threaded portion in good state.

Rod diameter:

34.740-34.715 mm (1.3672-1.3662")

Rod-cover fitting clearance:

0.010-0.085 mm (.00039-.00334")

### BOTTOM FORK COVER

It is in light alloy. Ensure its inner part is not scored or nicked.

I/D of cover:

34.750-34.790 mm (1.3678-1.3654")

Cover-rod assembly clearance:

0.010-0.085 mm (.00039-.00334")

### FORK SPRING

(See fig. 135)

Ensure that spring is not deformed or cracked.

Free length of spring is 418.500 - 423.500 (16.475 - 16.672").

Spring length (on assembly) should give a load of 11.3 kgs (23 lbs) when compressed to 16 mm (.629"). Spring length (static load) should give a load of 48.9 kgs (97.5 lbs) when compressed to 66 mm (2.598").

Spring at end of travel should give a load of 104.4 kgs (229.7 lbs) when compressed to 141 mm (5.551").

### RUBBER GAITER ON FORK COVER

Check if cracked or in bad state and replace as necessary.

### SEAL CIRCLIPS IN COVER

Replace if no longer efficient.

### SPRING RETAINER ON DAMPER ROD

Check if still in good condition and replace it if no longer efficient.

### RUBBER RING ON FORK DAMPER

Ensure it is not squashed or crumbled and replace as necessary.

## FORK DAMPERS

Should never be tampered with. Check both at same time to ensure they have the same load to prevent irregular operation of the fork.

If the dampers are no longer efficient, return them to the makers or replace them.

## STEERING DAMPER

Should never be tampered with. In case of irregular operation, return it to the makers or replace it.

## BOTTOM FORK YOKE

Ensure straightness of the steering column. If offset or the threaded portion is damaged or stripped, replace the yoke.

## STEERING BEARINGS

Check wear and if still in good state.

Races and rollers should show up quite bright and smooth all over their surface. If any fault is detected, replace the bearing. (See Chapter «Beomgs»).

## RE-ASSEMBLY OF FORK COMPONENTS

Proceed as follows:

- insert rubber ring on damper;
- screw nut on damper rod;
- screw tube on damper rod and lock the previously fitted nut;
- insert spring on tube;
- insert stop cap on tube;
- fit circlip in its housing on tube;
- insert rod housing on damper rod;
- insert the complete tube-spring-damper assembly in the fork;
- fit seals on cover;

- fill in the cover with 0,050 l. (50 cc) of Agip F.1 ATF Dexron;
- screw drain bolt with washer on cover;
- fit both rubber gaiters on fork and insert the complete tube-damper assembly in the fork cover.

• **NB.** - The other fork leg is similarly assembled.

- Fit the dust cap on bottom yoke, shim for the lower bearing and the bearing;
- fit outer bearing races on frame lug;
- insert both complete legs in the bottom steering yoke and secure this to the fork tubes with Allen screws;
- insert the fork on the frame;
- fit top bearing on frame and the dust cover on top of it;
- tighten nut on steering column after ensuring that the fork is adjusted i.e. that it can turn freely without any play;
- insert the handlebar halves in the fork members. Insert the headlight supports and fix them in position with Allen screws;
- insert the steering lock plate on the steering column;
- fit the top linking plate on the fork member and steering column and secure it with bolts and washers;
- screw stud on fork dampers;
- re-fit steering damper assembly and secure it bracket;
- re-fit the instrument panel complete with speedo, rev-counter, and indicator support complete of all indicators.

Fitting of: fenders, wheels, handlebars, and brake controls is proceeded by reversing removal sequence.

## STEERING DAMPER ASSEMBLY

It is fitted on the steering column and is controlled by a knob located on top of the column (see fig. 136).

- position «A»: damper disconnected;
- position «B»: damper connected.



# WHEELS AND BRAKES

## REMOVAL OF FRONT WHEEL (shoe brake)

(See fig. 137)

Removal of the wheel from the machine is carried out as follows:

- disconnect the front brake cable from brake levers on hub covers;
- slacken conternuts C and remove cable adjusting screws D; from the covers;
- undo nut «A» which secures the wheel spindle to the R/H bottom fork cover;
- slacken the bottom cover screws to wheel spindle Band withdraw spindle from the hub and bottom fork covers;
- push the wheel down just enough to free the hub cover from the anchoring lug on the L/H fork cover;
- withdraw the wheel.

## DISMANTLING THE FRONT WHEEL HUB (shoe brake)

Operate as follows:

- Remove both R/H and L/H hub covers from the drum;
- after undoing bolts which secure levers to cams, remove levers and rod from hub covers;
- remove sealing rings and withdraw the brake shoes and cams from the hub cover;
- remove retainer, bearing, distance piece, the other bearing and retainer from the hub.

## REMOVAL OF REAR WHEEL

(See fig. 138)

Removal of rear wheel is carried out as follows:

- undo nut «A» which secures the anchoring stay to the drive box;
- undo nut «B» which secures the wheel spindle to the drive box.

Cable controlled rear brake:

- slacken cable tensioner with conternut «E»;
- disconnet brake control cable «D» from cam lever on the hub cover.

Link controlled rear brake:

- slacken thumb screw «A» in fig. 147 and slide bush out of control link;
- slacken bolt «C» on ther rear fork link and withdraw wheel spindle F;
- slacken both knobs A in fig. 139, raise the rear fender tip;
- push the wheel to the left just enough to free the

gear from the internally toothed sleeve in the drive box;

- remove wherl.

## DISMANTLING OF REAR WHEEL HUB

To dismantle the rear wheel hub proceed as follows:

- back out the complete hub cover;
- after undoing the screws which retain the cams, remove from the hub cover both cam levers complete with forks;
- withdraw the brake shoes and operating cams from the hub cover;
- undo both nuts and remove the brake shoes retaining pins from the hub cover;
- remove retaining ring from hub cover.

## CHECKING AND OVERHAULING WHEELS AND BRAKES

Ensure that all wheel components are within the specified limits and not excessively worn or crumbled otherwise replace the damaged parts. Refer to sizes indicated in fig. 140 for truing the front wheel and fig. 141 for the rear wheel.

## ADJUSTING THE HUB COVER COMPLETE WITH SHOES ON FRONT WHEEL HUB

(See fig. 142)

- Turn the brake shoe linings to the specified size i.e. 219.800-219.950 mm (8.653-8.659"). Do this operation with cam in open position and the cam operating lever at 119.800-120.000 mm (4.716-4.724") from anchoring lug;
- ensure that the internal diameter of the drum is 219.900-220.000 mm (8.657-8.661") and in case of slight scoring grind the inner hub surface with very fine grain emery paper.

## ADJUSTING THE HUB COVER COMPLETE WITH SHOES ON REAR WHEEL HUB

(See fig. 143)

- Turn the brake shoe linings down to the specified size i.e. 219.800-219.950 mm (8.659-.0785") diameter. Do this operation with the cam fully open and operating lever at 116.800-117.000 mm (4.637-4.606") from anchoring lug;
- ensure the I/D of the drum is 219.900-220.000 mm (8.659-8.661"). In case of slight scoring or slight marks, grind the inner surface of the drum with very fine grain emery paper.

# ASSEMBLY OF FRONT WHEEL (shoe brakes)

## ASSEMBLY OF FRONT WHEEL HUB

To assemble the front wheel hub proceed as follows:

### R/H side of hub cover

- fit taper roller bearing in its housing, then retainer.

### L/H side of hub cover

- fit bearing spacer between bearings and press ball bearing in its housing, then retainer.

## ASSEMBLY OF HUB COVERS ON DRUM

- After having assembled the cams on the hub cover and the shoes complete with springs on the cams and the pins securing them with circlips, the adaptors on the operating levers, the brake rod and adjusting nut on the fork adaptor, the levers complete with forks and rod on cams, refit the complete hub covers on the hubs.

## ASSEMBLY OF FRONT WHEEL ON FORK BOTTOM COVERS (shoe brake)

(See fig. 137)

This is done as follows:

- lean the machine on one side and insert the wheel between the fork legs. In doing so ensure that the housings on the hub covers enter the anchoring lugs on the fork covers;
- insert the wheel spindle in the right fork member, the wheel hub and the left fork member and secure it with its nut and washer;
- tighten the bottom fork links with Allen head screws.

## CONTROL CABLES (shoe brake)

The front brake is provided with two control cables which act on the R/H and the L/H brake block. The R/H cable incorporates the stop cutout.

If the stop cutout should fail, it is necessary to change the cable. Ensure that cables and casings are in good conditions. If not, replace the cables.

## ADJUSTING THE FRONT BRAKE (shoe brake)

(See fig. 144)

The lever is correctly adjusted when there is about 20-25 mm play ( $\frac{3}{4}$  to 1") at the lever end before the linings contact the drums.

To adjust undo thumb screw A and act on adjuster B. To adjust the brake shoes on the linings in order that they will act simultaneously, operate as follows:

- disconnect the control cable from the brake block lever on the right;
- adjust brakes on the L/H drum acting on the cable adjuster (D), after having loosened conternut C on the left hub cover, until there is 20-25 mm play ( $\frac{3}{4}$  to 1") at the handlebar lever;
- connect control cable on the R/H hub cover;
- pull the handlebar lever fully and act on screw D after undoing conternut C on the R/H hub cover until the linings are in contact with the drum.

After adjustment put your thumbs on the cable operating levers on the hub-covers and ensure that by pulling the handlebar lever both the hub cover lever act simultaneously.

# ASSEMBLY OF REAR WHEEL

## ASSEMBLY OF REAR WHEEL HUB

To assemble the hub proceed as follows:

### Drive box side

— fit roller bearing, bushing and seal.

### Hub cover side

- fit the bearing spacer, shims, roller bearing, bushing and seal. If there is too much axial play, remove one or more shims, if the wheel does not turn freely add shims;
- fit the hub cover after having assembled the pins, cams, and shoes, and control levers complete with fork adaptor and rod.

## ADJUSTING AXIAL PLAY ON THE TAPER ROLLER BEARING ON THE REAR WHEEL HUB

(See fig. 145)

The taper roller bearings in the rear wheel hub should have an axial play of 0.05 mm with no grease on them (.0019").

Bedding down or wear of the hub components may increase this play and so influence unfavorably machine stability.

To correctly adjust these bearings proceed as follows:

- 1 Remove the group from the hub, wash it in petrol and dry with air jet.
- 2 Re-fit this group on the hub interposing between left bearing B and spacer C a shim A of such size as to bring play down to ZERO. Wheel rotation will have hardened somewhat.
- 3 Dismantle the L/H bearing again (B) and add to shim A a 0.10 mm (.0039") shim. This additional shim will ensure correct wheel rotation. Lubricate the bearings with Agip F. 1 grease 30. Re-fit bearing E with retainer D on the hub.
- 4 Fit the wheel on the fork legs and the rear fork and tighten the spindle securing nut at a torque loading of 14-15 kg/m (101-107 lbs/sq. in.).

## ADJUSTMENT OF REAR BRAKE (cable controlled)

(See fig. 146)

Periodically check that play at the lever end (C) is not more than 20-25 mm ( $\frac{3}{4}$  to 1") before the linings contact the drum.

To adjust operate on thumb screw A after loosening conternuts B.

Position of lever C can be adjusted to suit the rider requirements operating on thumb screw D after loosening conternut E.

At the end of this operation, holding fast screw D, tighten conternut E against the forked support.

## ADJUSTMENT OF REAR BRAKE (link controlled)

(See fig. 147)

To adjust, screw in or out the thumb screw «A» which is threaded, on the brake control link.

To avoid excessive play screw in this thumb screw «A» on the link, ensuring that the play at the lever end «B» is not more than 20-25 mm before the linings contact the drum.

## ADJUSTING THE WHEEL SPOKES

Check that all spokes are tightened and the truing of the wheel by proceeding as follows:

- turn the wheel and check its truing. If necessary, act on right or left spokes until the wheel turns properly. This checking has to be carried out after the first 500 km and later on every 1500 km or so.

## BALANCING THE WHEEL

To improve stability and decrease high speed wobbling, the wheels have to be kept balanced. It is recommended to balance the wheels by means of proper balancing machines, if at disposal; otherwise proceed as follows:

- after removing the wheel, checking spoke tightening and wheel truing, suspend it on a fork;
- spin the wheel lightly several times and see if it always stops in different positions, thus indicating a correct balance;
- if one point of the wheel always stops at the bottom, put a balance weight to the spoke opposite this point;
- repeat this adjustment until the wheel is correctly balanced, then fix the balance weights to the spokes by means of pliers.

Balance weights are available in following sizes:

- gr 15 (part n. 12611601)
- gr 20 (part n. 12616102)
- gr 30 (part n. 12616103)

An imbalance of less than 15 grams normally does not affect the motorcycle stability.

## REMOVAL OF FRONT WHEEL AND HYDRAULIC BRAKING CIRCUIT FROM FRONT FORK AND HANDLEBAR

To remove the front wheel from the motorcycle operate as follows:

- remove rubber caps, undo drain plugs («H» in fig. 148) and drain the fluid from the braking circuit;
- undo the screws securing pipes on twin control and caliper and remove pipes and hydrostop switch;
- undo screws and nuts then remove caliper and front fender from fork members;
- undo lock nut («A» in fig. 147/1) securing wheel spindle to the right fork member;
- undo screws («B» in fig. 147/1) securing fork members to wheel spindle;
- slide wheel spindle («C» in fig. 147/1) out of hub and fork members;
- raise the bike to enable wheel slipping of fork members;
- undo the securing nut and remove twin control at the fork bottom yoke;
- after removing the cap and undoing the screw from master cylinder slide the pipe off;
- remove master cylinder from handlebar after undoing securing screws.

# FRONT WHEEL BRAKING CIRCUIT

The hydraulic braking circuit on the front wheel consists of:

- master cylinder, on the right handlebar, lever controlled;
- caliper, on both right and left fork members;
- two braking discs;
- twin control at the fork bottom yoke;
- one pipe from master cylinder to twin control;
- two pipes from twin control to caliper;
- brake pads, controlled by pistons inside the caliper, which are actuated by the fluid pressure.

## GENERAL MAINTENANCE

For a good efficiency of the braking circuit on front wheel it is recommended to follow these directions:

- periodically check the fluid level in the reservoir on the handlebar, it has never to be lower than 8 mm under max. level;
- every 500 km fill up the fluid reservoir taking the fluid from an original container to be opened only by fluid pouring;
- completely renew the fluid every 15000 km or at least once a year.

The fluid pipes have to be always full and without air; a long and elastic movement of the control lever evidences the presence of air bubbles.

Use only fresh recommended fluid in case of washing of the braking circuit; no alcohol is to be used for washing and no compressed air for drying up. Recommended fluid: Agip F. 1 Brake Fluid.

## AIR BLEEDING

(See fig. 148)

This operation is required every time when the movement of the control lever is long and elastic because of presence of air bubbles inside the braking circuit.

Proceed as follows:

- turn the handlebar until the master cylinder (fluid reservoir) «A» reaches the horizontal position;
  - if necessary fill up the fluid reservoir «A» (take care that during the whole operation the fluid level is not lower than 8 mm than max.);
  - act on caliper one time right and one time left.
- a)** Take off the rubber cap then fit a transparent flexible pipe «I» on drain plug «H»; the other end of this duct will be plunged into a transparent container «L» partially filled up with fluid of the same type;
  - b)** loosen drain plug «H»;
  - c)** completely operate several times the brake control lever «B» release it slowly and wait for a few seconds before operating it again. Repeat this operation until the pipe plunged into the transparent container emits airless fluid;
  - d)** keep the control lever «B» completely drawn and lock the drain plug «H» then remove pipe «I» and fit the rubber cap.

If this air bleeding has been carried out correctly, the efficiency of the brake fluid will be immediately realized after the initial idle movement of the lever «B»; if it is not so, repeat the air bleeding.

**Remark:** The air in the braking circuit is not completely bled by the above operation; the remaining air is automatically bled after a short time riding; thus causing a less elastic and shorter lever movement.

## GENERAL DIRECTIONS FOR REMOVAL OF COMPONENTS FROM THE BRAKING CIRCUIT

Before starting removal, clean the outer parts of components and plug pipe ends to prevent entering of foreign material.

After removal of components, clean and take off grease from metallic parts by means of trichloroethylene, rubber parts will be cleaned using the recommended fluid; trichloroethylene must not get in touch with rubber gaskets.

Handle precision parts with care not to damage them. After cleaning dry up by means of unfrayed rags and moisten cylinder and piston walls with brake fluid to avoid corrosion.

## MASTER CYLINDER (FLUID RESERVOIR)

(See fig. 149)

It consists of a light alloy body (1) incorporating the fluid reservoir (2); this body includes also a cylinder housing which acts as a floater guide (3).

The floater has two housings for gasket (5) and gasket (4) and engages the lever end (6).

A bush (8) guided return spring (7) ensure the floater return.

The floater stop is given by washer (9) and ring (11) incorporating scraper (10) which prevents entering of moisture and foreign material.

Screw (12) secure the control lever (6) to the master cylinder while thumb screw (13) adjust clearance between lever and floater which must be 0.05-0.15 mm by feeler gauge measurement.

A higher or lower clearance would damage working efficiency either of lever or of master cylinder.

The fluid reservoir has a gaiter (14) preventing fluid exit in case the motorcycle falls down; this gaiter is secured by cap (15).

## INSPECTION AND CHECKING

Periodically check the fluid level in the reservoir, it has never to be lower than 8 mm under maximum level.

Every 5000 km fill up the fluid reservoir; take the fresh fluid from an original container to be opened only by pouring. The brake fluid is a hygroscopic one and requires complete renewal every 15.000 km or at least once a year.



Check the clearance of 0.05-0.15 mm between floater and lever end. Periodically grease scraper (10) and and floater stem (3); do not use mineral oil or grease.

## INSPECTION AND REPLACEMENT OF MASTER CYLINDER COMPONENTS

(See fig. 149 and fig. 151)

In case of uncorrect action of master cylinder (fluid leakages at lever action side, decreasing braking ability) it is necessary to replace gaskets (4 and 5).

Operations are as follows:

- drain the fluid from fluid reservoir (2);
- remove and plug delivery pipe (16);
- remove the control lever (6);
- insert tool n. 14926400 (53 in fig. 151) into the fluid pass hole and pull the floater (3) outside by lightly using a mallet taking care not to score the hole walls and the outer surfaces of floater (3);
- from floater (3) remove lock ring (11), scraper (10) and washer (9);
- from master cylinder (1) remove return spring (7) and guide bush (8);
- clean accurately oater (3) and master cylinder body (1) and check that they are not damaged. Check also I/D of master cylinder and O/D of floater (3):
  - max. allowed hole dia. mm 15.918
  - min. allowed floater dia. mm 15.832
- check gaskets (4 and 5) if still in good conditions do not remove them; if replacement is necessary remove them by means of a proper tool;
- fit new gaskets (4 and 5) on floater (3) by using tool n. 14926500 (54 in fig. 151) for gasket (5) and tool n. 14926600 (55 in fig. 151) for gasket (4) (pay attention to the mounting position of gasket [5]);
- on floater (3) fit washer (9) scraper (10) (check its good condition) and lock ring (11);
- fit return spring (7) on floater (3) and guide bush (8);
- fit the whole assembly into the master cylinder hole;
- fit lock ring (11) by tool 14926700 (56 in fig. 151) by lightly using a mallet until washer (9) is a travel end;
- connect oil delivery pipe to master cylinder body (1);
- fit lever (6) and check clearance between lever end and floater (3);
- fill up fluid reservoir (2) and drain the air from the braking circuit.

**Remark:** Before mounting moisten rubber and metallic parts with brake fluid; do not use mineral oil or grease.

## CALIPER

(See fig. 150)

It consists of two light alloy bodies (1) joined by two screws (2). Each body includes a cylinder housing acting as a piston guide (3). Sealing is ensured by a gasket (4) lodged in a groove inside the cylinder

housing. This sealing is automatically adjusted because brake pad (5) wearing increases piston exit out of cylinder housings.

A dust guard cap (6) prevents entering of moisture or foreign material. The two pistons act directly on the two pads which are secured by two pins (7) each locked by a spring ring (8).

A taper pin (10) pressed in spring (9) prevent pad flapping and make disc setting easier, after braking. Cap (11) prevents pads from getting too much wet because of mud and water.

Brake fluid is delivered to caliper through hole (12) while hydraulic connection between caliper bodies is provided through two inner holes. Sealing is ensured by gasket (13).

Each body is provided with drain plug «H» for air draining.

## INSPECTION AND CHECKING

Every 5000 km check the wearing conditions of pads as follows:

- remove cap (11);
- remove taper pin (10) and spring (9);
- slip off pin, pad retainer (7);
- slip off pads;
  - thickness must be:
    - new pad mm 9
    - wear limit mm 6

If thickness is under this wear limit, it is necessary to replace the pads. The friction material has not to be used until to reach the metallic plate which, by touching, would definitely damage the disc and avoid thermal insulation between brake fluid and pad.

Pads are replaced as follows:

- pull pistons (3) into inner caliper bodies (1); take care not to damage dust guard caps (6);
- fit new pads;
- fit pins (7) pad retainers, taper pin (10) and spring (9).

After pad replacement it is not necessary to carry out the air draining of the braking circuit; operate several times the control lever until the caliper pistons reach their normal position (pad-disc clearance 0,2 mm).

**Remark:** By pad replacement it is recommended to take a little amount of fluid out of fluid reservoir as backing of pistons into housing might cause the fluid to overflow.

**Caution:** For about 100 km or so, pay attention to operate new pads in order to allow the frictional material a correct efficiency.

## INSPECTION AND REPLACEMENT OF CALIPER COMPONENTS

The replacement of caliper gaskets is necessary when fluid leakages occur through cylinder housings; fluid traces will be seen on brake discs, and caliper while the fluid level in the reservoir will be lower and lower.





## BRAKING CIRCUIT FAULTS

FAULT CAUSES	REMEDIES
<p><b>Brake screeching</b></p> <p>Caliper unfully locked            Defective or missing taper pin springs            Pad wearing off limit            Dirty pads; oil or grease            Fitting of wrong pads</p>	<p>Screw in securing screws            Insert new spring            Fit new pads, after checking disc conditions            Replace pads            Replace pads</p>
<p><b>Brake wobbling</b></p> <p>Disc wobbling higher than 0.2 mm            Piston locking</p>	<p>Rectify or replace disc</p>
<p><b>Braking disc excessive heating on normal riding</b></p> <p>Piston locking, pads glued to disc            Playless control lever</p>	<p>Check pistons conditions, clean pad housings in caliper            Adjust lever play according the directions</p>
<p><b>Poor braking</b></p> <p>Braking disc dirty with oil or other material            Too much worn or vitrified pads            Pads, dirty with oil or grease            Piston locking</p>	<p>Clean braking disc            Replace pads, check up braking disc            Replace pads            Get piston sliding</p>
<p><b>Brake blocking</b></p> <p>Too high frictioning pads            High disc oxidation</p>	<p>Fit proper pads            Rectify disc</p>
<p><b>High pad wearing</b></p> <p>Pads locked in housings, ever touching braking disc            Piston locking            Disc deeply scored</p>	<p>Clean pad housing in caliper check coupling with their guides            Get piston sliding            Rectify or replace disc</p>
<p><b>Irregular or slantways pad wearing</b></p> <p>Dirty pad housings            Unproper piston sliding            Taper pin springs defective            Slantways mounted caliper</p>	<p>Clean pad housings            Get proper sliding            Replace springs            Check and mount properly</p>
<p><b>Too long control lever stroke</b></p> <p>Braking disc wobbling higher than 0,2 mm            Presence of air bubbles inside the braking circuit            Braking disc deeply scored</p>	<p>Rectily or replage braking disc            Bleed the air from the braking circuit            Rectify or replace braking disc</p>

FAULT CAUSES	REMEDIES
<p><b>Floater in master cylinder does not return</b></p> <p>U-bolt securing screws too much tightened  Lever screw too much tightened (not original part)  Uncorrect coupling between lever and its housing on master cylinder (too much thickness)  Deformed scraper by etching liquids  Dirty brake fluid</p> <p>Defective floater return spring</p>	<p>Slightly undo the screws  Slightly undo the screw</p> <p>Replace lever  Replace scraper  Strip master cylinder, clean and check components (seizing and scoring not allowed)  Replace the spring</p>
<p>Fluid leaking from fluid reservoir  Gaiter incorrectly fitted</p> <p>Damaged gaiter  Damaged fluid reservoir rim</p>	<p>Fit gaiter properly into its housing and smoothly close cap.  Replace gaiter  Repair or replace master cylinder</p>

### RECOMMENDATIONS

Braking circuit rubber parts (for master cylinder: gaskets, scraper ring, gaiter — for caliper: gasket joining caliper bodies, dust guard cap) are made of a special compound, brake fluid resistant; on the other hand such compound cannot bear etching action of

mineral oils, solvents and Diesel oil sometimes used for washing purposes, on the motorcycle. It is then strongly recommended to avoid any contact of these liquids with braking circuit rubber parts. On the master cylinder, it might occur that the scraper ring — because of contact with such liquids — melts and glues with floater, affecting the sliding of the same.

## BALL AND ROLLER BEARINGS

All ball and roller bearings used on this machine are generously dimensioned for longer life.

### INSPECTION

Examine carefully the outer raceway of the inner race and the inner raceway of the outer race. Raceways must be perfectly smooth and glossy. Should any cracks, nicks, or surface roughness be detected, the complete bearing must be replaced.

Balls and roller must be unimpaired and positively smooth all over their surface. If any fault is detected, replace the bearing.

Never attempt to repair a bearing as such repairs are extremely difficult and never give good results. When pressing in bearings make sure to always operate on the ring which is being pressed in.

Bear in mind that new bearings, before being pressed into a housing or on to a shaft, show a slight backlash (in the range of thousandths of mm only). Such backlash will decrease after the bearing is fitted, but it should not disappear completely otherwise ball and/or rollers would work under stress and the bearing get damaged in a short time.

In journals and thrust bearings a higher end play (in the range of hundredths of mm) is allowed.

## FRAME

The frame is made up of two parts: one conventional and the other by two bottom side member which form the cradle carrying the engine and which can be removed.

### INSPECTIONS AND OVERHAUL OF THE FRAME

Especially after an accident, check that the frame has not deformed, cracked, or has parts unwelded.

Check sizes against fig. 152. If deformed, replacement is recommended.

### CENTER AND SIDE STAND RETURN SPRING

Check that springs have not lost their elasticity. Under a load of 30 kgs (62 lbs) the spring should extend 10 mm (.39").

# ELECTRICAL EQUIPMENT

(See wiring diagram fig. 170)

## BATTERY FEATURES

Tension	12 V
Charge intensity (3' at 18°)	120 A
Capacity	32 Ah
Length	238 mm (9.37")
Width	127 mm (5")
Height	165 mm (6.49")

The battery is located in the central part of the machine (see A in fig. 153).

## INSPECTION AND MAINTENANCE

Battery access is obtained by lifting up the saddle using a suitable lever and disconnecting its anchoring straps.

## CLEANING

The battery should always be kept in a perfectly clean and dry condition, especially its top part. Clean it using a hard bristle brush. The cleaning operation is done with the plugs tightened down to prevent dust or foreign matter from entering the electrolyte. Check that there are no cracks in the sealing compound of each single cell (and consequent leakages). Eliminate leaks, if any as the electrolyte will always cause corrosion of any material it might contact.

## CHECK AND GREASING OF TERMINAL BLOCK

To undo or tighten the cable terminal locking, use always open ended wrenches.

Never tap on the terminals in order to make removal or fitting easier as this might cause stresses resulting in battery cracks or the terminals detachment with consequent electrolyte leakages.

After a thorough cleaning, terminal and clamps should be smeared with pure vaseline jelly to prevent oxidation. The bottom part of the cable terminals and terminal blocks should be smeared with particular care. Never use lubricating greases.

After cleaning and smearing with vaseline, secure cable terminals to terminal blocks very tightly.

## CHECKING ELECTROLYTE LEVEL

Every 3000 kms check electrolyte level and eventually top up each cell with distilled water using a glass or

plastic funnel. Correct level is attained when the electrolyte tops the plate separators by about 5 mm (3/16"). Always use distilled water and never sulphuric acid. Topping up must be done on a cold battery which has been at rest for about 6 hours.

If the electrolyte level of any one cell drops abnormally, check for possible leakages due to cracks and in such case it is necessary to immediately repair or change the battery.

## MEASURING DENSITY AND TEMPERATURE OF ELECTROLYTE

(See fig. 153)

This operation should be carried out periodically in each cell after topping up.

Use a hydrometer as shown in the pictures (153-154) to check density. Use a thermometer with its rounded end completely immersed in the liquid to check temperature.

## CORRECTION OF SPECIFIC GRAVITY READING IN RESPECT OF TEMPERATURE

All readings should be brought down to the standard temperature of 25 °C (77 °F).

For each 10 °C (50 °F) difference it is necessary to add or detract 7 g/l in order to bring the reading to the said value of 25 °C.

For example: a reading of 15 °C (59 °F) = 1.290 sp.g. the corresponding gravity at 25 °C (77 °F) will be  $1.290 - 7 = 1.283$  a reading of 35 °C (95 °F) = 1.275 the corresponding gravity at a temperature or 25 °C shall be  $1.275 + 7 = 1.282$  sp.g.

This corrective factor should always be within 1.270-1.280.

When measuring specific gravity the following precautions should be taken:

- take reading at eye level holding the tube vertically and ensuring that the float is free (see fig. 154);
- after measurement put back the acid in the cell from which it was taken;
- if any drops of acid have dripped, dry them with a woollen cloth.

The following table indicates specific ratings in respect to climate.

CLIMATE	SPECIFIC GRAVITY AT FILLING	SPECIFIC GRAVITY AT END OF CHARGE	MAX. TEMPERATURE PERMISSIBLE DURING CHARGE
TEMPERATE (normally below 32 °C [89 °F])	1260	1270-1280	50 °C
TROPICS (normally over 32 °C [89 °F])	1230	1220-1230	60 °C

## PUTTING THE DRY CHARGED BATTERIES IN SERVICE

Batteries are supplied with dry charge plates. In an emergency, these batteries can be used without previous charge after being topped up.

Keep the battery in a dry place.

**1** Fill the battery with chemically pure sulphuric acid — specific gravity 1.280 (32°Bé) measured at 20°C (68°F), in tropic 1.230 (27 Bé) at 28°C (82°F). Correct level is 5 mm (3/16") over the plate separators.

**2** After replenishment, check temperature and specific gravity of acid. Temperature should not be less than 20°C (68°F) and specific gravity not less than 1.270 (1,220 in tropics). With these readings, **the battery is ready for use.**

However, with external temperature under 5°C (23°F) and if after filling up the temperature is less than 20°C (68°F) it is necessary to proceed with a re-activation charge for 30 minutes at a current intensity 3 times higher than indicated at point 6.

**3** A week after this operation, check the acid level in each cell and if necessary add sulphuric acid.

**4 Caution:** if the specific gravity and temperature levels indicated at point 2 are not reached, a regular charge is required.

**5 Caution:** if the battery is not used within a week from filling, so that the generator can charge it sufficiently, it will be necessary to recharge it.

**6** Normal charging is done at a current intensity corresponding to 1/20 of the battery capacity i.e. 66 Ah : 20 = 3.3 A or 200 Ah : 20 = 10 A.

In any case, charging should proceed until the tension stays constant for 2-3 hours with 2.6-2.7 V per cell.

After this, check acid level and if necessary add sulphuric acid. For proper mixing of the liquid, continue the charge for a further 15 minutes.

During the charge, temperature should not exceed 40°C (105°F). In tropics 50°C (125°F). If the temperature is higher, stop the charge and allow the battery to cool down.

**7** For successive charges it is possible to use a current of double intensity than stated at 5. Up to the gasification point (2.4 V each cell), higher current intensities are allowed.

**8** The battery is charged when the tension of 2.6-2.7 V each cell and the specific gravity of 1280 (1230 in tropics) remains constant.

**9** Ensure that the acid level is always at specified level while the battery is in use, adding distilled water as necessary (Remember that only water evaporates). Check electrolyte level every month or, in the very hot seasons, every week.

**10** If after charging the battery is not used, it is necessary to recharge it every 3 months.

## ALTERNATOR (see fig. 155)

### MAIN FEATURES

Brand BOSCH                      G1 (R) 14 V  
    13 A 19  
    n. 0120340001

Drive	directly by crankshaft
Output W/V	180/14
Current intensity Ah	13
Charge starting r.p.m.	980
Peak revs r.p.m.	10.000
Max. permissible eccentricity	0.06 mm
Minimum commutator dia.	28.6 mm
Field winding resistance	6.30 ohm + 10%
3-phase winding resistance of stator (A.C.)	0.5 ohm + 10%

## TESTING THE ALTERNATOR ON THE BENCH

Output data (with regulator):

Load	Top speed
5 A	1350 r.p.m.
10 A	2300 r.p.m.
13 A	6000 r.p.m.

## REGULATOR (see A in fig. 156)

Brand BOSCH	AD 1/14 V n. 0190601009
Test speed	4500 r.p.m.
Test load	13 Amp.
Adjusting voltage	13.9 ÷ 14.8 V
Set load at nominal voltage	330 ÷ 360 W

## RECTIFIER

Brand BOSCH                      14 V/15A

## STARTER MOTOR

(See fig. 157)

Brand BOSCH	Bendix (DG(L) 12 V 0.4 PS) n. 0.001.160.010
Voltage	12 V
Current intensity Ah	24
Output	0.4 HP
Poles	4
Exciter winding	in series
Minimum commutator ring dia.	31.2 mm
Minimum brush length	11.5 mm
Brush pressure	750-1600 grams
Lengthwise commutator tolerance	0.05-0.2 mm
Pinion	8 teeth - mod. 2.5
Pinion rotation	anticlockwise

### **TEST BENCH OF STARTER MOTOR**

(See diagramm fig. 158)

The main electrical line from the bench is to be connected to the motor plug. Ensure the clamp does not get in touch with the motor casing.

### **LUBRICATION OF SPINDLE AND BUSHING**

(See lubrication chart fig. 159)

Special BOSCH 1 V 13 oil and use special BOSCH 1 v 13 oil and silicon grease BOSCH FT 2 v 3.



# IGNITION SYSTEM

This system includes:

- double contact breaker (**Marelli S 311 A**);
- ignition coils (**Marelli BM 200 C**);
- spark plugs (normal touring: **Marelli CW 240 L**; continued use at high speed: **Marelli CW 275 L - Lodge 4MLNY - Champion N 3**);
- high and low tension leads.

## DOUBLE CONTACT BREAKER

(See fig. 160)

**Marelli S 311 A** incorporating contact points, 2 condensers, and the automatic advance unit. It is driven by the camshaft through a gear machined on same.

## TEST DATA

### SPECIFICATIONS

MARELLI PART N.	ROTATION SENSE	NOMINAL VOLTAGE	AUTOMATIC ADVANCE	CYLINDER N.	CONDENSOR CAPACITY F
S 311 A	Counterclockwise	12 V	$13^{\circ} \pm 1$	2	0,25

### VOLTAGE TEST

Check dielectric strength with a 3 seconds test using 500 V-50 Hz a.c.

### MECHANICAL CHECK

MARELLI PART N.	CONTACTS OPENING mm	PRESSURE ON CONTACTS gr	BREAKER ARM OPENING ANGLE	BREAKER ARM CLOSING ANGLE
S 311 A	0.37-0.43	500-600	$180^{\circ} \pm \begin{matrix} 0^{\circ} \\ 5^{\circ} \end{matrix}$	$180^{\circ} \pm \begin{matrix} 0^{\circ} \\ 5^{\circ} \end{matrix}$
Breaker arm angle: $225^{\circ} \pm 1$ .				

### AUTOMATIC ADVANCE DEVICE

Consists of two suitably shaped centrifugal weights suitably shaped and pivoted on the spindles of the plates which are solid with the driving shaft.

At a predetermined number of revs, the weights begin to move and by means of a suitable slot in the same they entrain the pins secured to the cam plate, thus causing an angular displacement of the cam in respect to the distributor shaft. Return of weights is obtained by return springs hooked to the pins and their rest position is also determined by the pin when it contacts the end of the slot.

Every engine speed requires the equivalent ignition moment according to a curve which is determined in relation to the engine speed. Automation of the automatic advance is then represented by a diagram (see fig. 161). This unit is part of the double contact breaker unit.

### CONDENSER (see A in fig. 160)

#### Marelli type CE 36 N.

The condensers are inserted in parallel with the contact points of both breakers and their function is to expedite the current break and at the same time to dampen the strong sparking originating at the points as a result of the break in the primary windings.

The condensers consist of 2 tin foil strips insulated by the interposition of paper strips. The whole is then rolled up and dipped in a special insulating oil sealed in a casing.

One of the tin foil is internally connected to the metallic case while the other is connected to an insulated terminal.

Condenser is part of double contact breaker.

## COILS (See fig. 162)

The **Marelli** type **BM 200 C** coils consist mainly of 2 windings, the primary of which is formed by a few hundredths turns of fairly thick wire and the second by a few thousandths turns of thinner gauge wire.

## TESTING DATA

### SPECIFICATIONS

Feed current	12 V
Dia. of coil body	46 mm
Employment	on motorvehicles
N. of cylinders	1 or 2

## WINDINGS RESISTANCE AT 20°C

Primary	3,35 $\Omega$ $\pm$ 6%
Secondary	6,200 $\Omega$ $\pm$ 10%

## COIL TESTS

Connect up the coil as shown in diagram, inserting in the circuit a 3 point normalized spark gap instrument as used for 4 cylinder engines (i.e. S 86 A) having a  $60^\circ \pm 3^\circ$  contact closing angle. Turning the distributor at the specified speed and feeding the coils at the current specified in the following table, one should obtain the following spark plug values.

MAIN LINE VOLTAGE VOLTS	DISTRIBUTOR SPEED r.p.m.	CRITICAL LENGTH OF SPARK PLUG	
		COLD mm	HOT mm
8	75	8	6
12	450	10	9
12	1500	7	6

The hot engine measurement should be made after at least 2 hours of operation at nominal current with distributor at 900 r.p.m.

Each test last 10 seconds during which the spark should be regular. Critical length of spark can be defined as the spark should be regular.

Critical length of spark can be defined as the spark gap distance at which one starts to note no sparking.

## PERFORATION TEST

At the temperature of  $20^\circ\text{C} \pm 5^\circ$ , ensure that coil stands up to a tension of 1000 V eff. (50 Hz) applied for 3 seconds between a primary clamp and casing without electrical discharges.

## MAINTENANCE, INSPECTION, AND ADJUSTMENT OF DOUBLE CONTACT BREAKER MAINTENANCE

Every 3000 kms (1800 miles) lubricate the cam felt.

## INSPECTION

Remove the contact breaker cover by undoing its securing screws.

If contacts «A» and «B» are fouled or greasy, clean them with a petrol soaked cloth. If damaged in any way, replace them.

Check points breaker gap «A» (R/H cylinder, red

cable) and breaker «B» (L/H cylinder, green cable) which should be 0.37-0.43 mm (.014-.017").

If this distance is not correct, adjust the gap as follows.

## ADJUSTMENT OF CONTACT POINTS

(See fig. 164)

### Contacts points «A» - R/H cylinder (rider on soadle)

- Bring cam «I» to maximum lift, slacken screws C and D and acting on notch F move plate E to the position which will give the correct distance, relocking then screws C and D.

### Contact points «B» - L/H cylinder (rider on saddle)

- Bring cam «I» to maximum lift, loosen screws G and H and acting on notch M move plate L to the position which will give the correct distance, re-tightening then screws G and H.

## CHECKING AND ADJUSTING IGNITION TIMING (FIXED ADVANCE) (see fig. 164-165)

Remove the rubber plate which seals the inspection hole on the R/H side of the gearbox, in proximity of the flywheel.

To find the exact moment when the points of breakers A and B (fig. 164) start separating, it is best to use a suitable timing device mounted in between the clamp terminal of the breaker which is being tested and the ground.

### TIMING OF THE R/H CYLINDER

(See fig. 165)

- Rotate the flywheel anticlockwise until the piston is at the end of the compression stroke (both valves closed).  
In this position, mark «D» on the flywheel (TDC of R/H cylinder) should coincide with mark 1 on the rim of the inspection hole;
- rotate now the flywheel clockwise to a point about 15 mm (.59") in a forward position to the flywheel mark (2 in fig. 165) and then rotate back the flywheel very slowly to bring mark 2 in coincidence with mark 1 on the inspection hole rim.  
Purpose of this operation is to recover any backlash of the gears. In this position, fixed advance mark 2 is 13° from TDC («D») and so at the commencement of the points separation (A in fig. 164).

### TIMING OF THE L/H CYLINDER

(See fig. 165)

- Rotate the flywheel anticlockwise until the piston is at the end of the compression stroke (with both valves closed). In this position mark «S» on the flywheel (TDC of the L/H cylinder) should coincide with mark 1 on the gearbox inspection hole;
- rotate now the flywheel clockwise to a point about 15 mm (.59") in a forward position to flywheel fixed advance mark 3 (see fig. 165) and slowly rotate the flywheel backwards on the position where fixed advance mark 3 is in coincidence with mark on the inspection hole rim.  
Purpose of this operation is to recover any gear backlash. In this position, fixed advance mark 3 is 13° from TDC «S» and so at the point where the contact points stars separating («B» in fig. 164).

• **NB.** - If the points A and B in fig. 164 do not start opening in the above positions, the ignition timing needs adjustment.

### ADJUSTMENT OF IGNITION TIMING

#### R/H cylinder (contact breaker «A» - red cable)

- Set points of contact breaker «A» at correct distance (see chapter «Inspection of double contact breaker»);
- loosen contact breaker securing screws to crankcase by means of wrench 14927000 (13 in fig. 9) and move the breaker to the right or left to find the position where the points start opening when mark 2 in fig. 165 (fixed advance mark) on the flywheel coincides with mark 1 on the rim of the inspection hole, proceeding as described in «Checking and adjustment of ignition timing»;
- finally re-tighten the contact breaker by means of wrench 14927000 (13 in fig. 9) and fix securing screws.

#### L/H cylinder (contact breaker «B» - green cable)

- Set contact points of breaker «B» at a correct distance (see chapter «Inspection and of double contact breaker»);
- proceeding as described in «Checking and adjusting ignition timing of the L/H cylinder» (Contact breaker «B» fig. 164), set flywheel mark 3 in fig. 165 in coincidence with mark 1;
- loosen screws «O» and «P» (fig. 164) which secure the contact breaker plate «B» and by acting on notch «Q» move the plate to the position where the points of breaker «B» start opening;
- finally tighten screws «O» and «P».

# CHECKING THE IGNITION TIMING (FIXED ADVANCE) WITH THE ENGINE ASSEMBLED ON THE MOTORCYCLE

## CHECKING THE IGNITION TIMING (R/H cylinder) (See fig. 165)

Proceed as follows:

- remove alternator cover after loosening securing screws to distribution cover;
- fit tool with arrow «A» n. 14927500 (26 in fig. 64) on the threaded hole of distribution cover;
- undo the screw securing alternator to crankshaft;
- remove the rubber plug on the gear box inspection hole (on R/H of gear box);
- turn alternator clockwise until the mark «D» on flywheel (TDC of right cylinder) coincides with the marks «1» on inspection hole rim (for mark «D» and marks «1» see fig. 165);
- fit tool n. 14927400 (25 in fig. 64) on the alternator; then bring mark «P.M.S. (TDC)» of this disc in line with the arrow of tool «A» and tightly lock the screw on crankshaft paying attention not to shift P.M.S. mark (TDC) coinciding with arrow «A»;
- turn alternator, with checking disc on it, anticlockwise until the mark «A.F.» on the disc comes in line with arrow «A» at this point the contact breaker for R/H cylinder («A» in fig. 164) must start opening.

To check if contact breaker open correctly at the fixed point, it is recommended to use a proper light indicator set to be inserted between the clamp of contact breaker for R/H cylinder and the ground.

## Checking the ignition timing (L/H cylinder)

Proceed as by the checking of R/H cylinder by carrying out following changes:

- turn flywheel clockwise until the mark «S» comes in line with marks «1» on hole inspection rim;
- undo the screw securing tool n. 14927400 (25 in fig. 64) and get the mark «P.M.S.» (TDC) in line with arrow «A» the lock the screw;
- insert light indicator set between the clamp of contact breaker for L/H cylinder and the ground.

## CHECKING THE IGNITION ADVANCE (fixed and automatic) BY MEANS OF A STROBOSCOPE LAMP

(See fig. 54 and diagram fig. 166)

### Ignition data:

- fixed advance 13°
- automatic advance 26°
- full advance (fixed and automatic) 39° ± 3°

## CHECKING THE FULL ADVANCE (fixed and automatic)

Following marks are indicated on check disc n. 14927400 (25 in fig. 64)

- P.M.S. (top dead centre)
- A.F. (fixed advance)
- A.T. (full advance, fixed and automatic).

This disc has to be mounted on the alternator (as previously described) while the tool n. 14927500 (26 in fig. 64) with arrow «A» has to be mounted on the distribution cover (as previously described).

After fitting the check disc and arrow tool, turn the flywheel so that its mark «D» comes in line with marks «1» on inspection hole rim (see fig. 165) and mark «P.M.S.» (TDC) on the check disc comes in line with arrow «A» (see fig. 64) (for this operation see «Ignition timing for R/H cylinder».

To check ignition advance (fixed and automatic) by means of a stroboscope lamp proceed as follows:

- connect stroboscope lamp cable to R/H cylinder spark plug (sitting on saddle);
- connect the two clamped cables of stroboscope lamp to a battery; positive clamp (+) to positive pole and the other clamp to battery negative pole (-);
- start the engine and direct the stroboscope lamp beam on arrow «A»; check ignition advance — fixed and automatic — of R/H cylinder;
- checking of ignition advance of L/H cylinder is carried out as above, taking note that stroboscope lamp cable is to be connected to L/H cylinder spark plug. Turn alternator so that mark «S» on flywheel comes in line with marks «1» on the inspection hole rim; then undo the screw securing the check disc on alternator and bring mark P.M.S. (TDC) on the disc in line with arrow «A». Now start the engine;
- check that arrow «A» is in line with mark «A.F.» (fixed advance) and mark «A.T.» (full advance - fixed and automatic) for both R/H and L/H cylinders at following engine revs.:
  - mark «A.F.» (fixed advance) at 1500 r.p.m. ± 100
  - mark «A.T.» (full advance) (fixed and automatic) at 4500 r.p.m. ± 100

If checking detects that arrow «A» is in line with marks «A.F.» and «A.T.» on the check disc at above engine revs. this means that ignition advance (fixed and automatic) on both R/H and L/H cylinders is correct.

## CONNECTION OF THE CONTACT BREAKER CABLES TO IGNITION COILS (see fig. 167)

Do not forget that red cable «C» of the R/H cylinder breaker has to be connected to coil A and that green cable D for the L/H cylinder breaker has to be connected to coil B.

## SPARK PLUGS (see fig. 168)

This model fits spark plugs n. 240 (points gap 0.6 mm = .023") and in the tool kits are included 2 fur-

ther plugs n. 275 (points gap 0.5 mm = .019").  
The 240 thermal degree plug is recommended for normal touring rides. The 275 thermal degree plug is recommended for continued use of the machine at high speed.

The spark plugs are best cleaned with petrol and a wire brush, using a needle for the inner part.

In re-fitting the plugs ensure they are properly started for a few turns. If not properly started, the cylinder head thread may get stripped.

If overtightened the thread may get strained.

In any case, the plugs should be replaced every 10.000 kms. (6000 miles) even if they still appear in good conditions.

## ELECTRIC HORNS (See fig. 169)

The horn circuit includes:

- high pitched tone horn;
- low pitched tone horn;
- control button on the L/H side of the handlebar;
- ground on frame.

### SPECIFICATIONS

Combined horn, **Belli** make:

- High pitch horn (90/12/2): absorption 3 A;
- Low pitch horn (90/12/4): absorption 4 A;
- Total combined absorption: 7 A.

### OVERHAUL AND REPAIR INSTRUCTION

If any horn loses its tone or fails altogether, check if this is not due to some fault in the electric system. If the horn does not work, ensure the pushbutton is not faulty or any wire is disconnected in the terminal block.

If horn gives an irregular sound, check if securing bolt is well tight.

If the horn sounds uninterruptedly, inspect the grounded contact between button and horns.

Should this inspection fail to determine the trouble, the fault lies obviously in the horns themselves and they should be replaced or repaired by a specialized shop.



# LIGHTING EQUIPMENT

## HEADLIGHT - EUROPEAN VERSION (See fig. 170)

This model fits a 40/45 W two-filament bulb for high and low beam and a 4 W bulb for parking or town driving light.

Access to the lamp is obtained by undoing screw 1 and pulling the rim from below in order to slip it out of the top retaining lug (2).

To replace the bulb it is necessary to disconnect the faston cables, remove retaining springs 3 and withdraw it from the inside.

## HEAD LIGHT (USA VERSION):

sealed beam insert 40/45 W.

## INSTRUMENTS PANEL

(See fig. 171)

This incorporates:

- speedometer (1);
- Rev-counter (2);
- red indicator light for insufficient battery charge (3);
- orange neutral indicator (4);
- red indicator light for insufficient oil pressure (5);
- green indicator light showing lights on (European version);
- red parking light indicator (USA version).

## IGNITION SWITCH

(See fig. 172)

The ignition key has 5 positions:

- «0» (vertical) machine at standstill, key not removable;
- «1» (key turned anticlockwise). Machine at standstill, key removable. The steering is locked on removal of key;
- «1» intermediate position (key turned clockwise between position «0» and position «2»). Key removable. The key can be removed without locking the steering;
- «2» running position or ammachine ready to set out (key turned clockwise). For daylight driving no other operation is necessary. For night driving, the lighting switch must be actuated (see fig. 175);
- «3» is only for engine starting (key turned clockwise from position «2»). As soon as the engine starts, on releasing, the key return automatically in position 2.

## DISMANTLING THE IGNITION SWITCH

(See fig. 173)

- disconnect electric cables;
- move ignition key towards pawl A and withdraw key;

— undo screws B;

- press pawl A by the aid of a pointed tool and withdraw the complete switch C from its housing D.

## STARTER BUTTON

(See fig. 174)

It is located on the R/H handlebar. With key in position (2 see fig. 172) the machine is ready to set out. To start the engine pull clutch lever fully and press button A.

## LIGHT AND HORN SWITCH

(See fig. 175)

It is located on left handlebar:

### «A» Light switch

- position «1» = parking light (town driving light);
- position «2» = low beam.

### «B» Dimmer switch

- position «3» = low beam;
- position «4» = high beam (or vice versa).

### «C» Horn button

## TERMINAL PLATE WITH FUSES

(See B in fig. 176)

It is located in the central part of the motorcycle. To get access to this, raise the saddle by acting the proper lever on the left side of motorcycle.

- n. 8 of 15 A;
- n. 1 of 25 A.

## COURTESY LIGHT

(See A in fig. 176)

Raising the saddle lights the lamp. Bulb fitted: 3 W.

## TAIL AND STOP LIGHT

This unit is secured to the rear fender and fits a two-filament bulb for plate illumination (5 W) and stop light (20 W).

Front brake (shoe): incorporated in the right brake control cable.

Front brake (disc): incorporated in the L/H side of twin control at bottom yoke.

Rear brake (cable): incorporated in the control cable.  
Rear brake (link): incorporated on frame, spring joined to control lever.

#### **BULBS (12 V)**

- Headlight:
  - 40/45 two-filament bulb for low and high beam.
  - 5 W bulb for parking light, (European version).
- Tail lamp:
  - 5/21 W two-filament bulb for parking light and stop.
- Instrument panel:
  - 1.2 W red bulb for insufficient oil pressure.
  - 1.2 W orange bulb for neutral indicator.
  - 1.2 W red bulb for insufficient generator charge.
  - 1.2 W green light indicating lights on.
- Rev-counter and speedometer illumination:
  - 3 W bulb.
- Courtesy light:
  - 3 W bulb.

- Turn light indicators:
  - 21 W bulbs.

#### **TURN INDICATOR LIGHTS (REAR AND FRONT)**

Electric wiring is fit for mounting of these assemblies (even if the production machines do not fit them). The front lights are to be mounted on headlight and its supporting lugs.

- The rear lights are to be mounted, by means of screws, on the rear side of machine lift grips. Connect then lights to electric wiring.

#### **CABLES**

Check these over periodically to ensure they are in good condition. Replace as necessary.

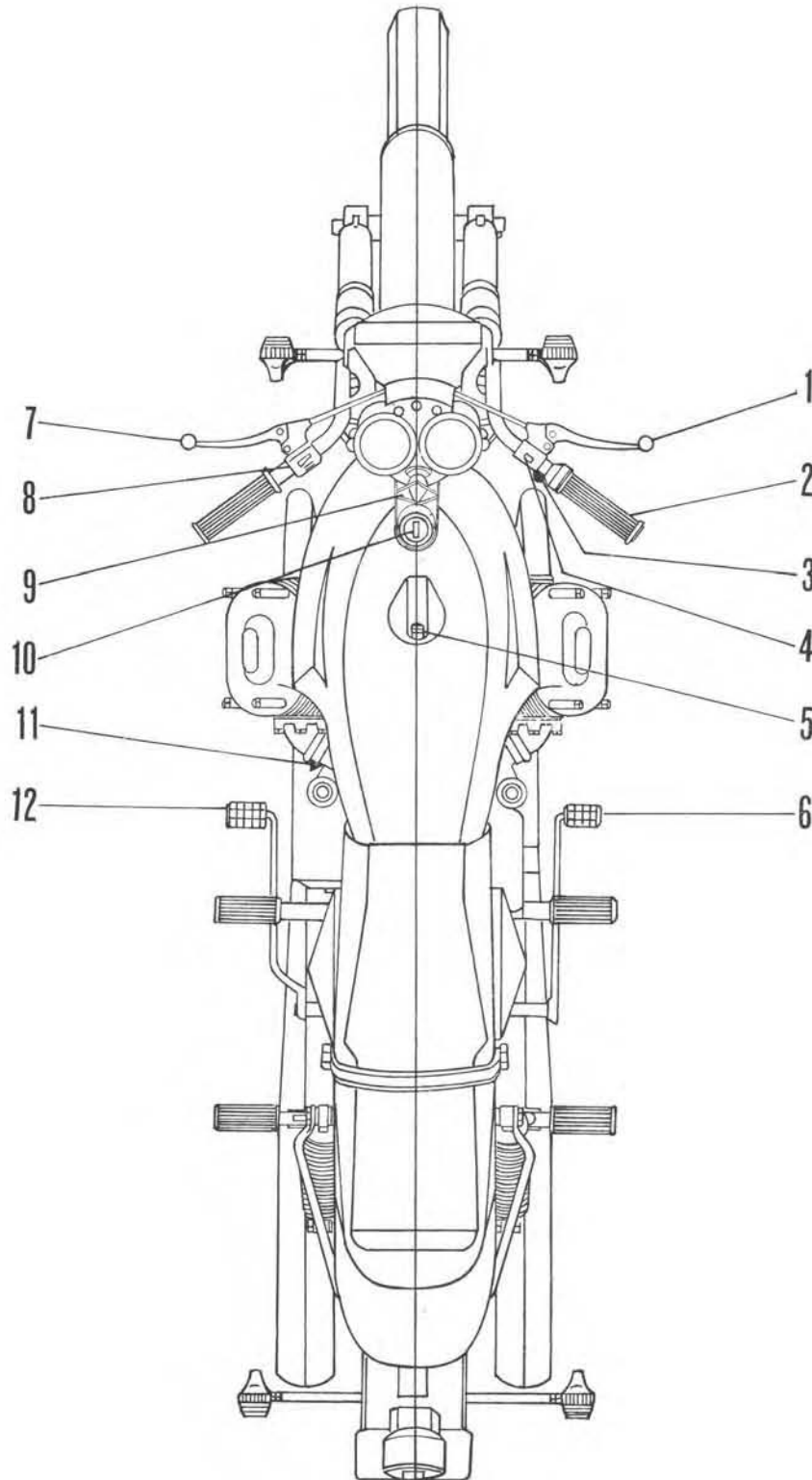
- **NB.** - If any extra accessories are added, ensure that these are connected to terminals which can stand the extra load without going beyond the capacity of the terminal itself or the H.T. loads, thus avoiding possible damage to the electric system.



## CONTROLS AND ACCESSORIES (Front Shoe Brakes)

(See fig. 177)

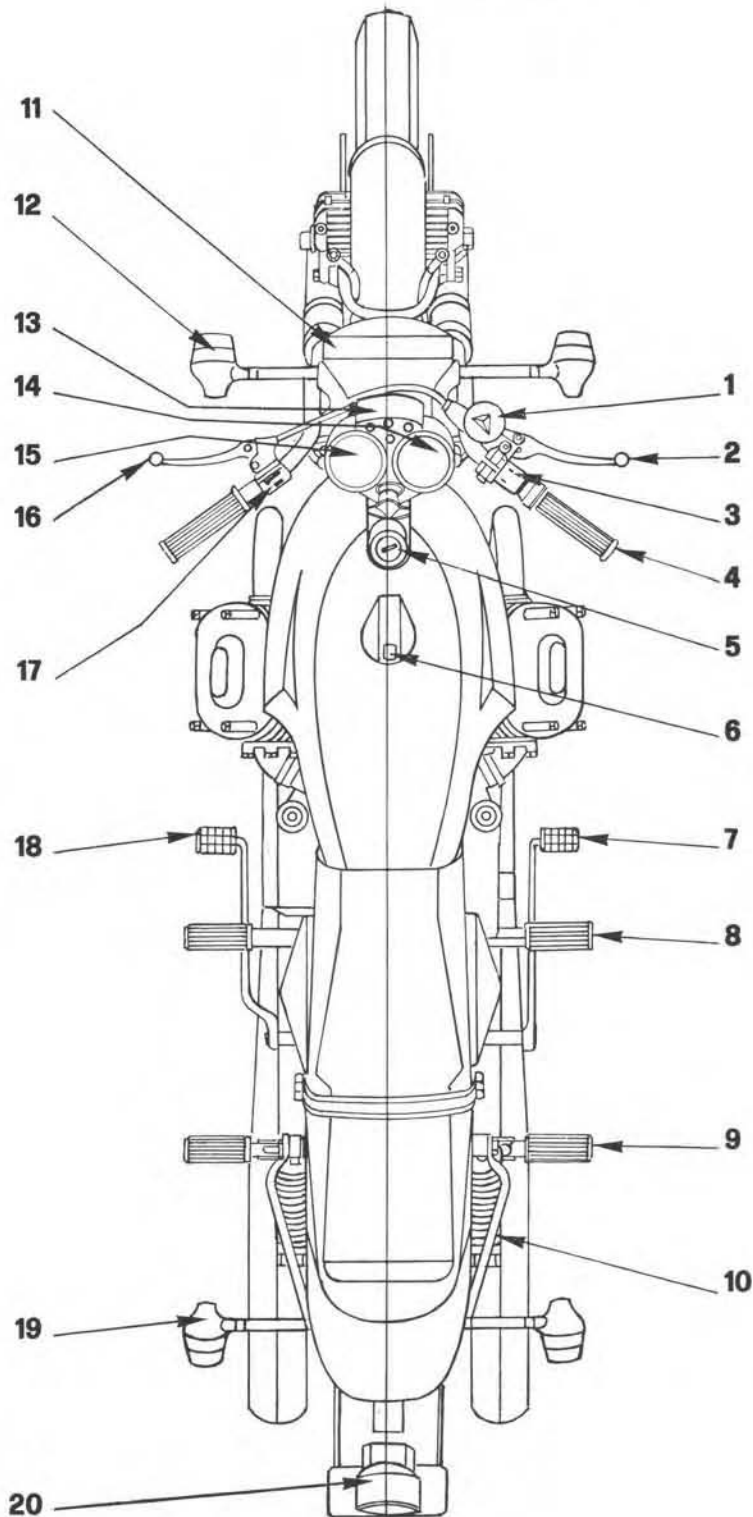
- |   |                                      |    |                                    |
|---|--------------------------------------|----|------------------------------------|
| 1 | Front brake control lever.           | 7  | Clutch control lever.              |
| 2 | Throttle control grip.               | 8  | Light switch and horn button.      |
| 3 | Engine starter button.               | 9  | Steering damper control knob.      |
| 4 | Turn light switch.                   | 10 | Control key.                       |
| 5 | Fuel tank filler cap opening button. | 11 | Carburettor starter control lever. |
| 6 | Gear change control lever.           | 12 | Rear brake control lever.          |



## CONTROLS AND ACCESSORIES (Front Disc Brakes)

(See fig. 178)

- |    |  |    |                               |
|----|--|----|-------------------------------|
| 1  | Master cylinder (brake fluid reservoir). | 11 | Headlight.                    |
| 2  | Front brake control lever.               | 12 | Front turn lights.            |
| 3  | Turn light switch.                       | 13 | Indicator lights panel.       |
| 4  | Throttle control grip.                   | 14 | Speedometer.                  |
| 5  | Starting switch and steering locking.    | 15 | Rev. counter.                 |
| 6  | Fule tank filler cap.                    | 16 | Clutch control lever.         |
| 7  | Rear brake control lever.                | 17 | Light switch and horn button. |
| 8  | Front foot-rest.                         | 18 | Gear change pedal.            |
| 9  | Rear foot-rest.                          | 19 | Rear turn lights.             |
| 10 | Rear dampers.                            | 20 | Tail light.                   |



178

# LUBRICATION AND MAINTENANCE CHART

(See fig. 179)

## MONTHLY (EVERY 3000 KM)

- 1 Check electrolyte level in battery.

## PERIODICALLY

- 2 Check tyre pressure.

## AFTER FIRST 500 KM

- 3 Replace crankcase oil.
- 4 Tighten all nuts and bolts.
- 5 Check tightening of wheel spokes and wheel truing.
- 6 Check clearance between rocker and valve.

## EVERY 500 KM

- 7 Check oil level in crankcase.

## EVERY 1500 KM

- 8 Check tightening of wheel spokes and wheel truing.

## EVERY 3000 KM

- 9 Replace oil in crankcase.
- 10 Check clearance between rocker and valve.

- 11 Check oil level in gear box.
- 12 Check oil level in rear drive box.

## EVERY 5000 KM

- 13 Check fluid level in fluid reservoir (front disc brakes).

## EVERY 10000 KM

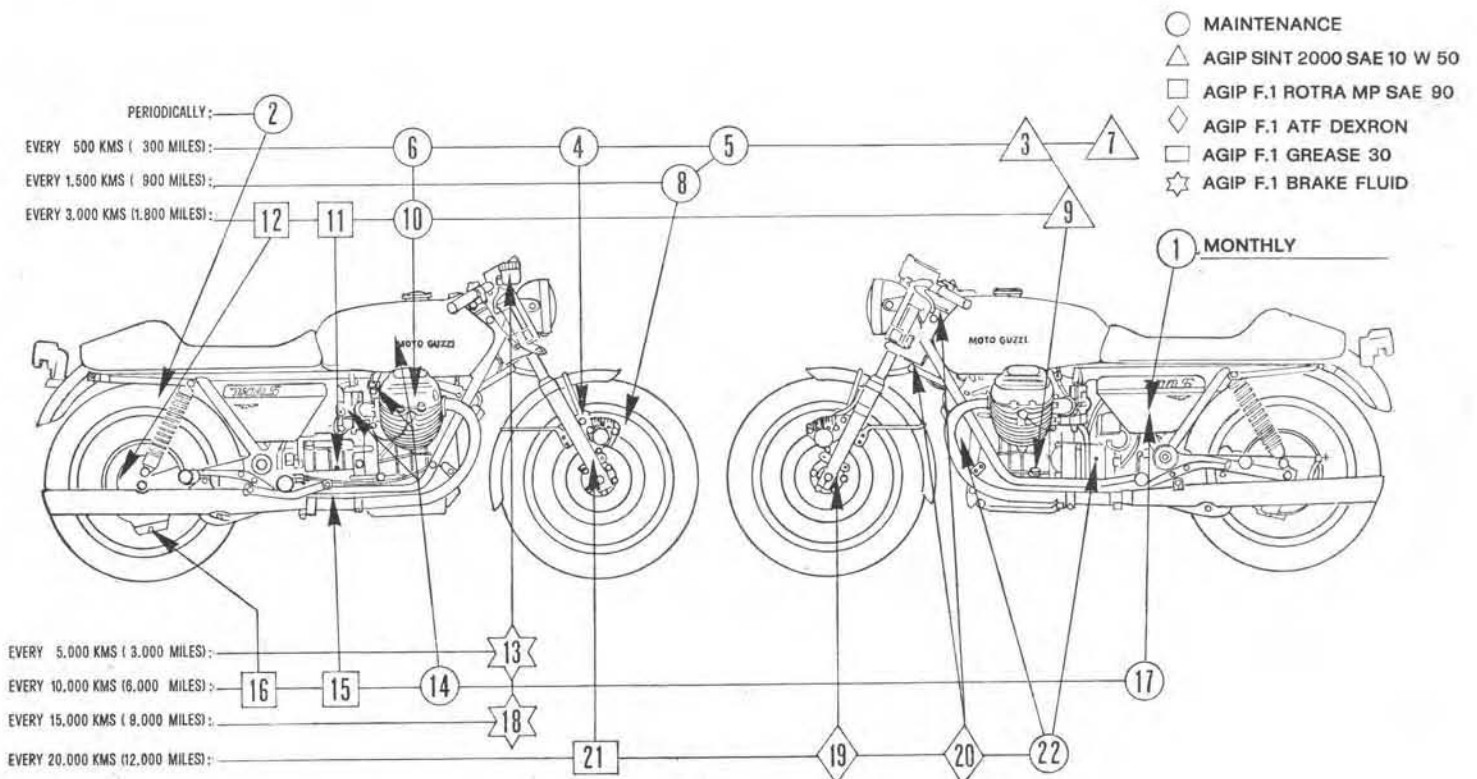
- 14 Clean fuel tank, fuel tap filters and fuel line.
- 15 Replace oil in gear box.
- 16 Replace oil in rear drive box.
- 17 Clean and grease battery connections.

## EVERY 15000 KM

- 18 Replace the fluid of front braking circuit.

## AFTER FIRST 20000 KM

- 19 Check conditions of wheel bearings, pack with grease «Agip F. 1 Grease 30».
- 20 Check conditions of steering bearings, pack with grease «Agip Grease 30».
- 21 Replace oil in fork members (Agip F. 1 ATF Dexron I. 0.050 each member).
- 22 Clean starter motor commutator and alternator slip ring using a petrol moistened rag.



# WIRING - DIAGRAM

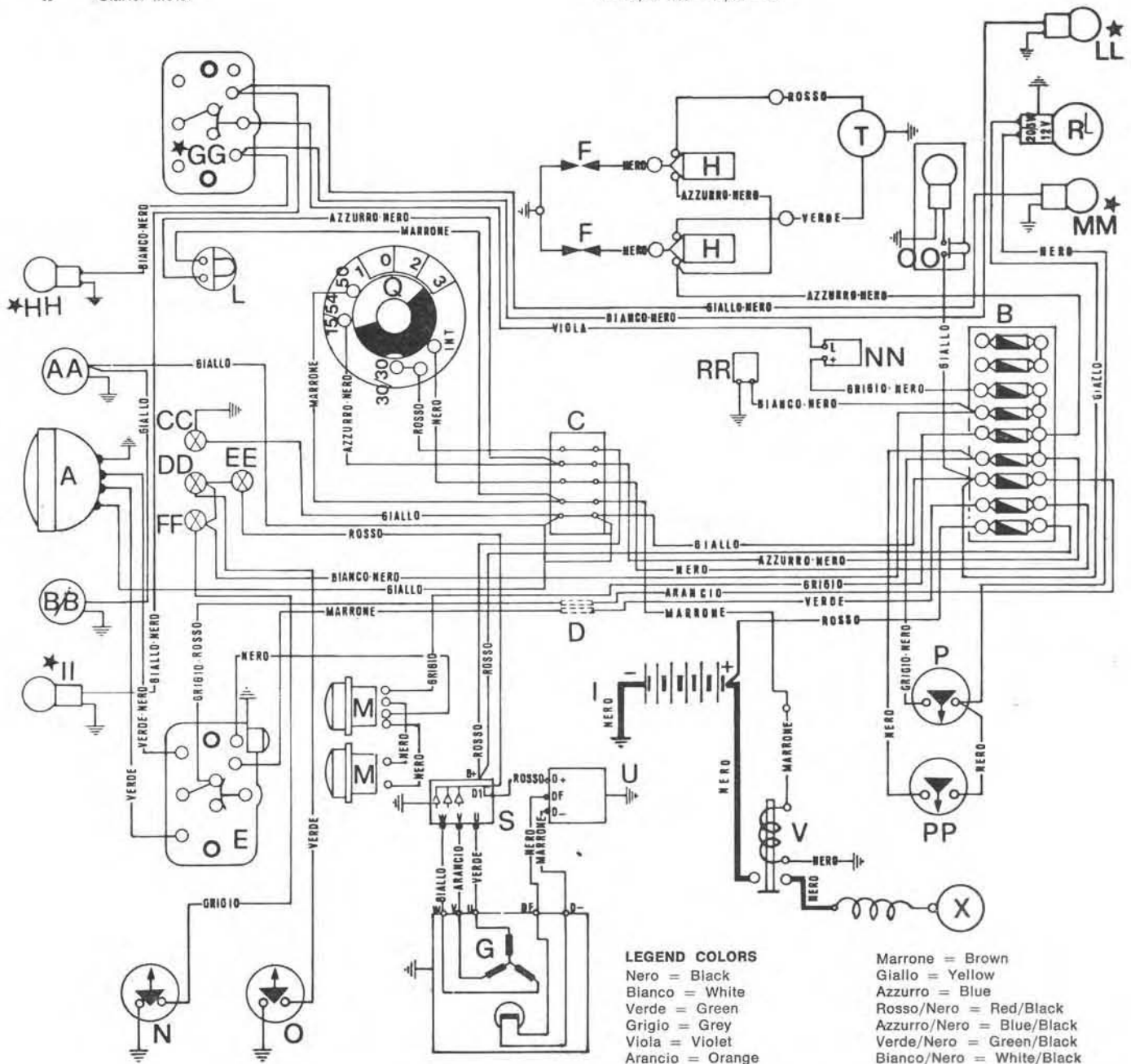
(See fig. 180)

- A Headlight: (bulb 40/45W - 12V - bulb 5W - 12V) European version
- Sealed beam insert (40/45W - 12V) USA version
- B Terminal block with fuses
- C Distributing block
- D Faston connectors
- E Switch, lighting and horn control
- F Spark plug
- G Generator
- H H.T. Coils
- I Accumulator
- L Engine starting bottom
- M Horn
- N Oil pressure indicator cutout
- O Neutral position indicator cutout
- P Rear stop light cutout
- Q Ignition switch
- R Number plate and stop light
- S Rectifier
- T Double contact breaker
- U Voltage regulator
- V Solenoid
- X Starter motor

- AA Speedometer (bulb 12V - 3W)
- BB Rev. counter (bulb 12V - 3W)
- CC Green warning light (12V - 1,2W) lights on (European version) Or red warning light (12V - 1,2W) parking (USA version)
- DD Orange warning light (12V - 1,2W) neutral indicator
- EE Red warning light (12V - 1,2W) oil pressure
- FF Red warning light (12V - 1,2W) battery charge
- GG Turn indicator lights cutout
- HH Front turn light, right (orange)
- II Front turn light, left (orange)
- LL Rear turn light, right (orange)
- MM Rear turn light, left (orange)
- NN Flasher unit relay
- OO Courtesy light
- PP Front stop light cutout
- RR Electrovalve

## IGNITION SWITCH POSITION

- 0 -
- 1 - 30/30 INT
- 2 - 30/30 INT - 15/54
- 3 - 30/30 INT - 15/54 - 50



- LEGEND COLORS**
- Nero = Black
  - Bianco = White
  - Verde = Green
  - Grigio = Grey
  - Viola = Violet
  - Arancio = Orange
  - Rosa = Pink
  - Rosso = Red

- Marrone = Brown
- Giallo = Yellow
- Azzurro = Blue
- Rosso/Nero = Red/Black
- Azzurro/Nero = Blue/Black
- Verde/Nero = Green/Black
- Bianco/Nero = White/Black
- Giallo/Nero = Yellow/Black
- Grigio/Nero = Grey/Black

# ADDITIONS AND CHANGES FOR 850-T MODEL

## MAIN FEATURES

### ENGINE

Cycle:	4 stroke
Number of cylinders:	2
Cylinder disposition:	«V» type 90°
Bore:	83 mm
Stroke:	78 mm
Displacement:	844 cc
Compression ratio:	9.5
Max. output:	53 HP at 6300 r.p.m.
Max. revs output:	6000 r.p.m.

### Valve gear

— inlet:	valve opens 20° before TDC
	valve closes 52° after BDC
— exhaust:	valve opens 52° before BDC
	valve closes 20° after TDC

Rocker clearance for valve timing:	1.5 mm
Normal rocker clearance (cold engine):	0.22 mm

2 Dell'Orto Carburetors type VHB 30 CD (right) type VHB 30 CS (left).

### Lubrication

By pressure with gear pump.  
Oil pressure 3.8 ÷ 4.2 kg/cm<sup>2</sup> (pressure relief valve).  
Oil pressure solenoid.

### Generator-alternator

On the front crankshaft (14 V - 13 A).

### Ignition

By battery with double contact breaker.

— Initial advance:	8°
— Automatic advance:	26°
— full advance (fixed and automatic):	34°
— Contact breaker gap:	mm 0.42 ÷ 0.48
— Spark plugs:	∅ 14 x 1.25 (long thread) thermal degree 240
— Spark plug point gap:	0.6 mm
— Ignition coils:	n. 2

### Starting

Electric starter (12 V - 0.7 HP) with electromagnetic ratchet control and relay. Toothed crown joined to flywheel.  
Starter button on R/H handlebar.

### TRANSMISSIONS

#### Clutch

Dry discs, flywheel driven. Lever controlled from the handlebar (L/H side).

#### Speed change

5 speed, constant mesh gears. frontal engagement, cush drive incorporated foot controlled from L/H side of vehicle.

#### Secondary drive

Bevel set ration (gearbox-wheel): 1.465 (Z = 8/37).  
Overall l gear ratios:

1ow gear:	1:11.424
2nd gear:	1: 7.928
3rd gear:	1: 5.980
4th gear:	1: 4.963
high gear:	1: 4.284

### CYCLE PARTS

Frame: tubular structure, duplex cradle.  
Suspensions: telescopic front fork with hydraulic dampers. Rear swinging arm with externally adjustable springs.

Wheels: spoked rims, WM 3/2.15 x 18" front and rear.

Tyres: Front studdedtyre 3.50 H - 18  
Rear studdedtyre 4.10 H - 18

Tyre pressure:  
front, solo: 1.8 kg/cm<sup>2</sup>  
with pillion: 1.8 kg/cm<sup>2</sup>  
rear, solo: 2.2 kg/cm<sup>2</sup>  
with pillion: 2.5 kg/cm<sup>2</sup>

• **NB.** - The above tyre pressure are for normal cruising speed. If using the machine at constant high speed or on motorways, the above pressure should be increased of 0.2 kg/cm<sup>2</sup>.

Brakes: Front disc hydraulic brake, caliper with twin braking cylinder (disc ∅ mm 300). Lever controlled from the right handlebar. Rear shoe mechanical brake (∅ 220 x 25) pedal operated from the R/H side of the motorcycle.

### Overall dimensions and weights

Wheelbase:	m 1.470
Max. length:	m 2.200
Max. width:	m 0.780
Max. height:	m 1.060
Min. ground clearance:	m 0.150

Weight of motorcycle (in running order): kg 235 a.

## Performances

Max. speed solo:

Low gear: km/h 66  
 2nd gear: km/h 95  
 3rd gear: km/h 126  
 4th gear: km/h 152  
 top gear: km/h 184  
 Max. speed at max. r.p.m.: km/h 202  
 Fuel consumption: l 7.27 x 100 km (CUNA regulations).

## Electrical equipment

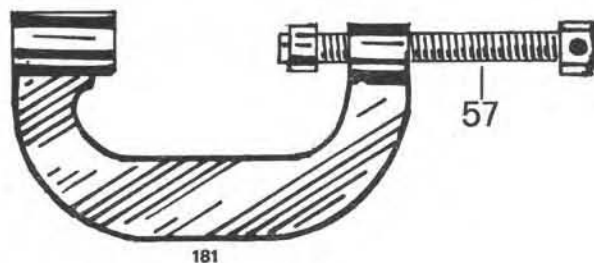
Battery: 12 V - 32 Ah  
 Headlight (bulb) (European Model):  
 high and low beam: 12 V - 45/40 W  
 town driving: 12 V - 5 W  
 Head light (USA version):  
 Sealed beam insert 40/45 W  
 Tail light (bulb): town driving or  
 parking and stop light: 12 V - 5/20 W  
 Turn lights (bulbs): 12 V - 21 W  
 Instrument panel (bulbs): n. 4 (12 V - 1.2 W)  
 Horns: 12 V

## FUEL AND OIL CAPACITIES

Part to be replenished	Quantity	Recommendation
Fuel tank	25 lts	} Petrol, super (98/100 NO-RM)
Reserve	4 lts	
Sump	3.5 lts	Oil «Agip SINT 2000 SAE 10 W/50»
Gear box	0.750 lts	Oil «Agip F.1 Rotra MP SAE 90»
Rear drive box	0.360 lts	Oil «Agip F.1 Rotra MP SAE 90» Oil «Molykote» type A
	of which:	
	0.340 lts	
	0.020 lts	
Front fork	0.050 lts	Oil «Agip F.1 ATF Dexron»
Disc brake circuit		Fluid «Agip F.1 Brake Fluid»

## SPECIFIC WORKSHOP TOOLS

FIG. N.	REF. NUMBER	DESCRIPTION
57	13907860	Puller, piston pin (fig. 181)



## CYLINDERS - PISTONS - PISTON RINGS

(See fig. 182 and 183)

### SELECTION OF CYLINDER DIA.

CLASS «A»	CLASS «B»	CLASS «C»
83.000	83.006	83.012
83.006	83.012	83.018

Cylinders must always be matched with pistons of same class.

### SELECTION OF PISTON DIA.

CLASS «A»	CLASS «B»	CLASS «C»
82.968	82.974	82.980
82.974	82.980	82.986

Pistons must always be matched with pistons of same class.

### PISTON RINGS

(See fig. 183)

- n. 2 upper compression rings  
 $\varnothing$  83 mm - thick. mm 1.478-1.490
- n. 1 intermediate oil scraper  
 $\varnothing$  83 mm - thick. mm 1.478-1.490
- n. 1 lower oil scraper  
 $\varnothing$  83 mm - thick. mm 3.978-3,990

play mm 0.006 to a negative clearance of mm 0.004.

### REMOVAL OF PIN FROM PISTON

After removal of circlips, use tool n.13907860 (57 in fig. 181) to slide pin out of piston and con-rod small end.

### PISTON PIN

(See fig. 183)

- Length:  
mm 59.970-59.984 -  $\varnothing$  mm 22.000  $\div$  22.004
- Piston pin coupling data:

### CRANKSHAFT

(See fig. 184)

The only change is in crankpin dia. (see following table):

### CRANKPIN DIAMETER

SELECTION A-B	ORIGINAL $\varnothing$ mm	OVERSIZE BEARING		
		0,254	0,508	0,762
«A» blue mark on shoulder flywheel side	44.008 $\div$ 44.014	43.754 $\div$ 43.766	43.500 $\div$ 43.512	43.246 $\div$ 43.258
«B» white mark on shoulder flywheel side	44.014 $\div$ 44.020			

Clearance between crankpin and bearing: min. 0.030 - max. 0.054.

**Remark:** Crankpin of nitride treated crankshafts must not undergo any oversize bearing. Such crankshafts have been mounted on vehicles indicated in a special list at your hands. For eventual adjustments send the shafts back to «SEIMM MOTO GUZZI».



## CRANKSHAFT BALANCING

Static balancing of crankshaft is obtained by applying a weight of kg  $1.586 \div 1.616$ .

Max. offset in axis parallelism: crankpin and main bearing pin must not overcome mm 0,02 at mm 40.

## TIMING DATA

(See chapter «Timing data»)

Timing data (referred to the clearance of 1,5 mm

between rocker and valve) are the following (see fig. 185):

— inlet:

opens 20° before TDC

closes 52° after BDC

— exhaust:

opens 52° before BDC

closes 20° after TDC

Normal rocker clearance (cold engine) mm 0.22.

## ENGINE LUBRICATION BY FILTER CARTRIDGE

A certain number of 850 T model bikes fits an oil cleaner which in addition to a wire gauze filter is also provided with a filter cartridge.

This ensure an almost integral filtering before the oil passes in the pump and lubricating channels.

### OIL SUMP

(See fig. 186)

It fits:

- «A» filter cartridge, removable;
- «B» magnetic oil drain plug;
- «D» wire gauze filter;
- «E» oil pressure relief valve.

### FILTER CARTRIDGE

(See fig. 186)

To remove filter cartridge «A» from sump proceed as follows:

- undo plug «B» and let the oil fully drain;
- undo securing screws and remove sump «C» including:
  - filter cartridge «A»;
  - wire gauze filter «D»;

— oil pressure relief valve «E»;

- undo filter cartridge «A» and replace it by another original one.

By this operation, wash and dry with a compressed air jet also wire gauze filter «D» before mounting sump «C» on the crankcase. Remember to replace gasket between crankcase and cover; fill up l. 3.5 of oil «Agip SINT 2000 SAE 10 W/50».

### WIRE GAUZE FILTER

(See fig. 186)

It is screwed on the oil sump and is calibrated to allow an oil pressure of kg/cm<sup>2</sup> 3.8-4.2 in delivery circuit.

Should pressure be higher than calibrated, this valve opens and bring pressure into fixed limits.

### CHECKING THE OIL LEVEL

Every 500 km check oil level in the oil sump (level almost at max. mark on the dipstick welded to filler cap «A» (see fig. 20).

If level is lower top up with oil of same features. This checking will be carried out after engine running for a few minutes and dipstick «A» must be fully screwed.

Use «oil Agip SINT 2000 SAE 10 W/50».

## REAR SUSPENSION

(See fig. 187)

Shock absorber springs can be adjusted in five different positions by means of lever «F». Take note that the marks «I», «II», «III», «IV», «V» on the sliding body must be in line with the «red» mark on the fixed body («A» and «B» in above fig.).

Should suspension efficiency be not normal, replace shock absorbers.

### REMOVAL OF SPRINGS FROMS SHOCK ABOSRBERS

(See fig. 187)

Before removal of springs, check that the red mark «A» on the fixed body is in line with the mark «I» of sliding body «B»; pull cap «D» to compress the springs to the point allowing removal of semicollars «C» release spring and slip off cap and spring.

### CHECKING DATA FOR THE REAR SUSPENSIONS

(«E» in fig. 187 and drwg.)

— free length of the spring is mm 300.

#### Position «I»

Assembly compression: mm 54 - load kg 63  
End stroke compression: mm 129 - load kg 163

#### Position «II»

Assembly compression: mm 59 - load kg 70  
End stroke compression: mm 134 - load kg 171

#### Position «III»

Assembly compression: mm 63 - load kg 74  
End stroke compression: mm 138 - load kg 178

#### Position «IV»

Assembly compression: mm 66,5 - load kg 79  
End stroke compression: mm 141,5 - load kg 184

#### Position «V»

Assembly compression: mm 69,5 - load kg 83  
End stroke compression: mm 144,5 - load kg 190

Max. allowed spring distortion: mm  $\pm 3$

Allowed spring load tolerance: 10%

## FRONT SUSPENSION

### FRONT FORK

Sealed damper type. See chapter «Front Suspension and steering - Inspection and checking of the front

fork».

For inspection measures see drwg. 188.

Replenishing quantity: l. 0.050 of Agip F. 1 ATF Dexron per fork member.

## WHEELS AND BRAKES

The standard 850-T model fits one only braking disc on the R/H side of the front wheel and one caliper secured to the R/H side fork cover.

To slip front wheel off from fork members, it is not necessary to remove caliper from fork cover.

For removal and re-fitting of the front wheel, see chapter «Removal of front wheel».

### REMOVAL OF PARTS TO BE REPLACED

Proceed as follows:

- remove wheel from fork members;
- flatten stop plates locking nuts and bolts securing braking disc to wheel hub;
- undo nuts and slip off bolts;
- drain the fluid from the braking circuit and undo hydrostop switch (front stop light).

### FITTING OF TWIN DISC AND BRAKING CIRCUIT ON L/H SIDE OF WHEEL HUB

To make orders for necessary parts easier, a twin disc kit has been arranged under part number 17923000.

Fitting operations are as follows:

- fit twin braking disc on the L/H side of wheel hub;
- fit stop plates on new bolts;
- fit bolts on left disc, left flange, hub, right flange and right disc;
- fit lock plates nuts and screw in by means of a wrench with torque of kg/m  $4 \div 4.3$ ; bend down stop plates on nuts and bolts and after checking everything is normal (see chapter «Braking Disc») fit the wheel between fork members and on caliper (R/H side) then lock securing bolts and nut.
- fit caliper on L/H side of fork and front fender by means of bolts, washers, shims and nut; check fitting is correcte (see chapter «Caliper»);
- fit a gasket between twin control and pipe, then fit L/H side pipe, another gasket and screw in hydrostop switch (front stop light);
- fit pipe with screw and two gaskets on L/H side caliper;
- fill up braking circuit with «Agip F. 1 Brake Fluid» then drain the air bubbles (see chapter «Draining the air from the braking circuit»).

# MAINTENANCE, INSPECTION AND ADJUSTMENT OF DOUBLE CONTACT BREAKER

Contacts gap for 850-T model must be within mm 0.42 ÷ 0.48.

For descriptions and adjustments see Chapter «Maintenance Inspection and Adjustment of Double Contact Breaker».

## CHECKING AND ADJUSTING IGNITION TIMING (FIXED ADVANCE)

See chapter «Checking and adjusting ignition timing» considering the following changes:

### TIMING OF THE R/H CYLINDER

In this position, fixed advance mark 2 is 8° from P.M.S. (TDC) «D» and so at the commencement of the point separation (see A in fig. 164).

### TIMING OF THE L/H CYLINDER

In this position fixed advance mark 3 is 8° from P.M.S. (TDC) «S» and so at the commencement of the point separation (see B in fig. 164).

## CHECKING THE IGNITION TIMING (FIXED ADVANCE) WITH THE ENGINE ASSEMBLED ON THE MOTORCYCLE (See fig. 165)

Only the mark «A.F.» (fixed advance) changes, namely 8° instead of 13°.

## CHECKING THE IGNITION ADVANCE (FIXED AND AUTOMATIC) BY MEANS OF A STROBOSCOPE LAMP (See fig. 64 and diagram fig. 188)

### Ignition data

- fixed advance: 8°
- automatic advance: 26°
- full advance (fixed and automatic): 34°

## CHECKING THE FULL ADVANCE (FIXED AND AUTOMATIC)

Changes:

- A.F. (fixed advance) 8° instead of 13°;
- A.T. (full advance) 34° instead of 39°.

## SPARK PLUGS

The 850-T model fits spark plugs n. 240 (points gap 0.6 mm).

For other description see chapter «Spark Plugs».

## ELECTRICAL EQUIPMENT

### Starter motor

- Brand: BOSCH DF - 12 V - O5 PS  
n. 0001157016
- Voltage: 12 V
- Output: 0.5 HP
- Current Intensity Ah.: 36
- Pinion: Z = 8 - mod. 2.5
- Pinion rotation: counterclockwise

## ELECTRICAL TESTS

RUNNING	VOLTAGE	CURRENT	SPEED	TORQUE
Unloaded	11.5 V	20 ÷ 40 A	6500 ÷ 8500 rpm	—
Loaded	9 V	170 A	3200 ÷ 3500 rpm	kgm 0.15
Short circuit	8 V	280 ÷ 360 A	—	kgm 0.75

# LIGHTING EQUIPMENT

## IGNITION SWITCH

The ignition key has 4 positions:

- «0» (vertical) machine at standstill, key not removable.
- «1» (key turned anticlockwise). Machine at standstill, key removable. Steering is locked by removal of key and handlebar turning right or left.
- «I» (key turned clockwise) between positions «0» and «2» key removable. The key can be removed without locking the steering.
- «2» (key turned clockwise) for engine starting, all controls in.

## LIGHTS SWITCH

- OFF Lights off.
- PARK Town driving light.
- L Low beam.
- H High beam.

## HORN, FLASHING LIGHT AND TURNING LIGHTS SWITCH

Left, on the handlebar («C» in fig. 190).

- HORN Horn button.
- FLASH Flashing light control.
- OFF Turning lights control.
- Left Left turning lights on.
- Right Right turning lights on.

## ENGINE STARTING AND STOPPING BUTTON

(See «A» in fig. 191)

Right, on the handlebar.

Ignition switch key in position «2» and button «1», START pressed (see «A»).

To stop the engine (emergency case) shift lever in position «3» or «4» OFF.

## TERMINAL BLOCK WITH FUSES

(See fig. 192)

Under the seat, it includes 6 (15 A) fuses.

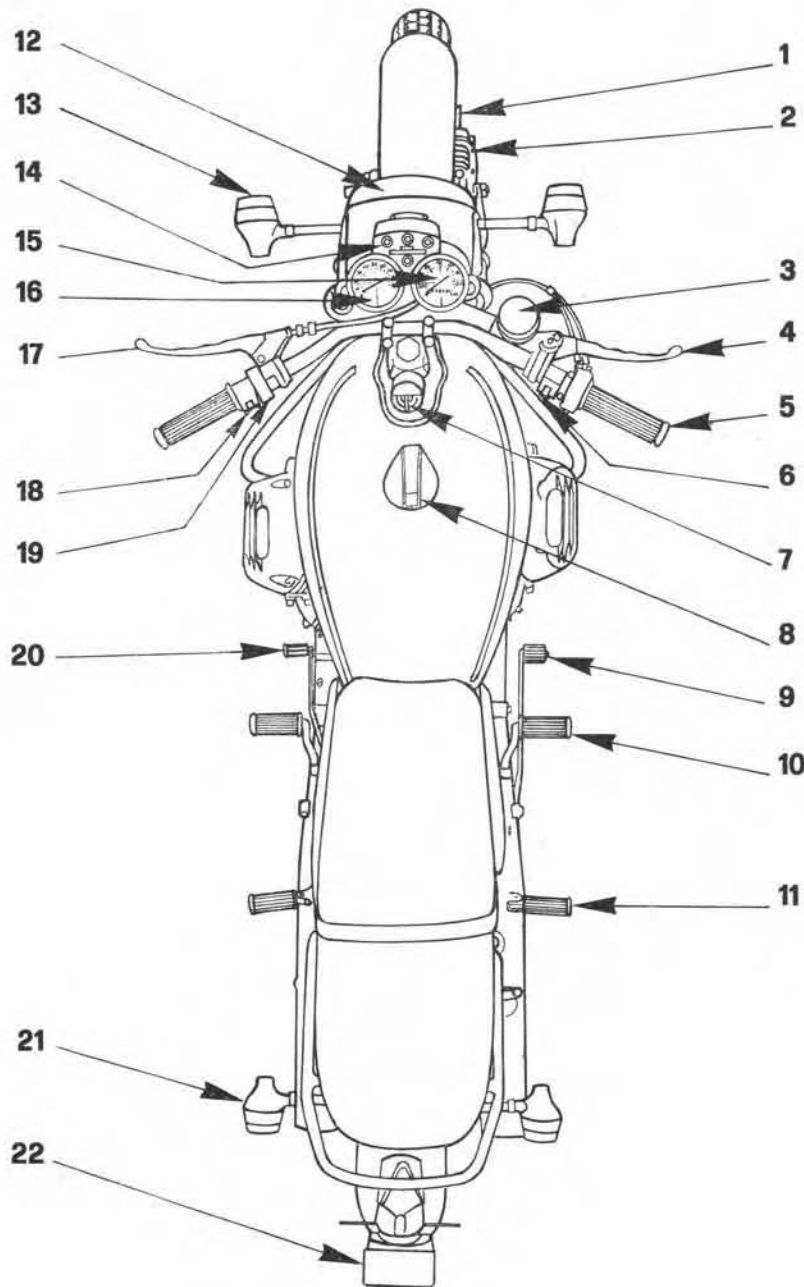
# CONTROLS AND ACCESSORIES

(See fig. 193)

- 1 Front brake disc.
- 2 Front brake caliper.
- 3 Master cylinder (brake fluid reservoir).
- 4 Front brake control lever.
- 5 Throttle control grip.
- 6 Engine starting and emergency stoppin button.
- 7 Key switch.
- 8 Fuel tank filler cap.
- 9 Rear brake control lever.
- 10 Foot-rest.
- 11 Pillion foot-rest.
- 12 Headlight.
- 13 Front turning lights.

- 14 Instrument panel.
- 15 Speedometer.
- 16 Rev. counter.
- 17 Clutch control lever.
- 18 Horn, flashing light and turning lights button.
- 19 Lighting switch.
- 20 Gear change lever.
- 21 Rear turning lights.
- 22 Tail lamp.

• **NB.** - Right or left is referred for controls as seen from riding position.



193

# LUBRICATION AND MAINTENANCE CHART

(See fig. 194)

## MONTHLY (EVERY 3000 KM)

- 1 Check electrolyte level in battery.

## PERIODICALLY

- 2 Check tyre pressure.

## AFTER FIRST 500 KM

- 3 Replace crankcase oil.
- 4 Tighten all nuts and bolts.
- 5 Check tightening of wheel spokes and wheel truing.
- 6 Check clearance between rocker and valve.

## EVERY 500 KM

- 7 Check oil level in crankcase.

## EVERY 1500 KM

- 8 Check tightening of wheel spokes and wheel truing.

## EVERY 3000 KM

- 9 Replace oil in crankcase.
- 10 Check clearance between rocker and valve.

- 11 Check oil level in gear box.
- 12 Check oil level in rear drive box.

## EVERY 5000 KM

- 13 Check fluid level in fluid reservoir (front disc brakes).

## EVERY 10000 KM

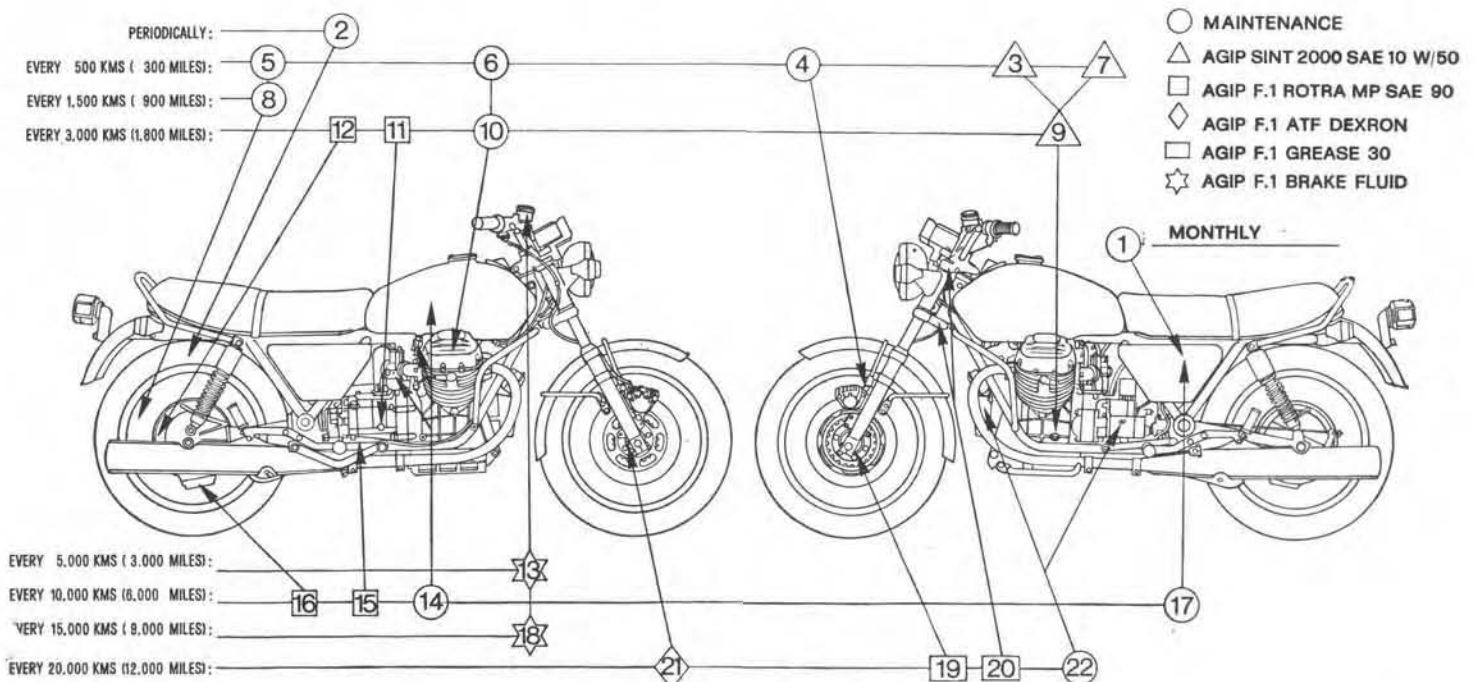
- 14 Clean fuel tank, fuel tap filters and fuel line.
- 15 Replace oil in gear box.
- 16 Replace oil in rear drive box.
- 17 Clean and grease battery connections.

## EVERY 15000 KM

- 18 Replace the fluid of front braking circuit.

## AFTER FIRST 20000 KM

- 19 Check conditions of wheel bearings, pack with grease «Agip F. 1 Grease 30».
- 20 Check conditions of steering bearings, pack with grease «Agip F. 1 Grease 30».
- 21 Replace oil in fork members («Agip F. 1 Dexron» l. 0.050 each member).
- 22 Clean starter motor commutator and alternator slip ring using a petrol moistened rag.





# WIRING DIAGRAM - LEGEND (European version)

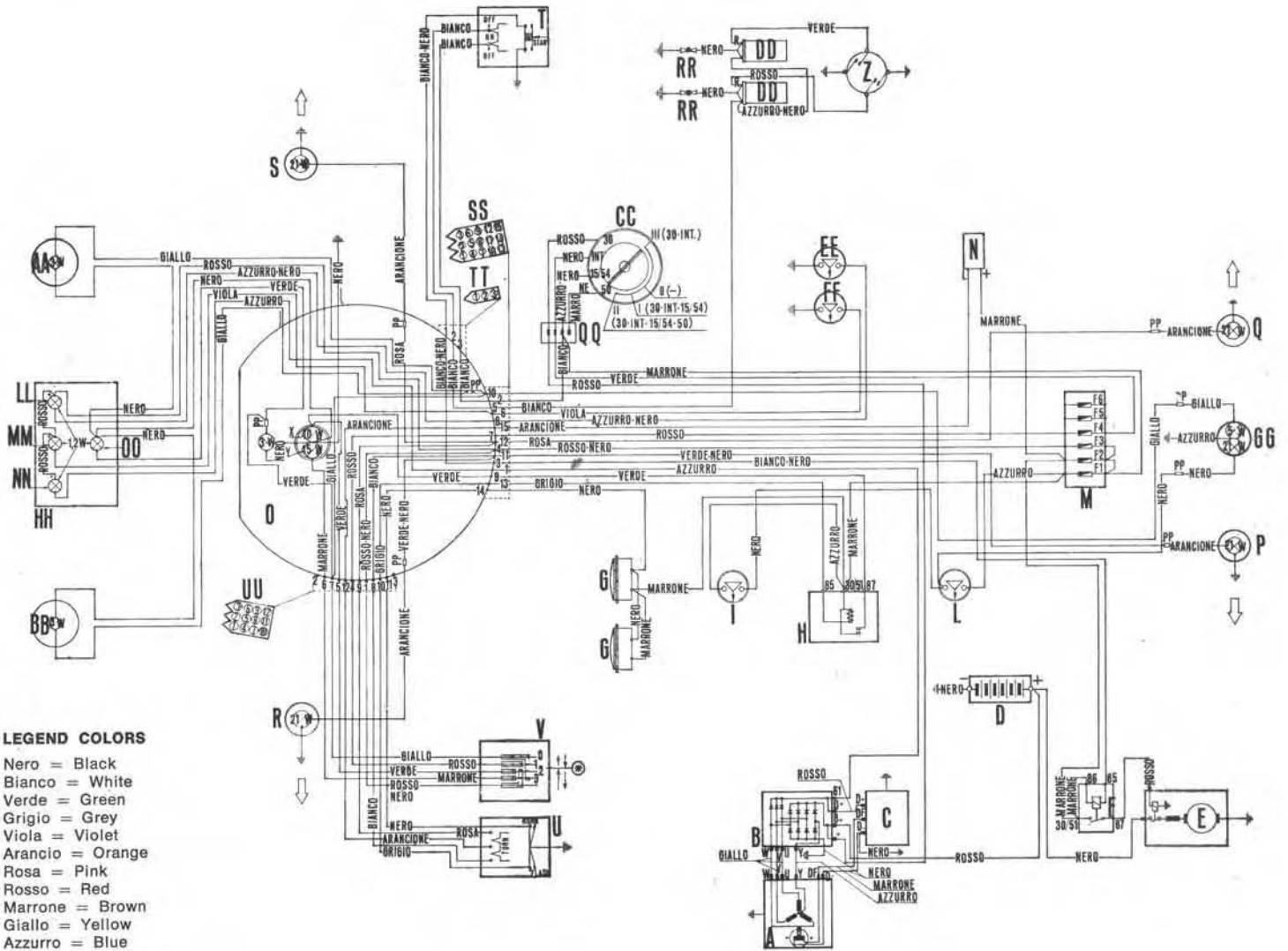
(See fig. 195)

- A - Generator
- B - Rectifier
- C - Regulator
- D - Battery
- E - Starter motor
- F - Starter motor relay
- G - Horn
- H - Flashing light relay
- I - Hydrotop
- L - Rear stop switch
- M - Terminal block with fuses
- N - Flasher unit
- O - Asymmetric light
- P - Left turn signal, rear
- Q - Right turn signal, rear
- R - Left turn signal, front
- S - Right turn signal, front
- T - Engine starter and stop switch
- U - Control device, turn signals, horn, flashing light
- V - Light switch; dimmer, city light, parking light
- AA - Speedometer
- BB - Rev. counter
- CC - General commutator
- DD - H.T. coil

- EE - Oil light switch
- FF - Neutral light switch
- GG - Number plate and stop light
- HH - Instrument panel
- LL - Oil pressure light (red)
- MM - Neutral light (orange)
- NN - Battery light (red)
- OO - City light (green)
- QQ - 4-way connector «AMP»
- RR - Spark plugs
- SS - 15-way connector «MOLEX»
- TT - 3-way connector «MOLEX»
- UU - 12-way connector «MOLEX»
- X - Low beam
- Y - High beam
- Z - Contact breaker

## Fuses

- F1 - 15 A - Horn, stop, signals relay
- F2 - 15 A - Starter relay, flasher unit
- F3 - 15 A - Head light, lights LL; MM; NN
- F4 - 15 A - Parking light, light OO
- F5 - 15 A - Reserve
- F6 - 15 A - Reserve



## LEGEND COLORS

- Nero = Black
- Bianco = White
- Verde = Green
- Grigio = Grey
- Viola = Violet
- Arancio = Orange
- Rosa = Pink
- Rosso = Red
- Marrone = Brown
- Giallo = Yellow
- Azzurro = Blue
- Rosso/Nero = Red/Black
- Azzurro/Nero = Blue/Black
- Verde/Nero = Green/Black
- Bianco/Nero = White/Black
- Giallo/Nero = Yellow/Black
- Grigio/Nero = Grey/Black

# WIRING DIAGRAM - LEGEND (U.S.A. version)

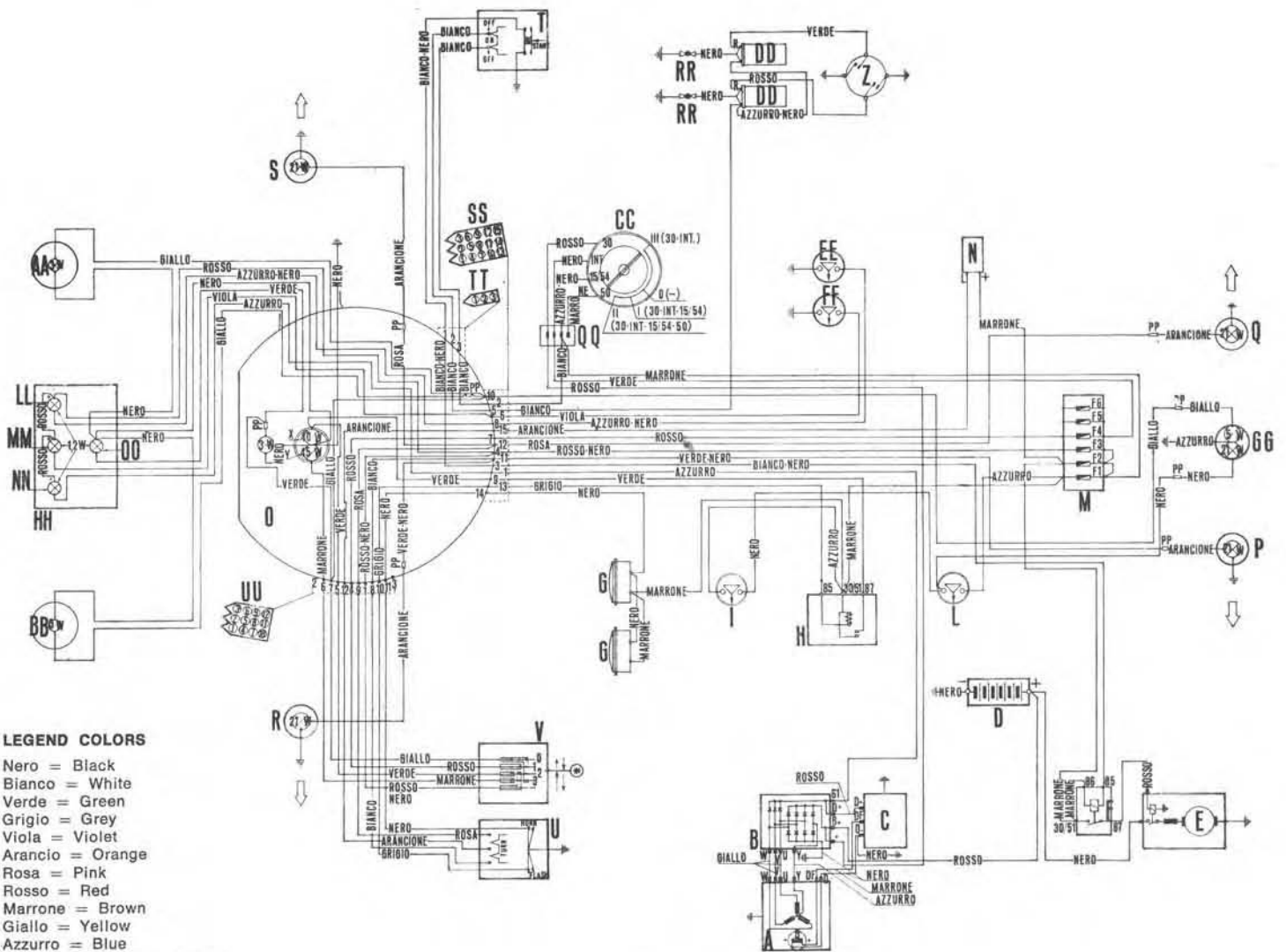
(See fig. 196)

- A** Generator alternator
- B** Rectifier
- C** Voltage regulator
- D** Battery
- E** Starter motor
- F** Relay for starter motor
- G** Horn
- H** Relay flashing light
- I** Hydrostop
- L** Rear stop light cutout
- M** Terminal fuse holder
- N** Flasher unit (turning lights)
- O** Asymmetric headlight
- P** Rear turning light, left
- Q** Rear turning light, right
- R** Front turning light, left
- S** Front turning light, right
- T** Engine starting and stopping switch
- U** Horn, flashing light, turning lights, control switch
- V** Lights switch, with travel cutout from dimmer to town driving and parking light
- AA** Km counter
- BB** Rev. counter
- CC** Ignition switch
- DD** H.T. coil
- EE** Oil pressure indicator cutout

- FF** Neutral indicator cutout
- GG** Number plate and stop light
- HH** Instrument panel
- LL** Oil pressure indicator light (red)
- MM** Neutral indicator light (orange)
- NN** Battery charge indicator light (red)
- OO** Parking indicator light (red) (USA version)
- PP** Faston connectors
- QQ** 4-way connector «AMP»
- RR** Spark plugs
- SS** 15-way connector «MOLEX»
- TT** 3-way connector «MOLEX»
- UU** 12-way connector «MOLEX»
- X** Low beam light
- Y** High beam light
- Z** Contact breaker

## Fuses

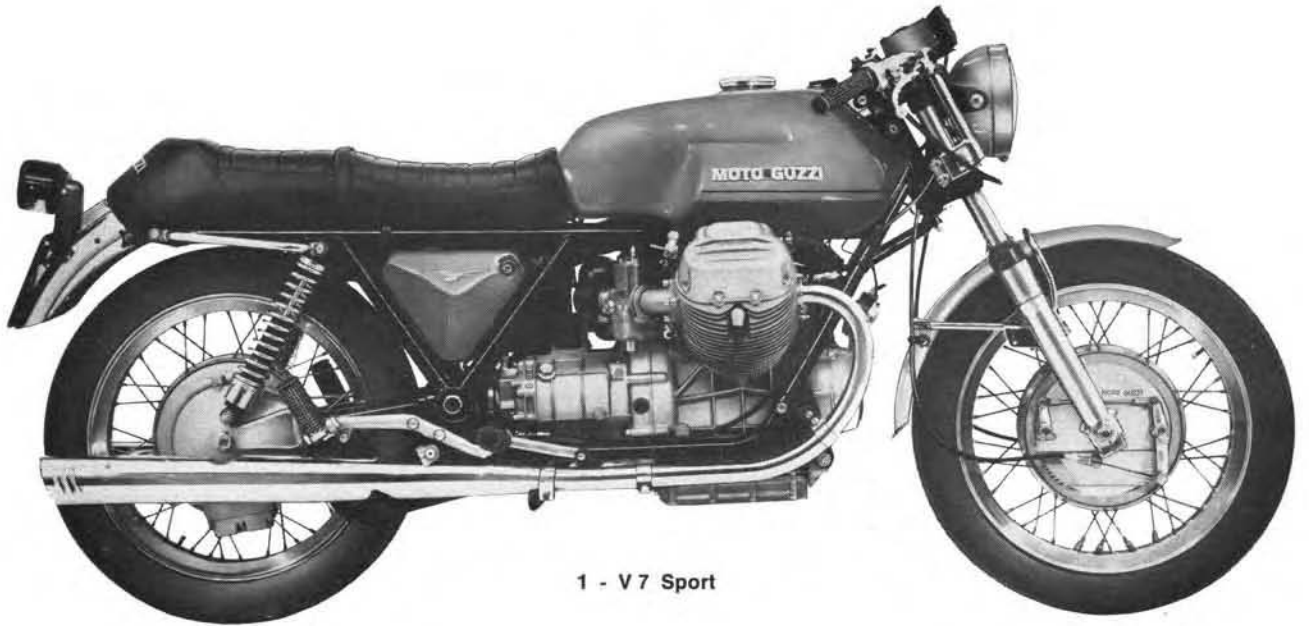
- F1 - 15A** - Horn, stop lights - Turning lights relay
- F2 - 15A** - Starter motor relay - Flasher unit
- F3 - 15A** - Headlights - Indicator lights LL MM NN
- F4 - 15A** - Parking lights - Indicator light OO
- F5 - 15A** - Spare fuse



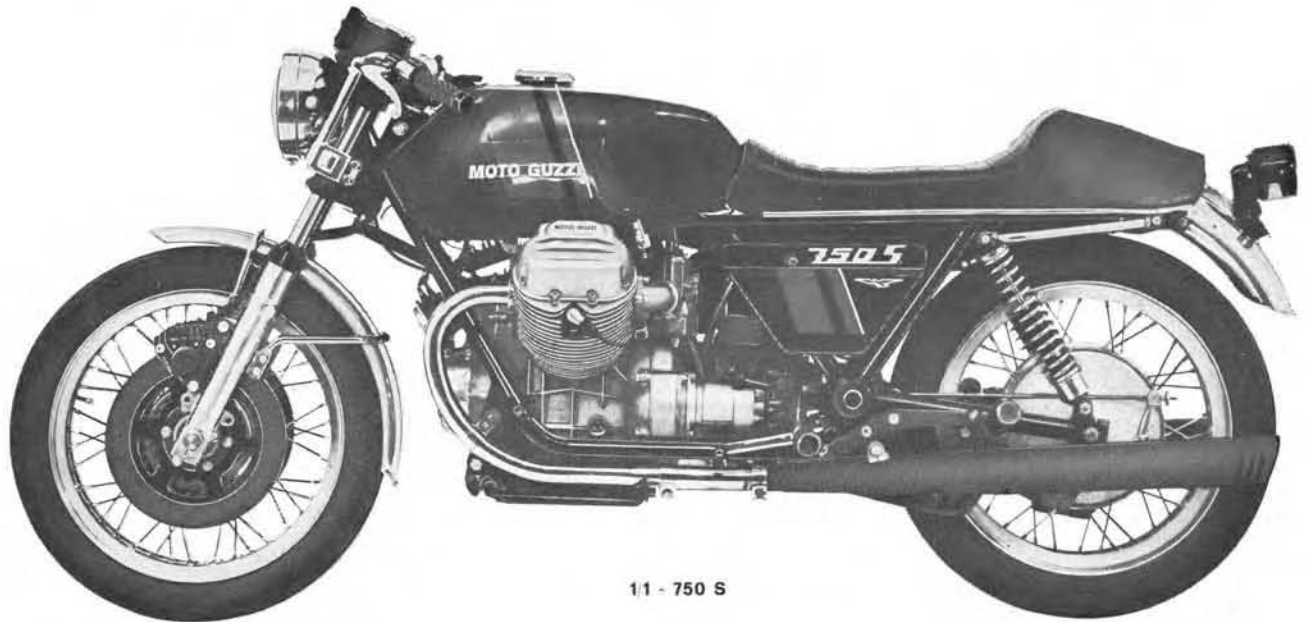
### LEGEND COLORS

- Nero = Black
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- Giallo/Nero = Yellow/Black
- Grigio/Nero = Grey/Black

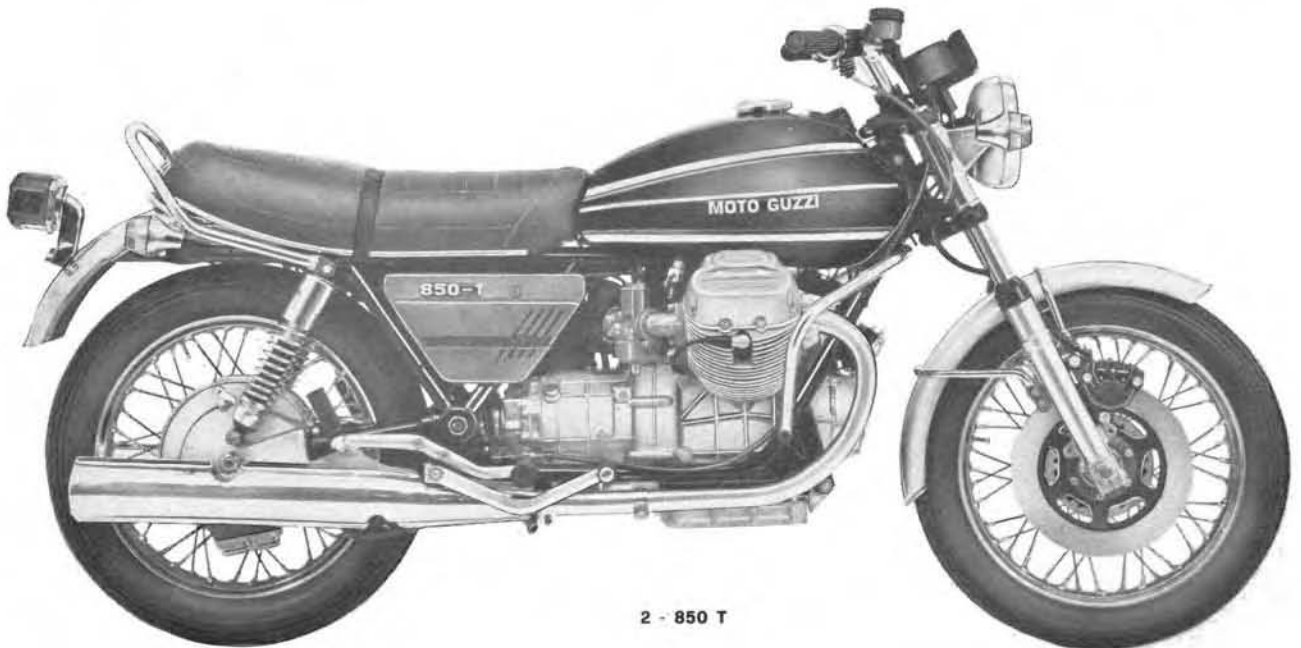




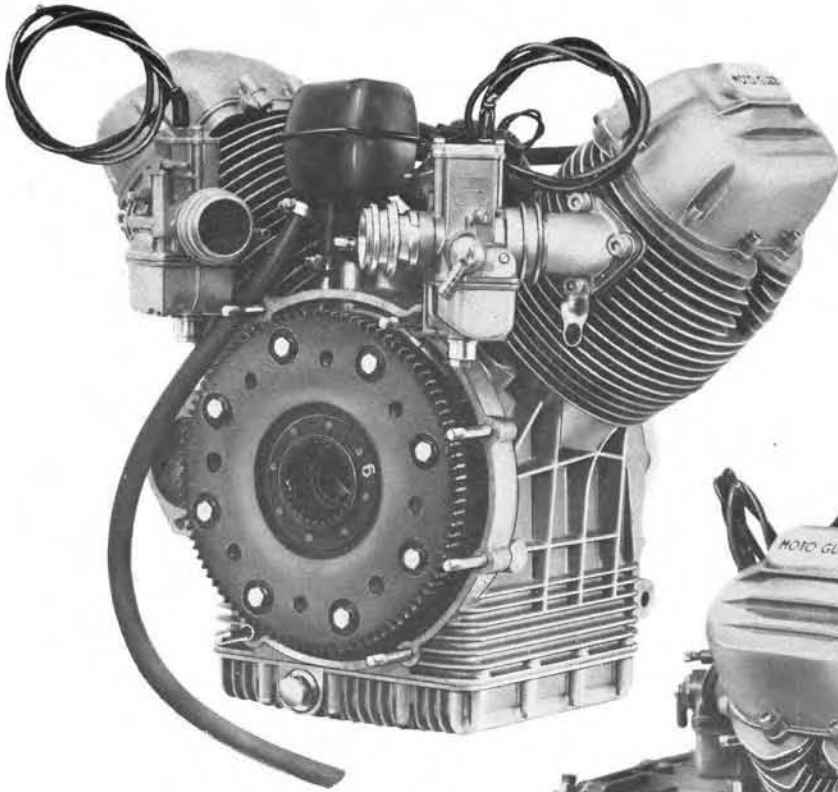
1 - V7 Sport



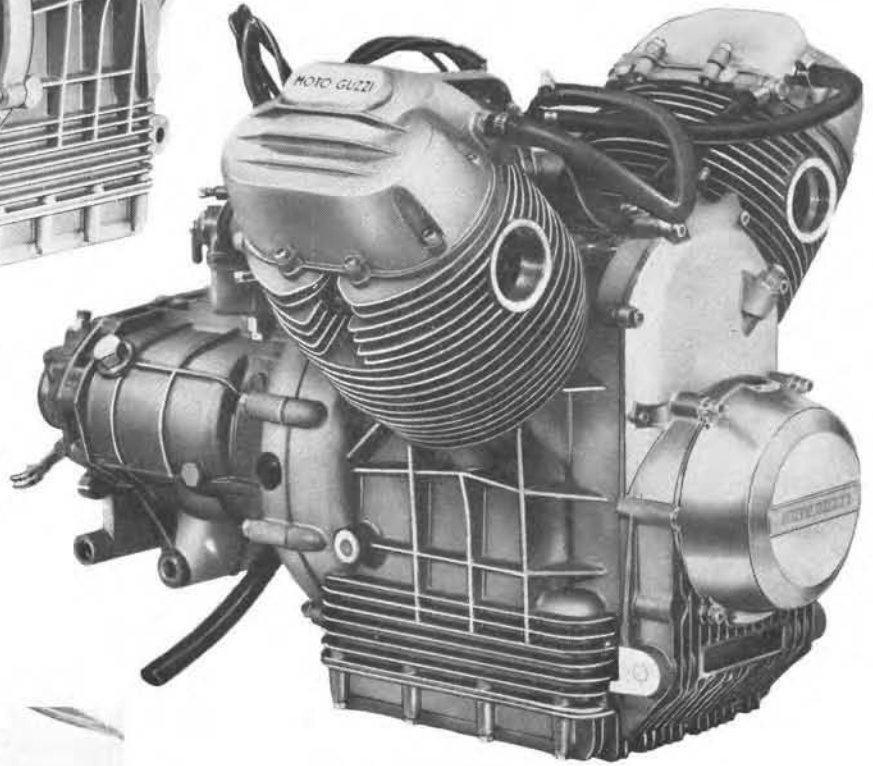
11 - 750 S



2 - 850 T



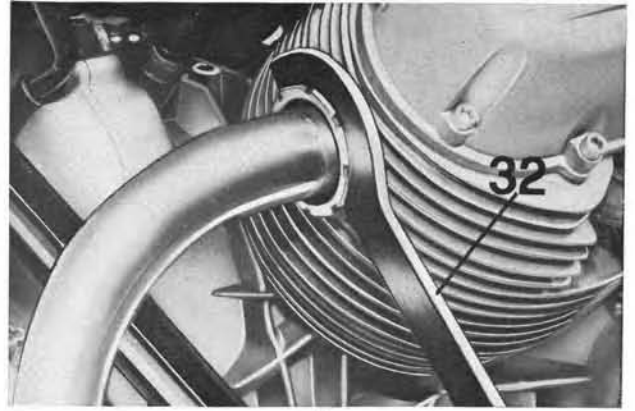
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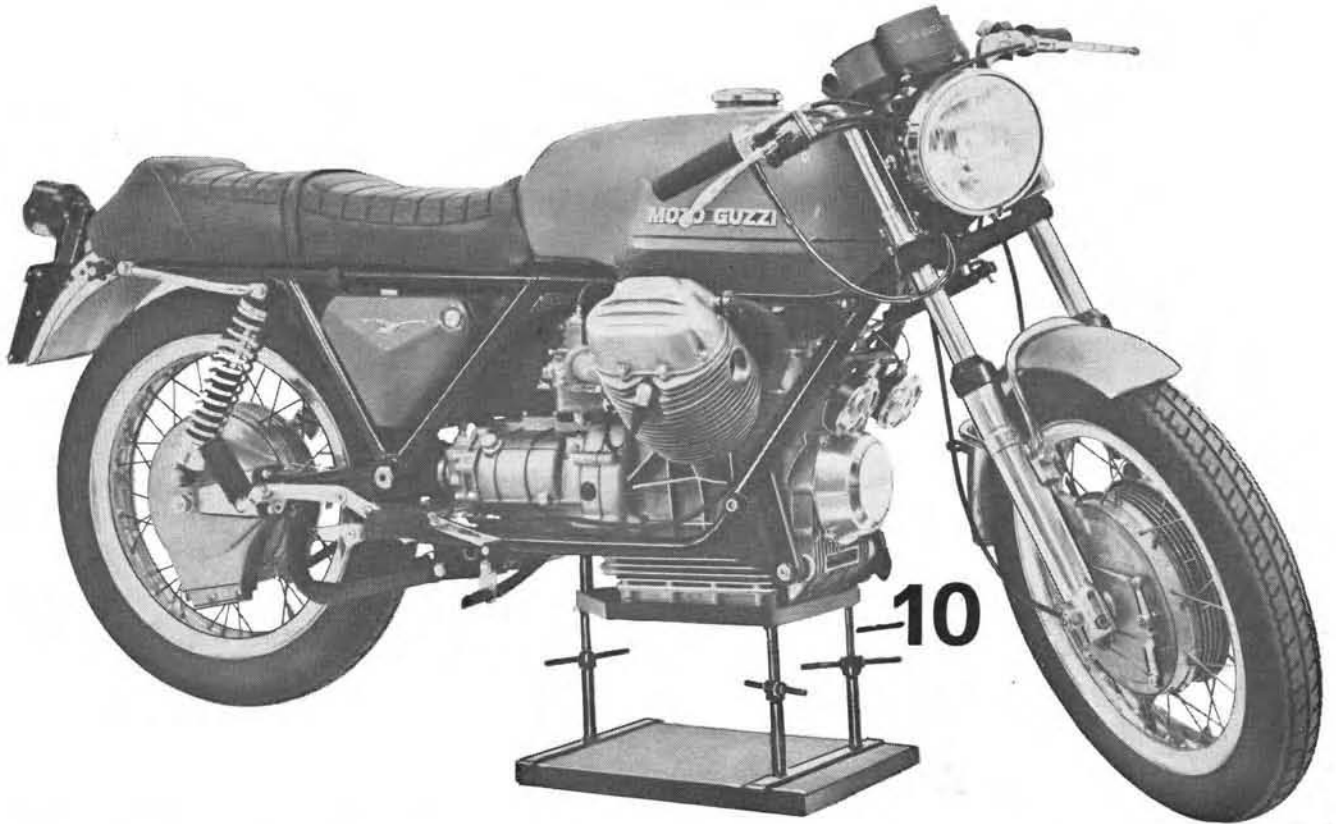
3/1 - Motore con cambio



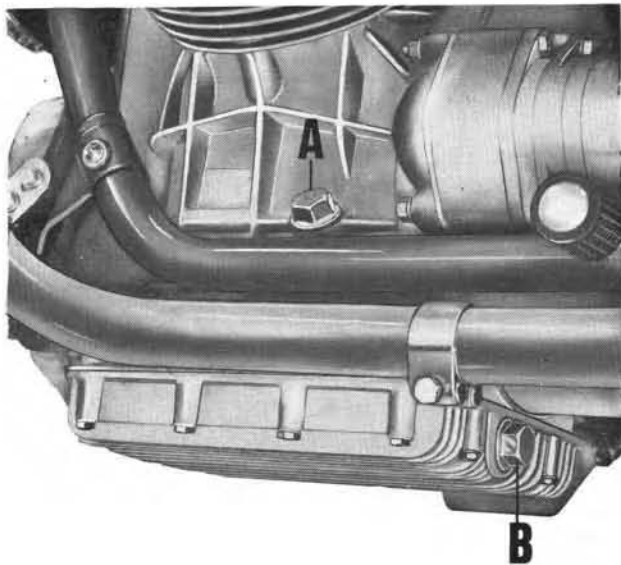
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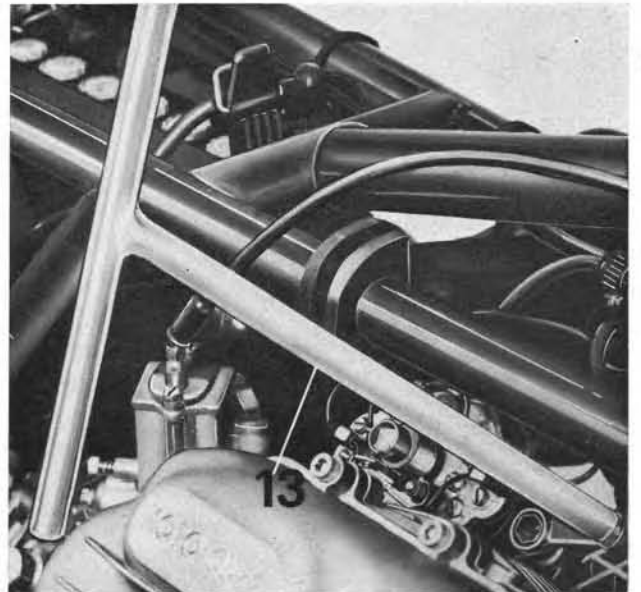
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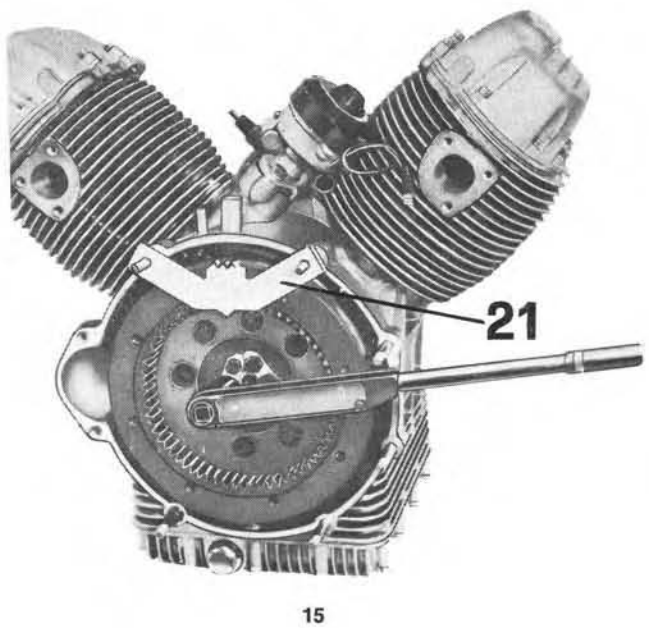
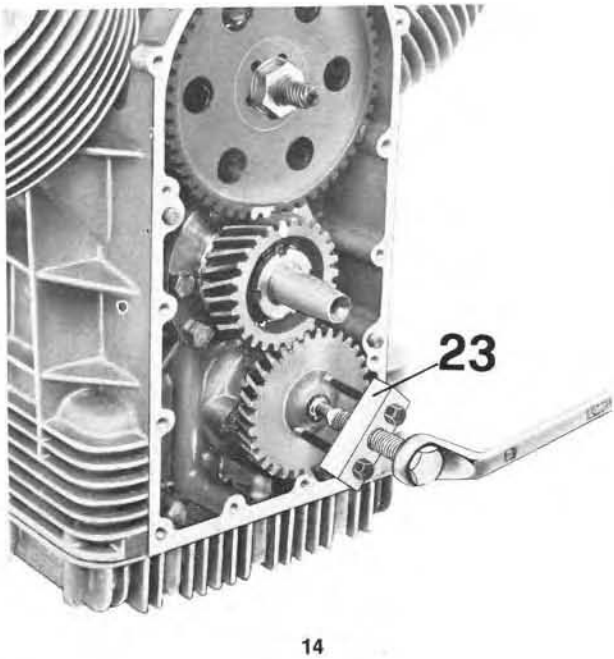
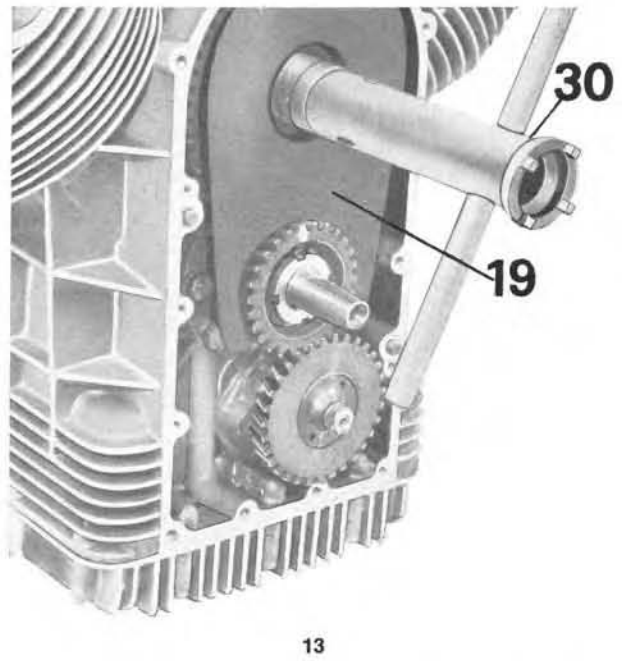
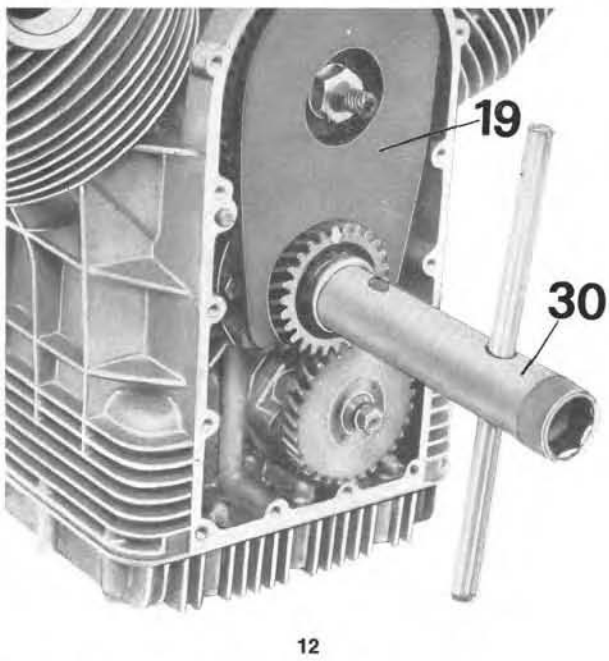
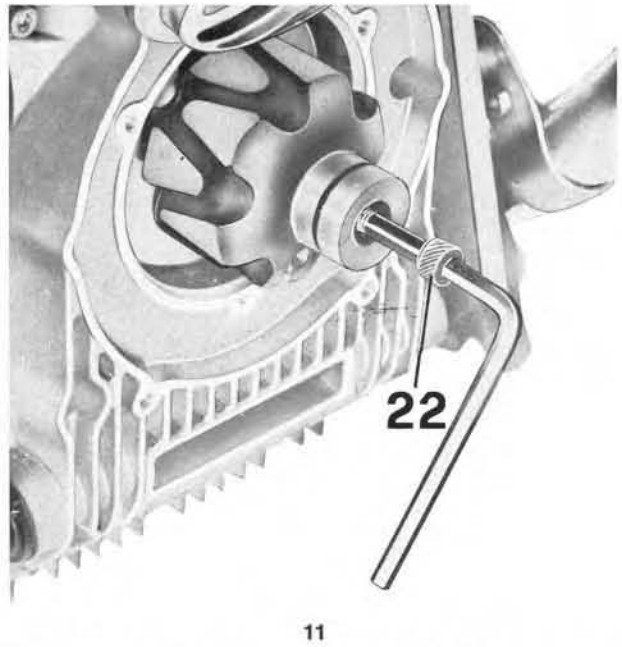
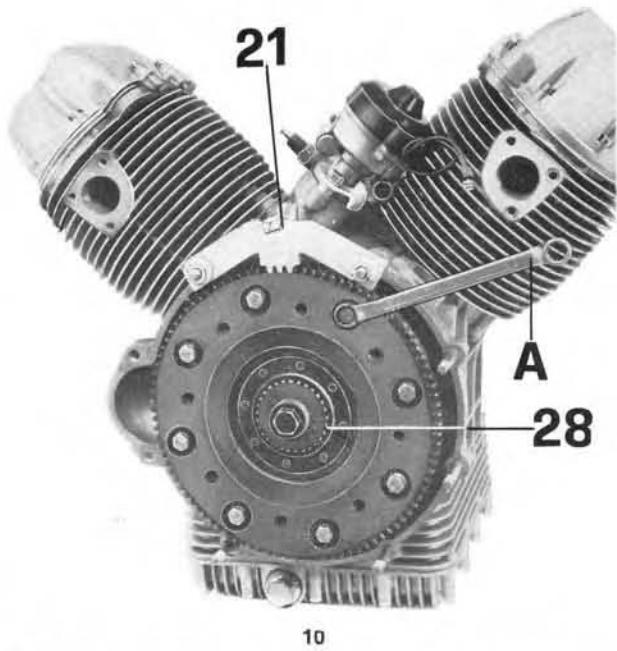


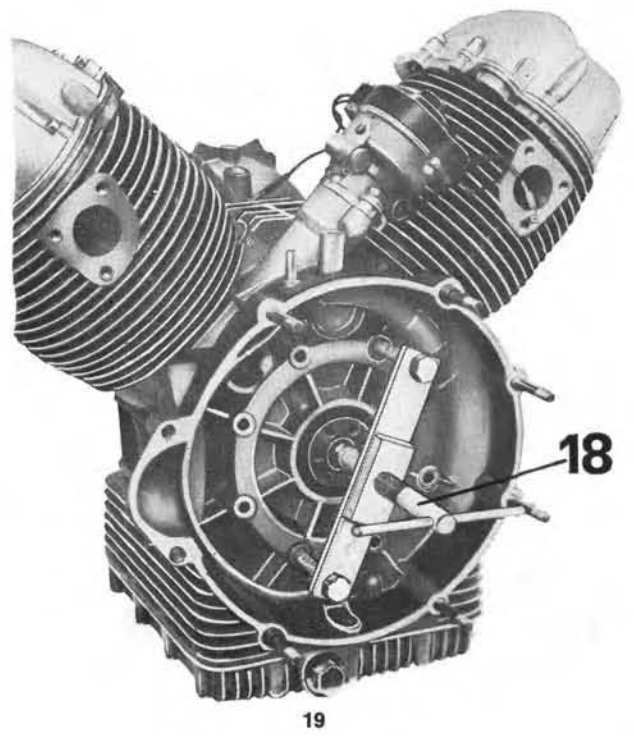
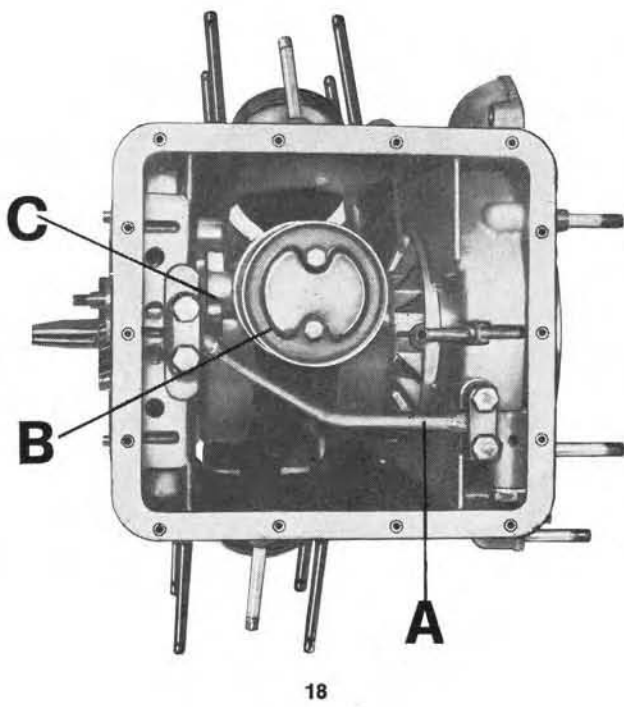
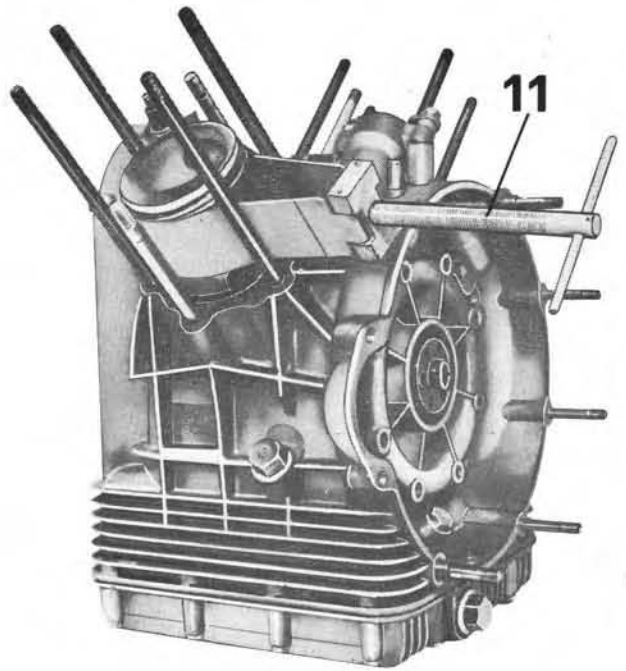
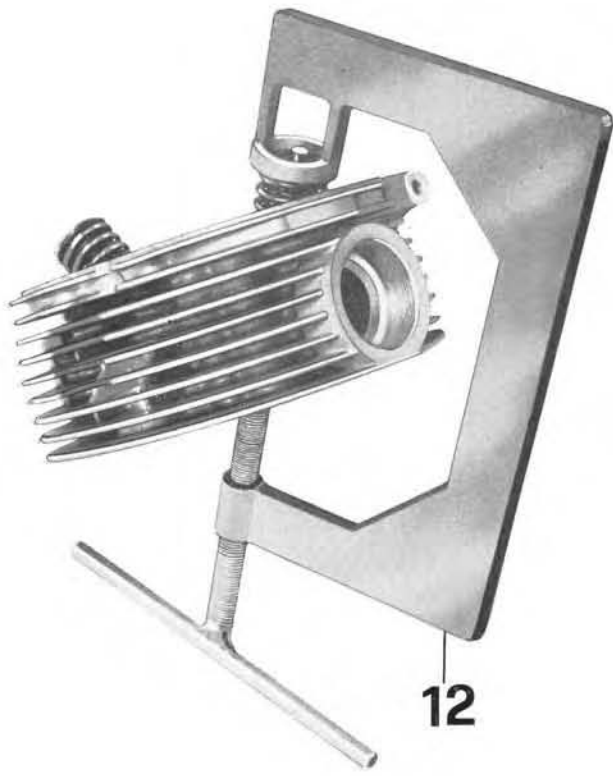
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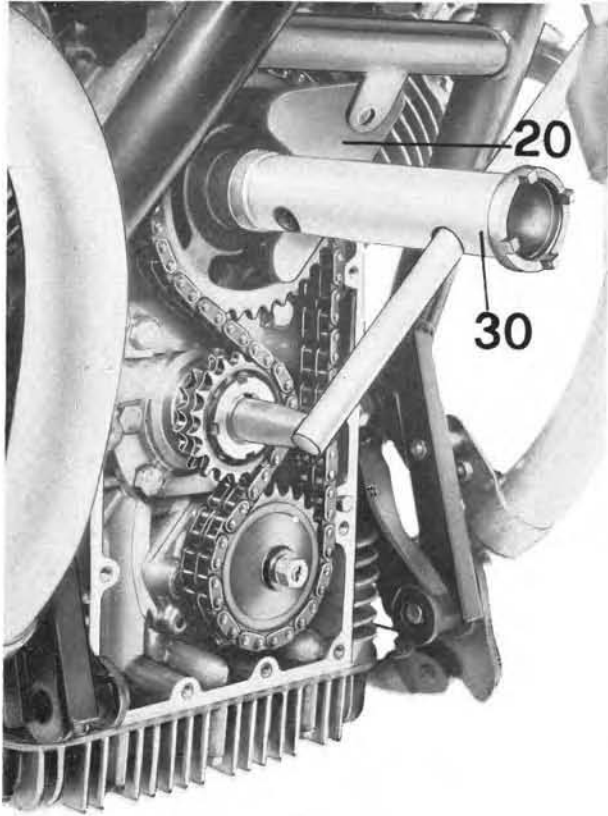


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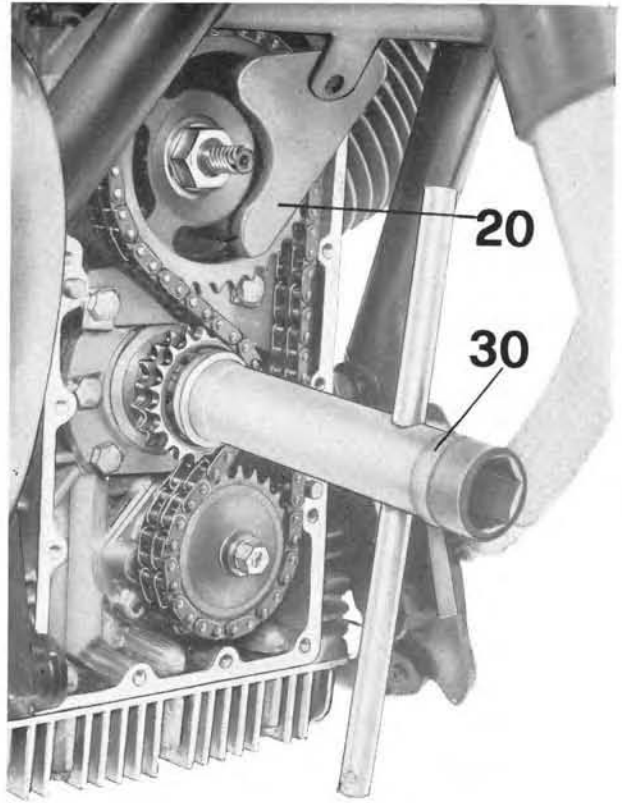




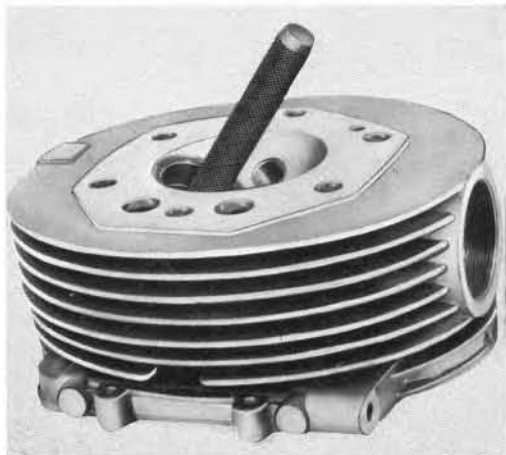




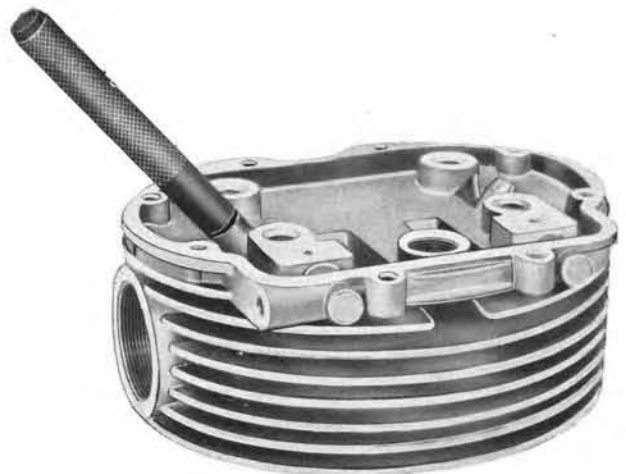
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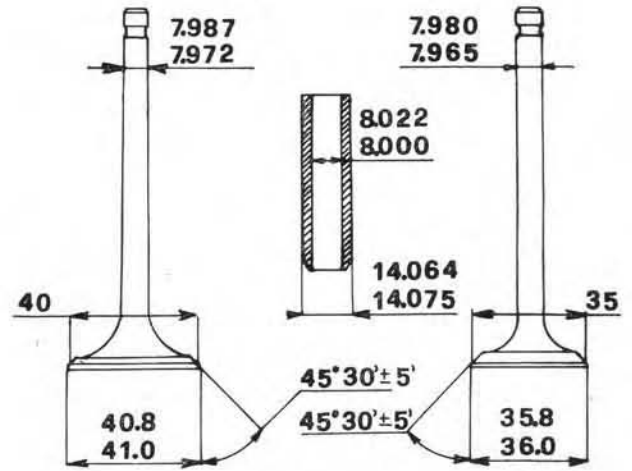
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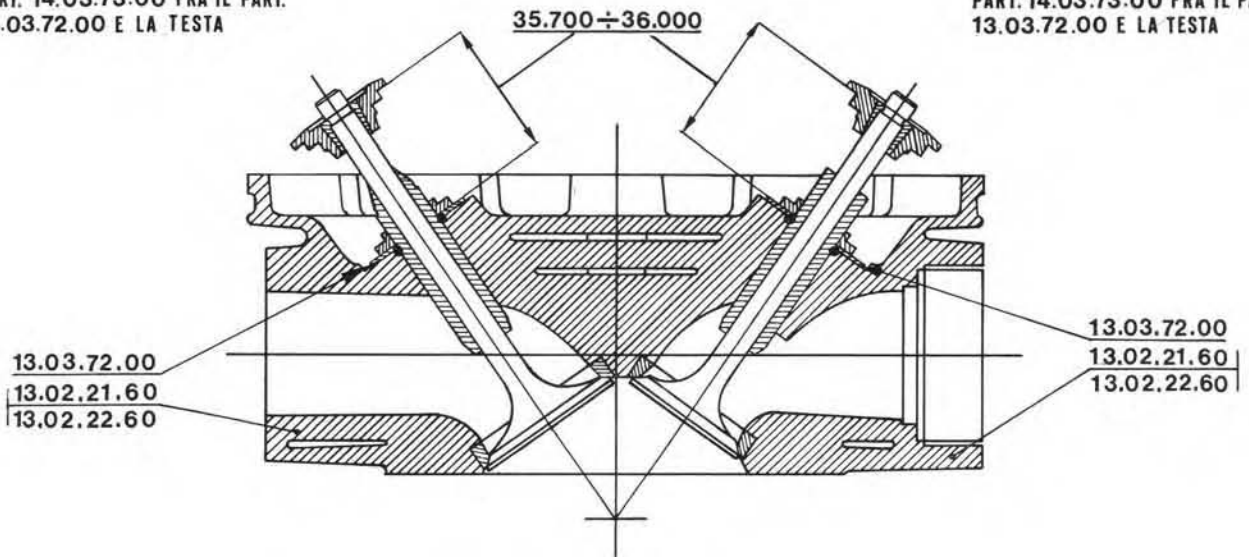
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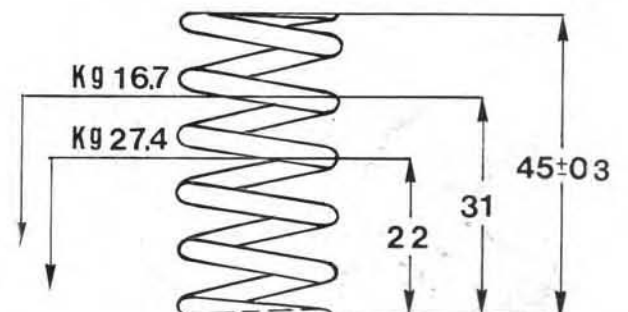
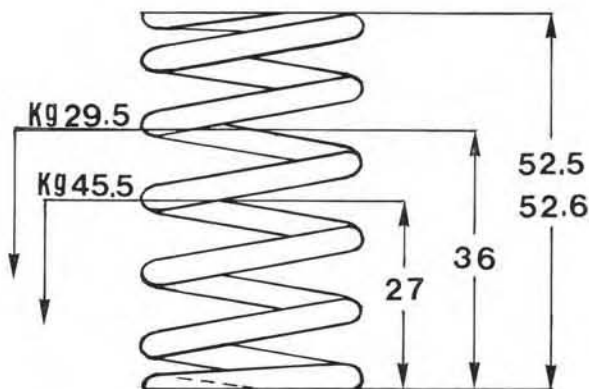
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 13.03.72.00 E LA TESTA

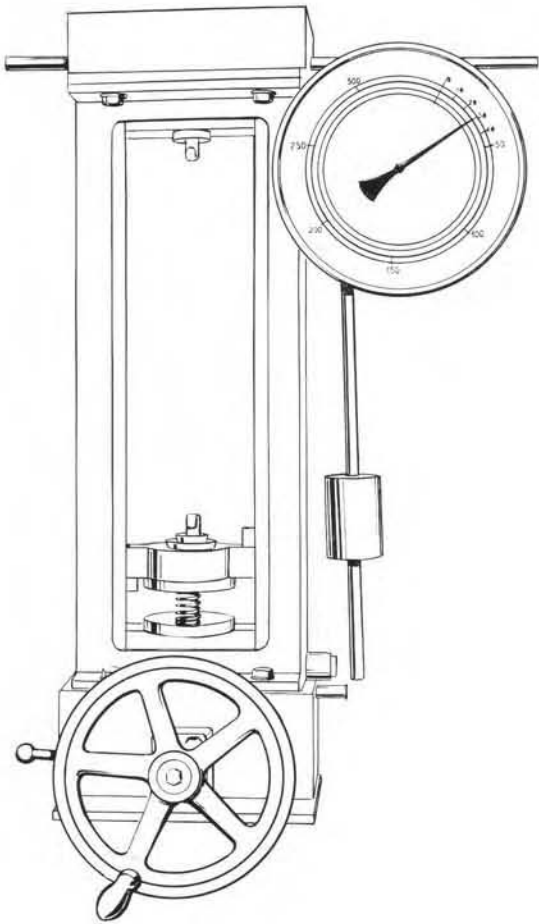
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 13.03.72.00 E LA TESTA



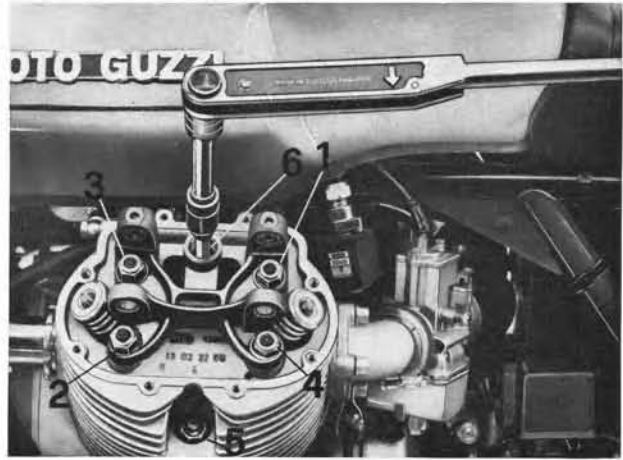
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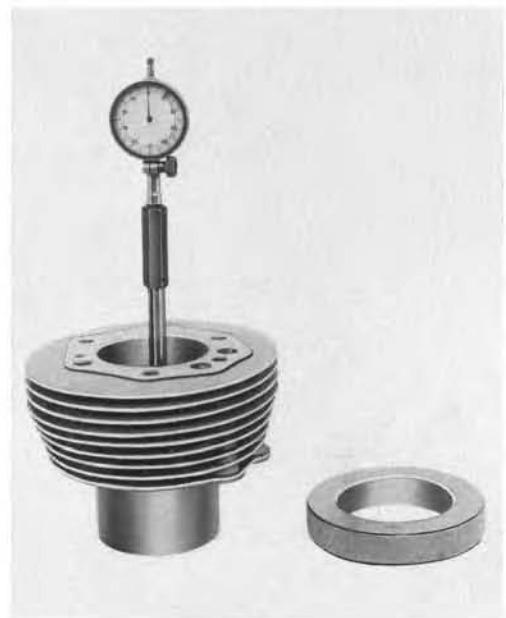
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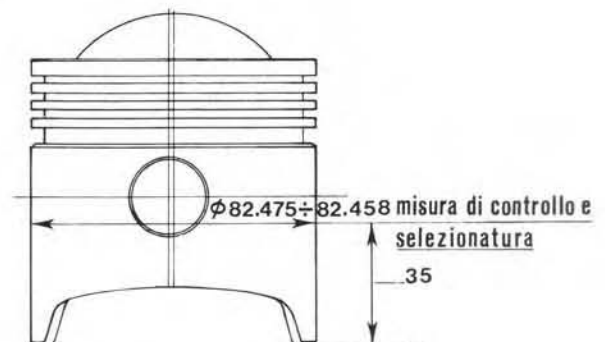
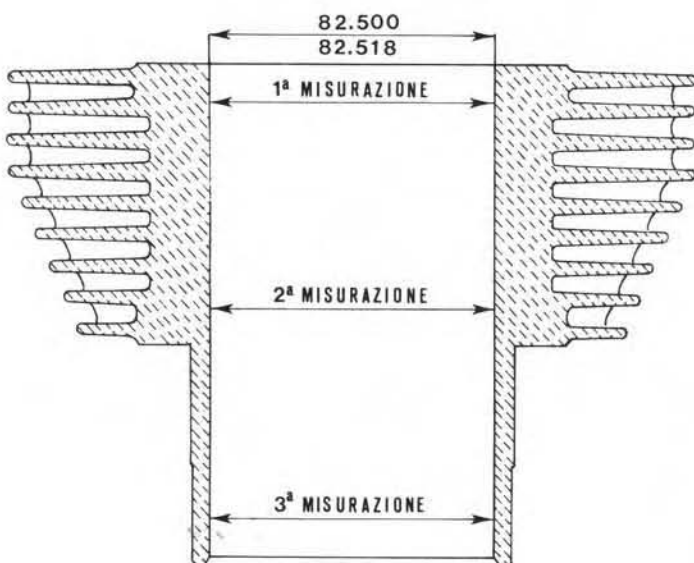
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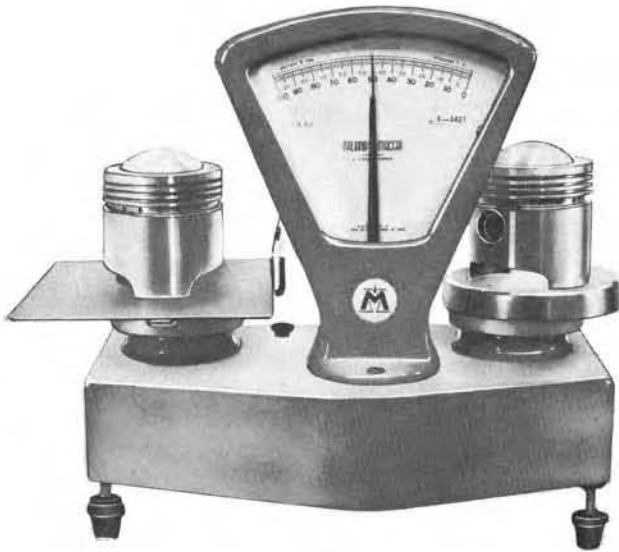
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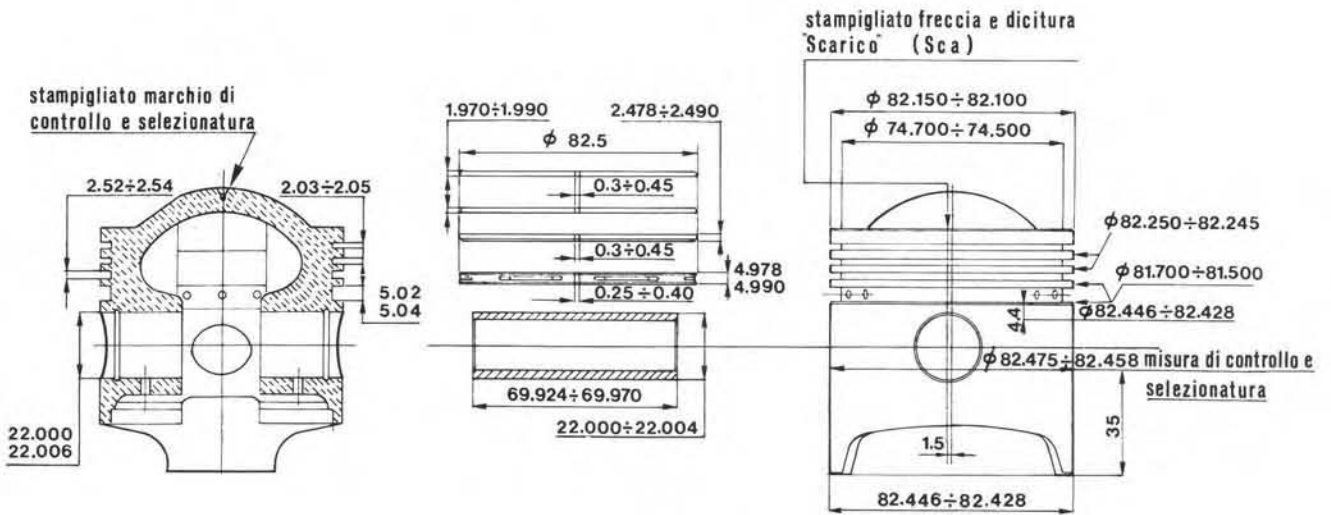
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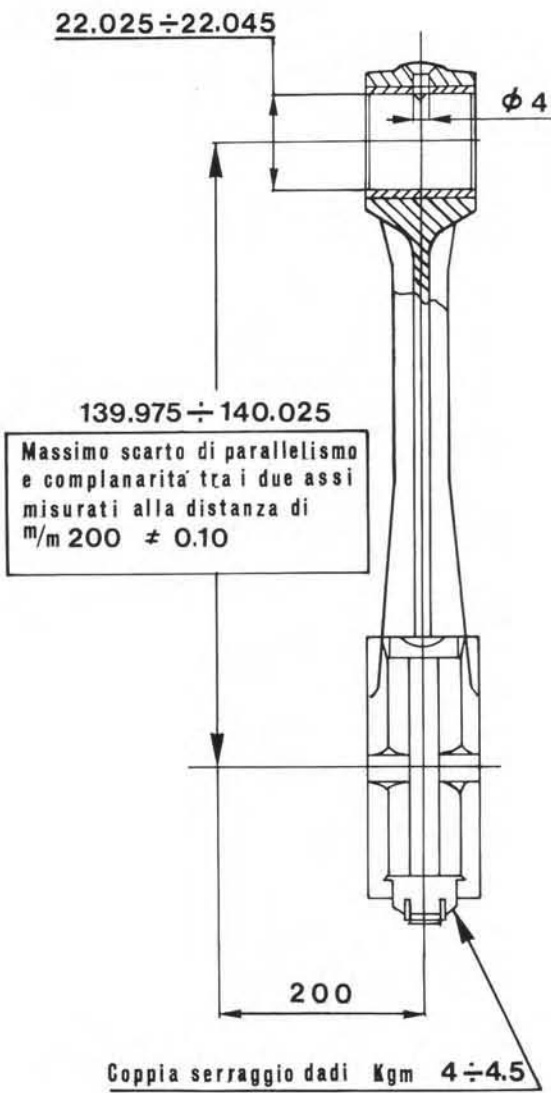




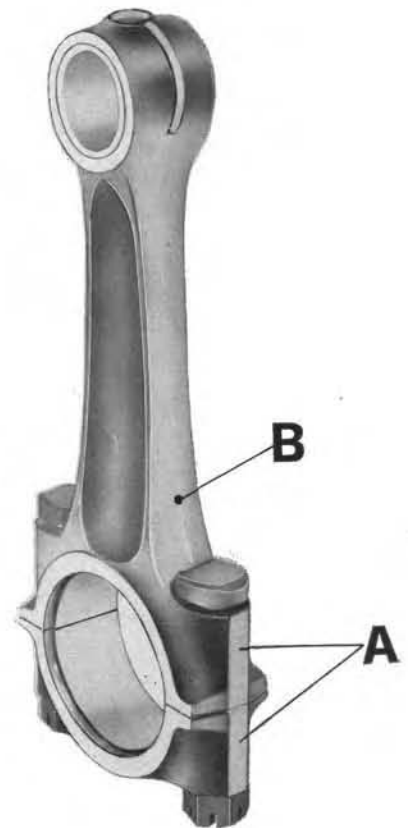
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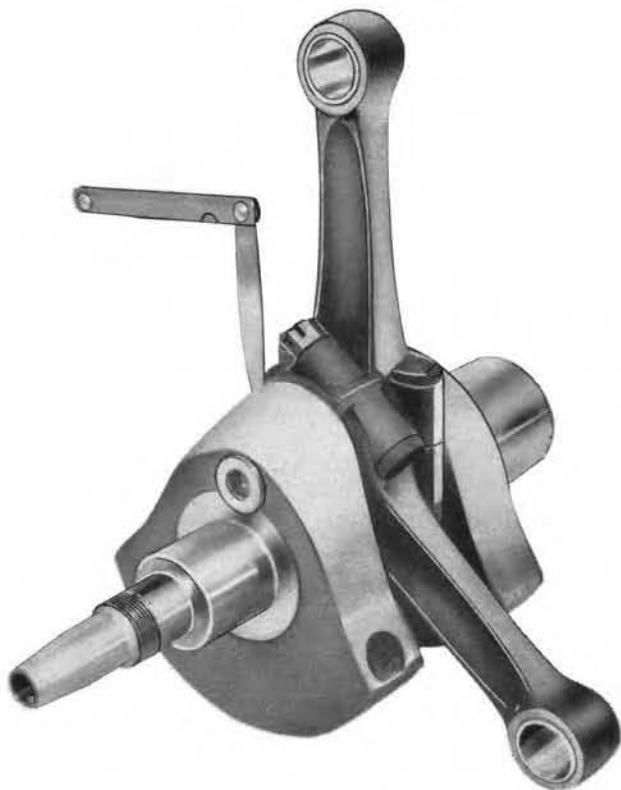


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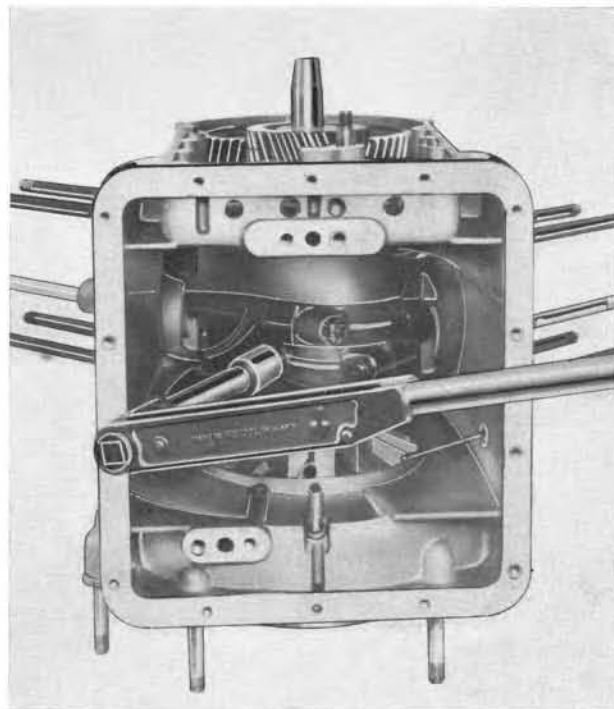


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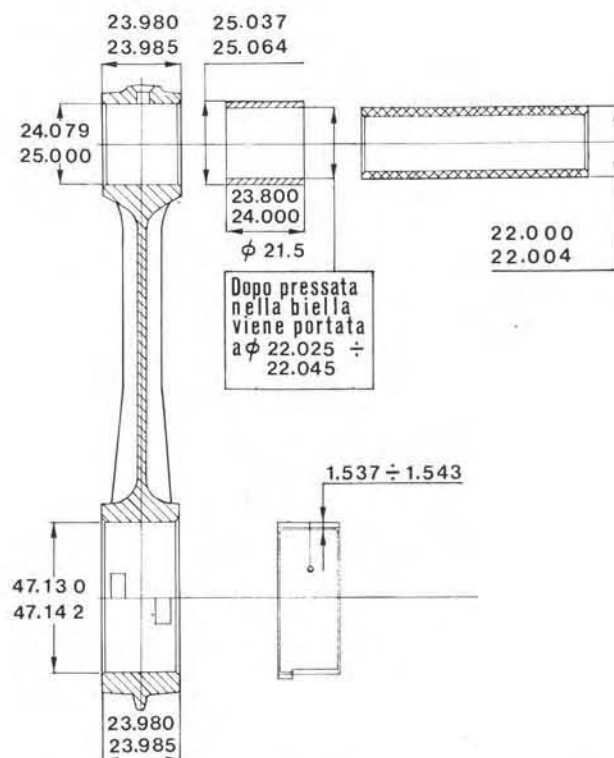
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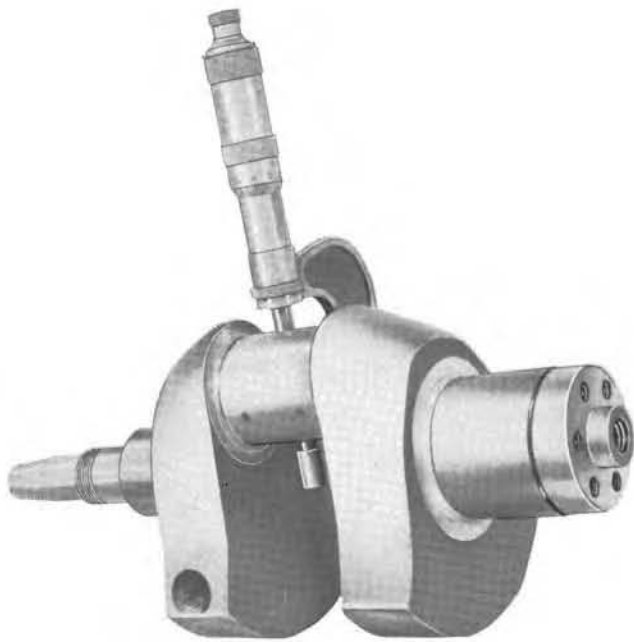
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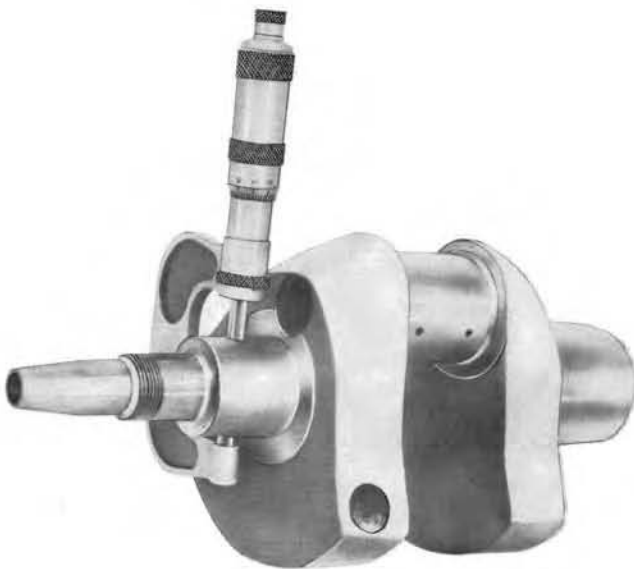
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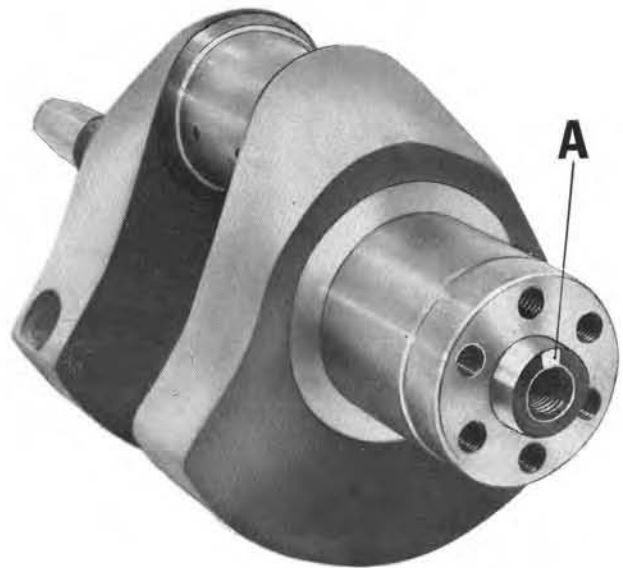
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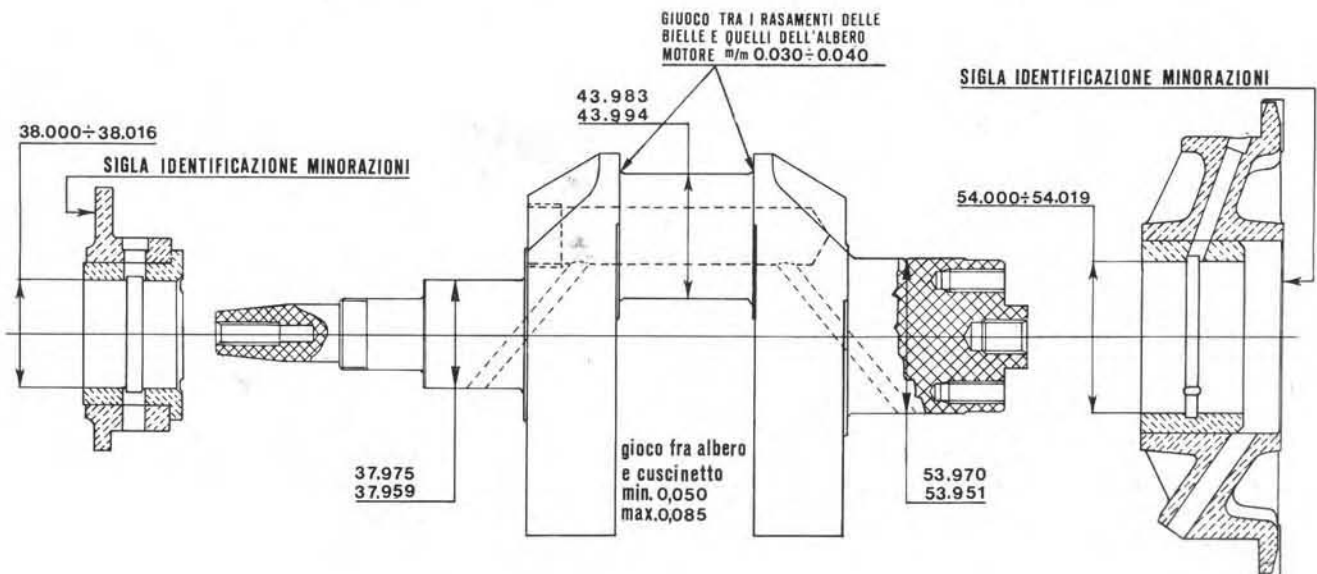
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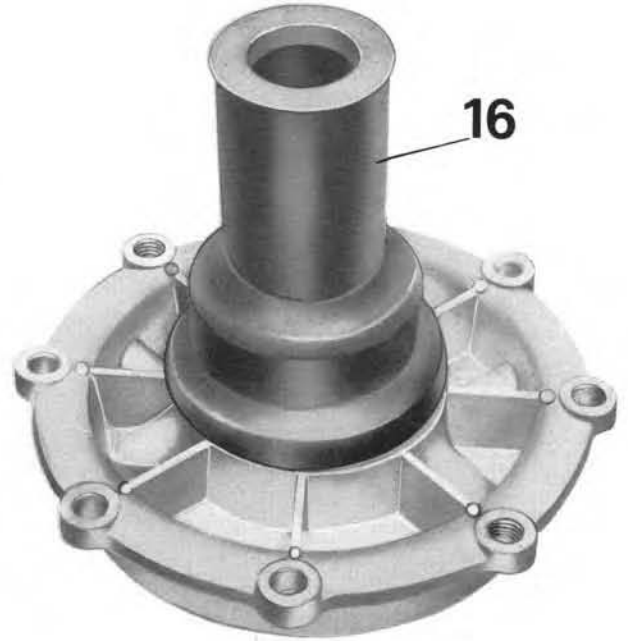
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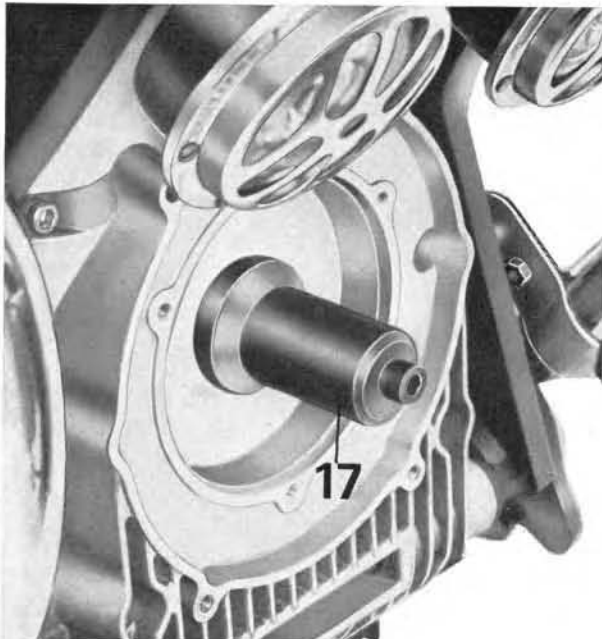
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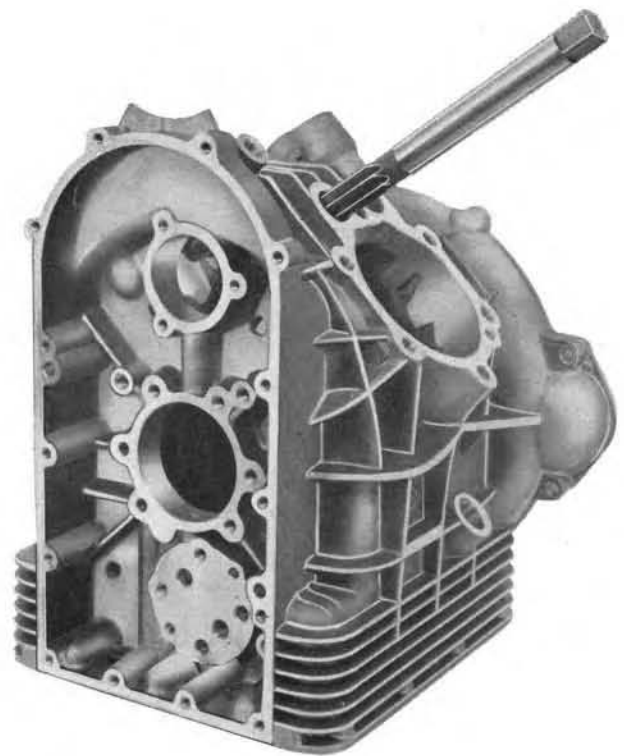
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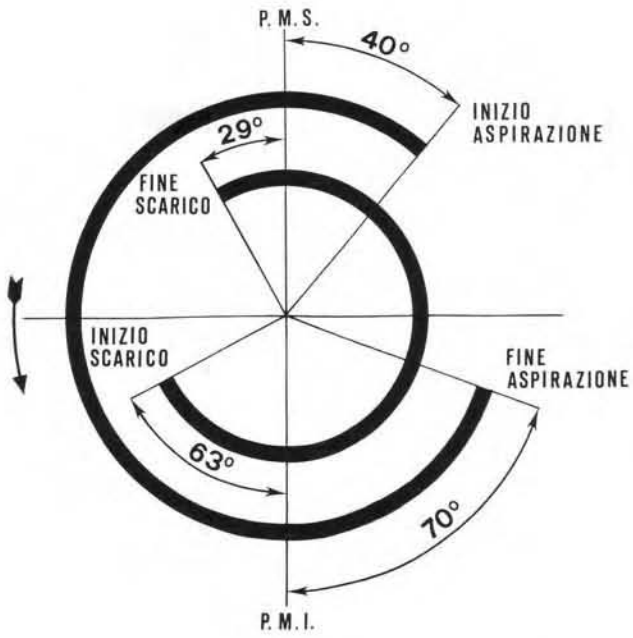
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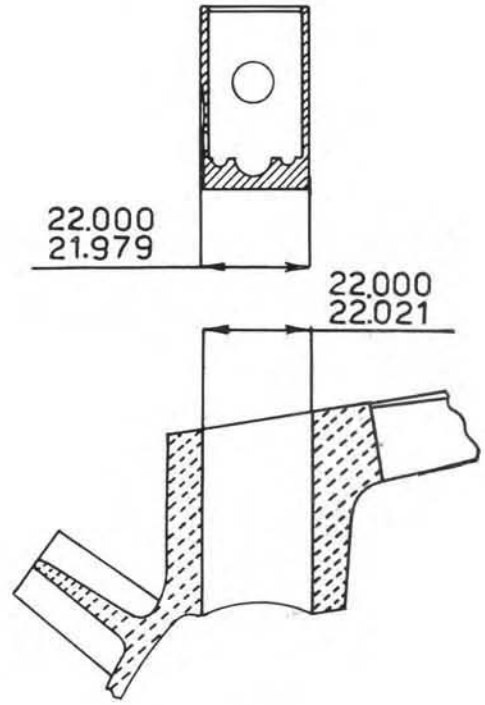
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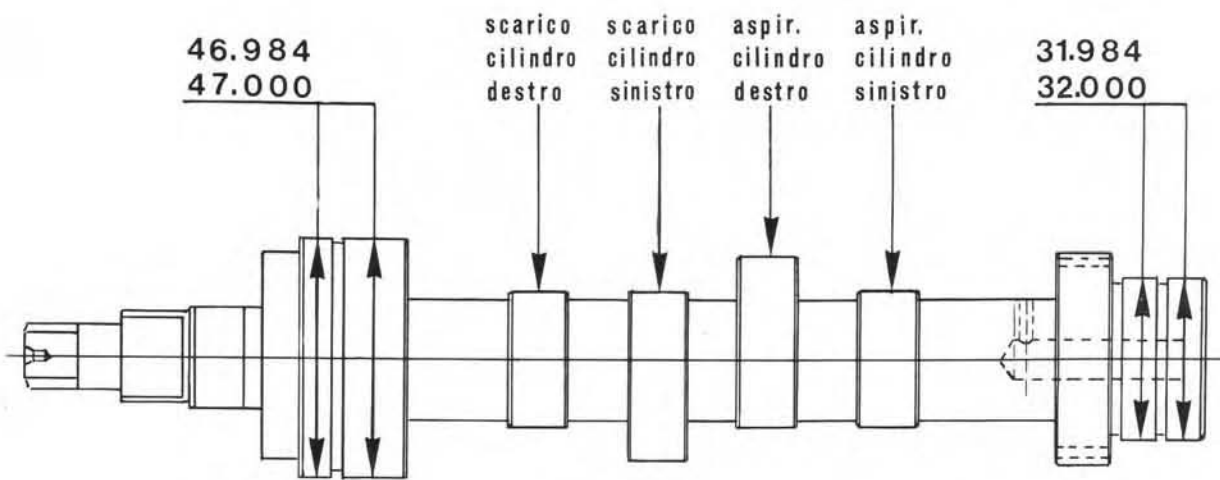
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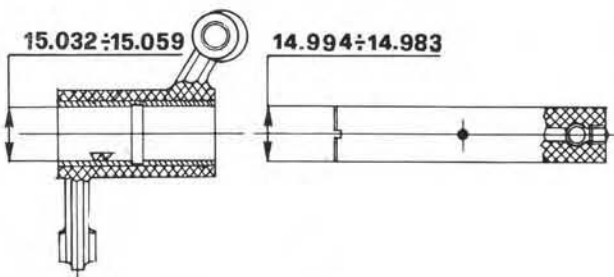
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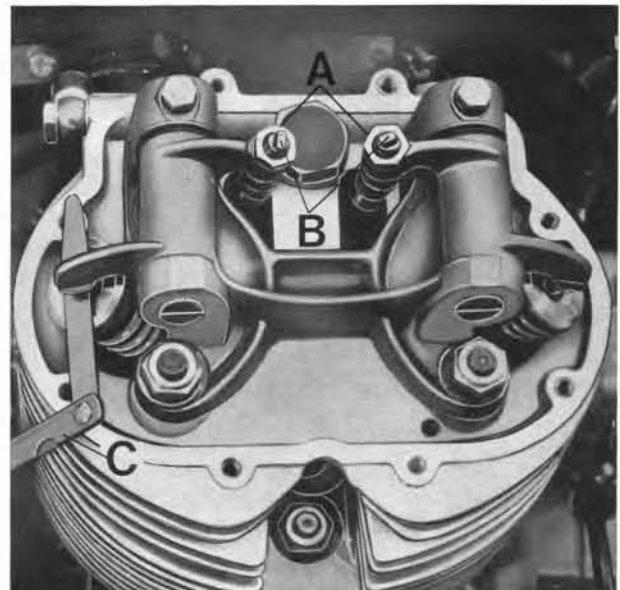
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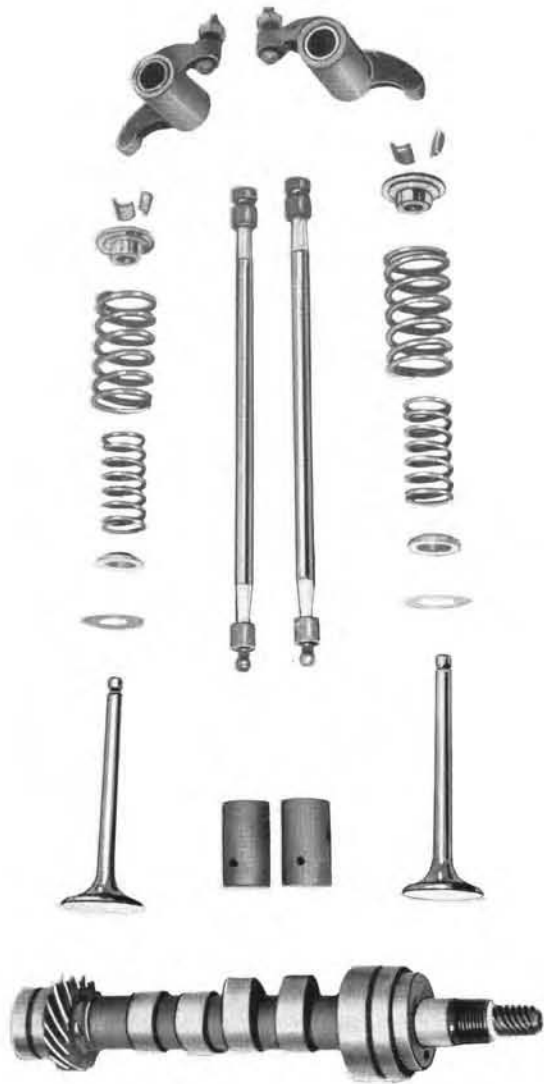
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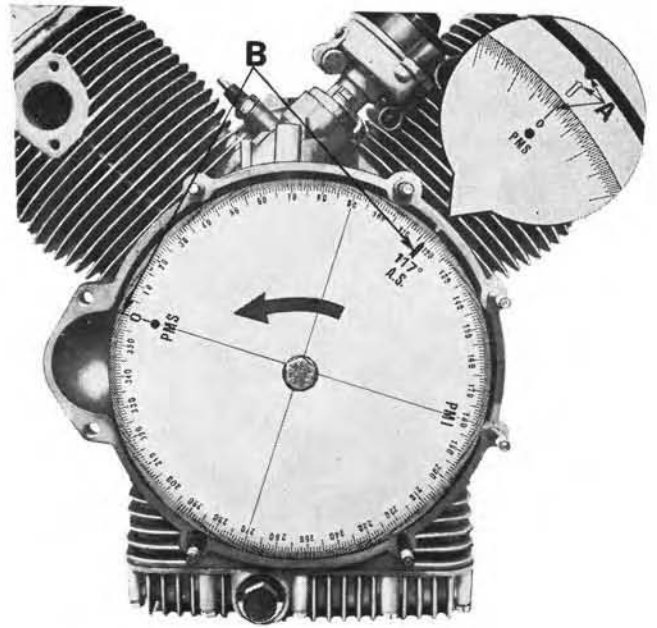
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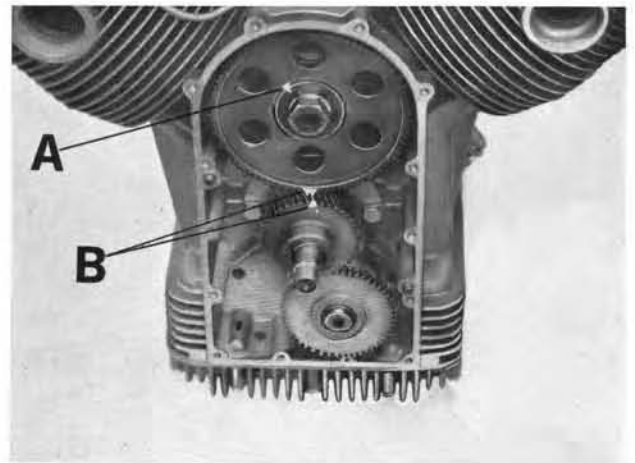
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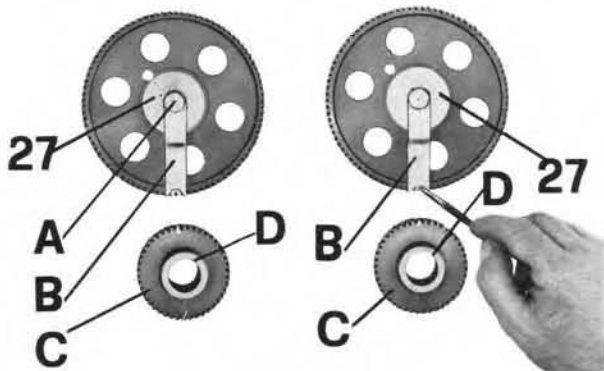
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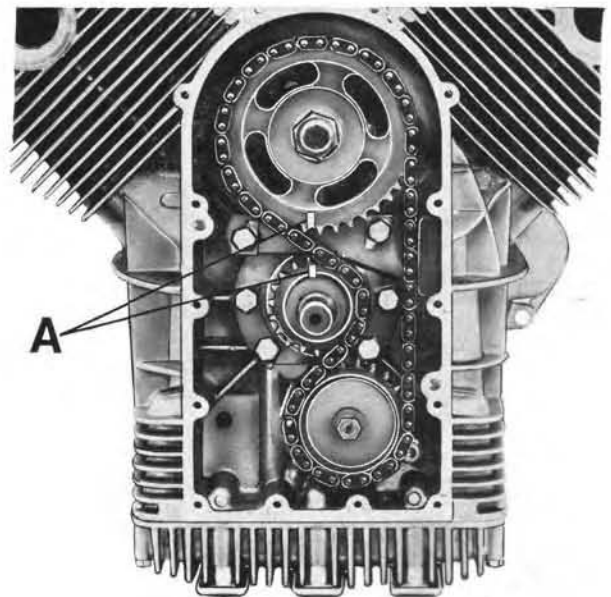
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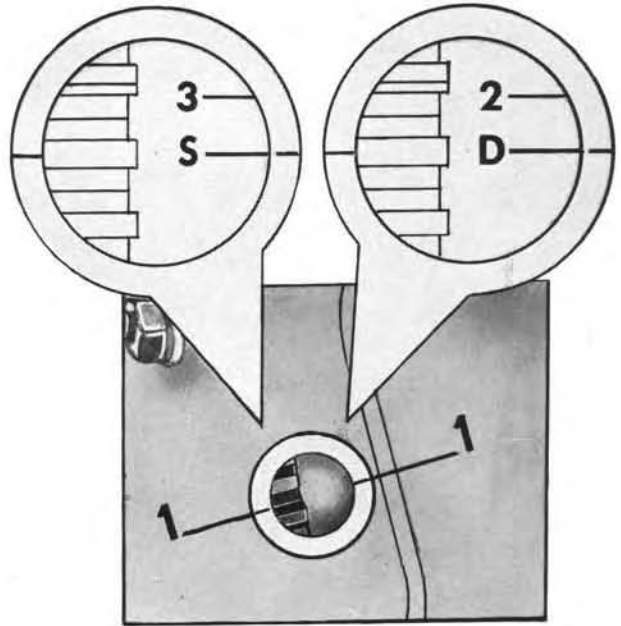
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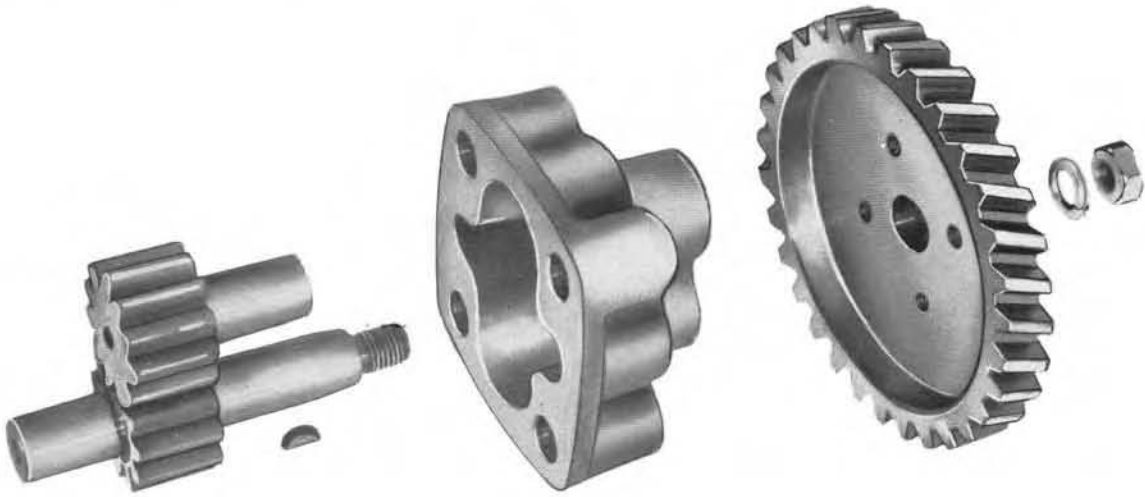
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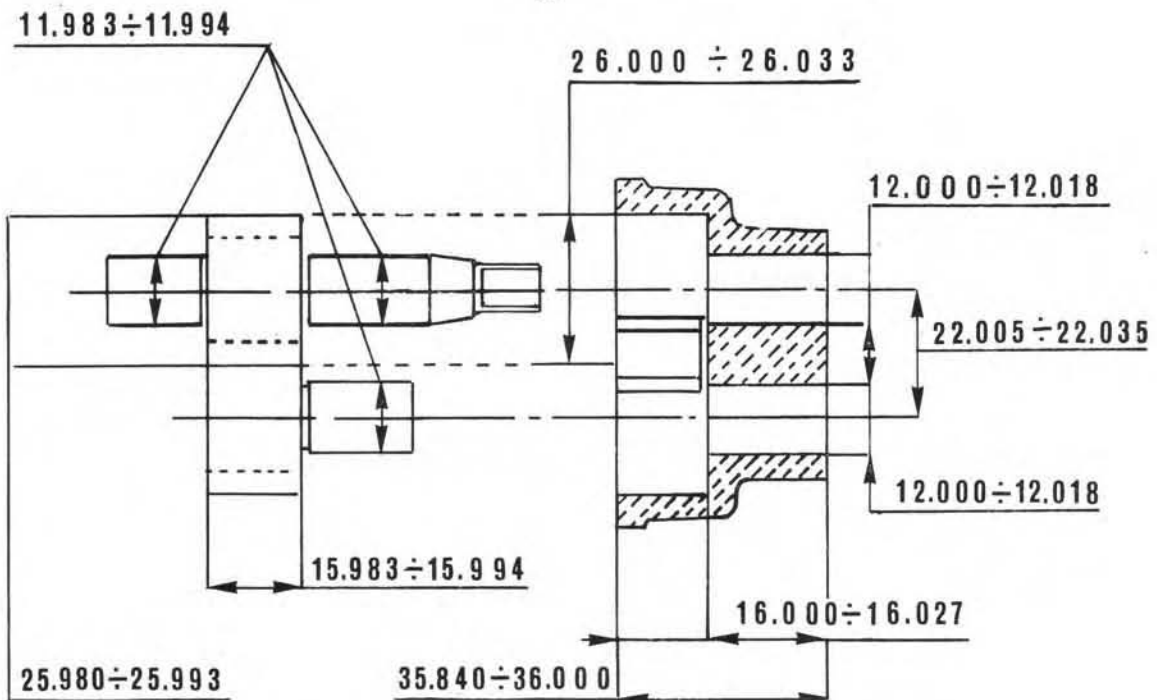
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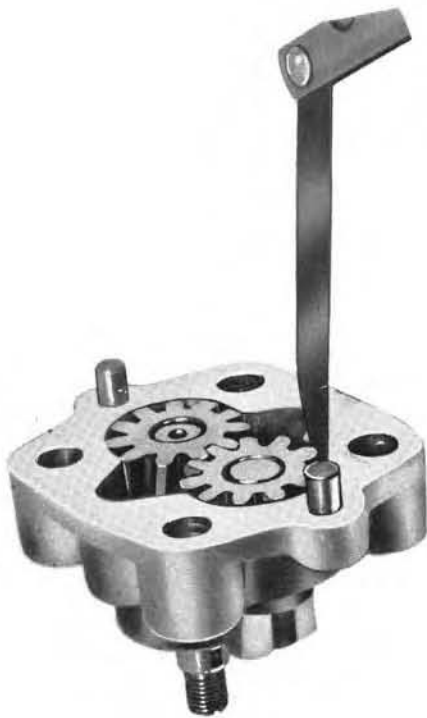
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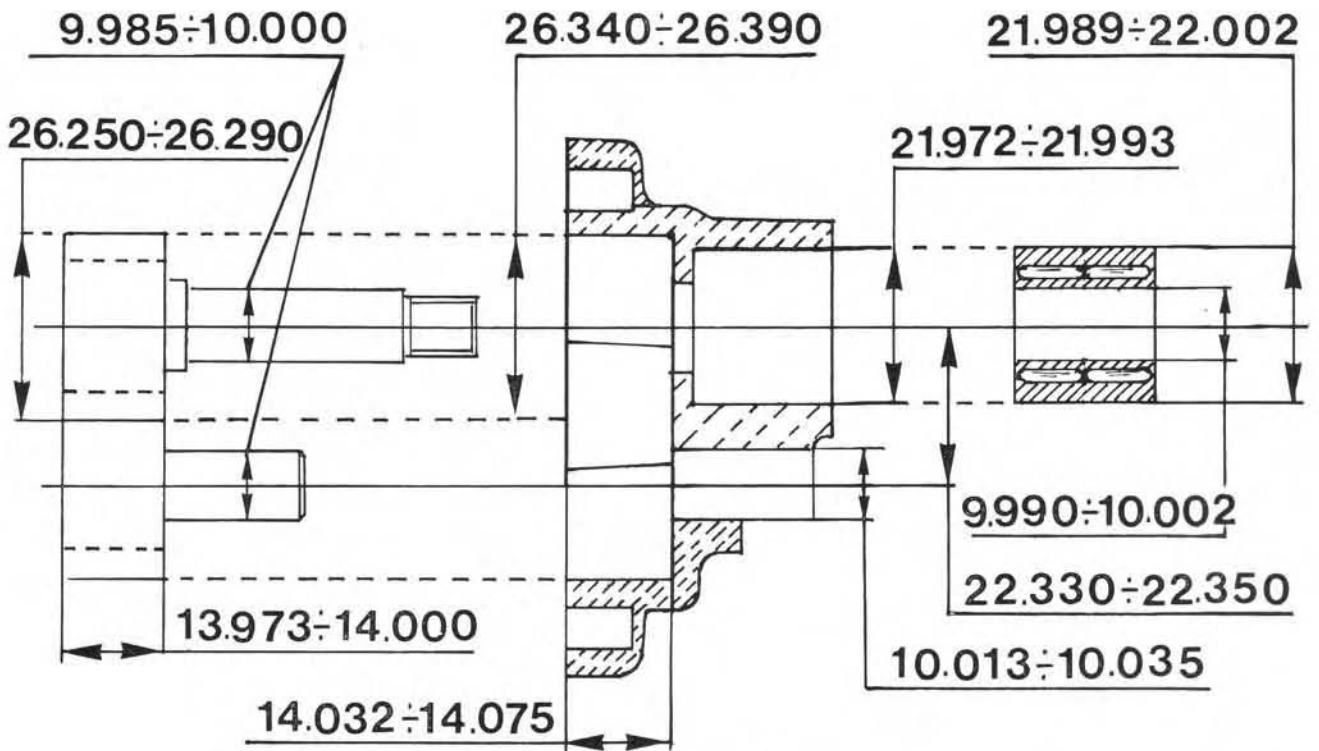
67



68

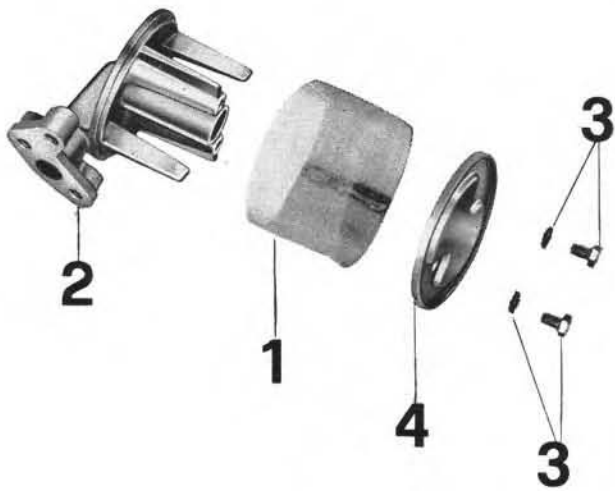


69

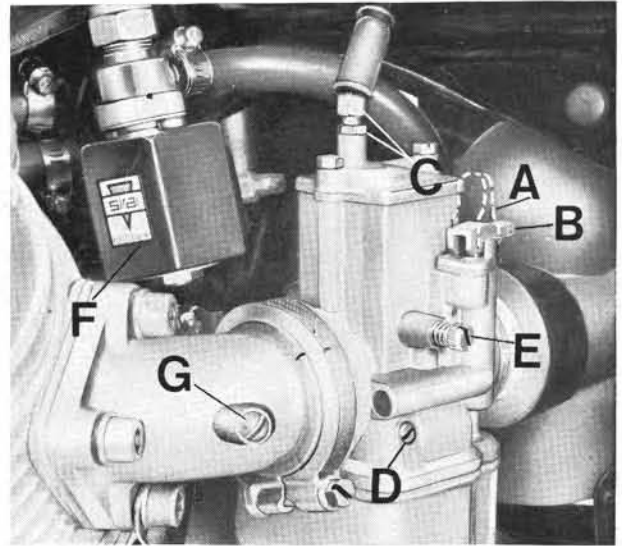


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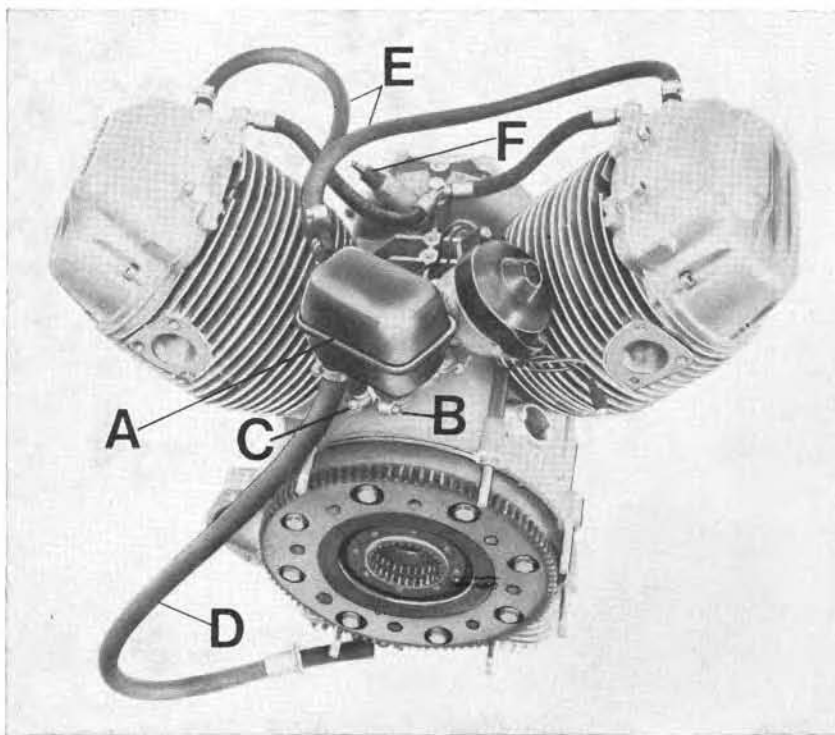




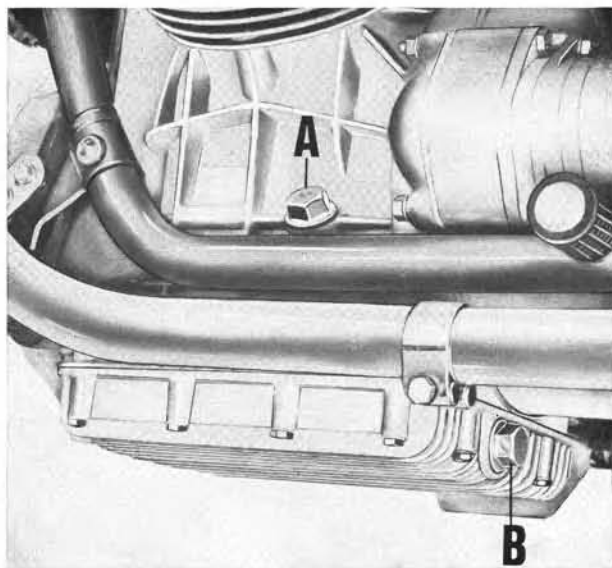
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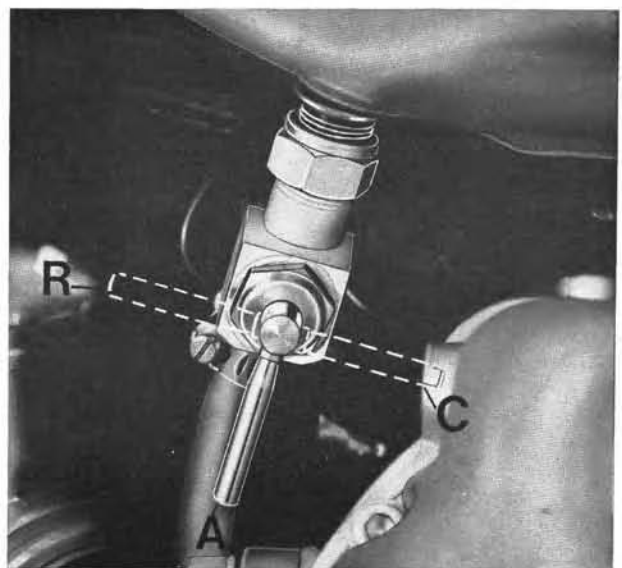
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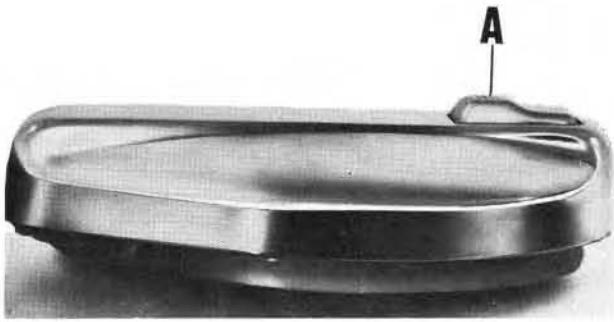
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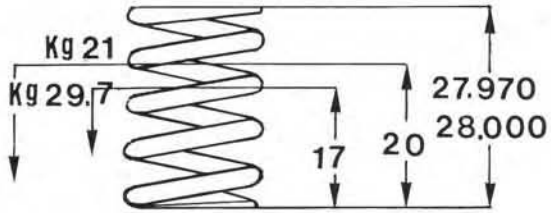
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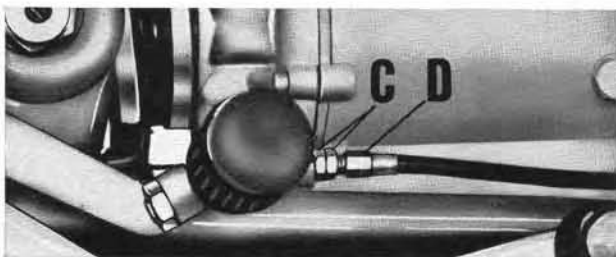
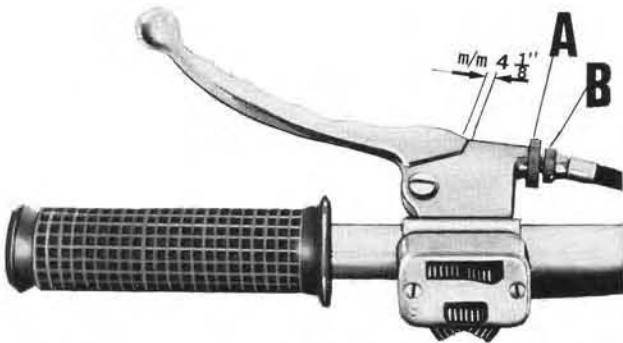
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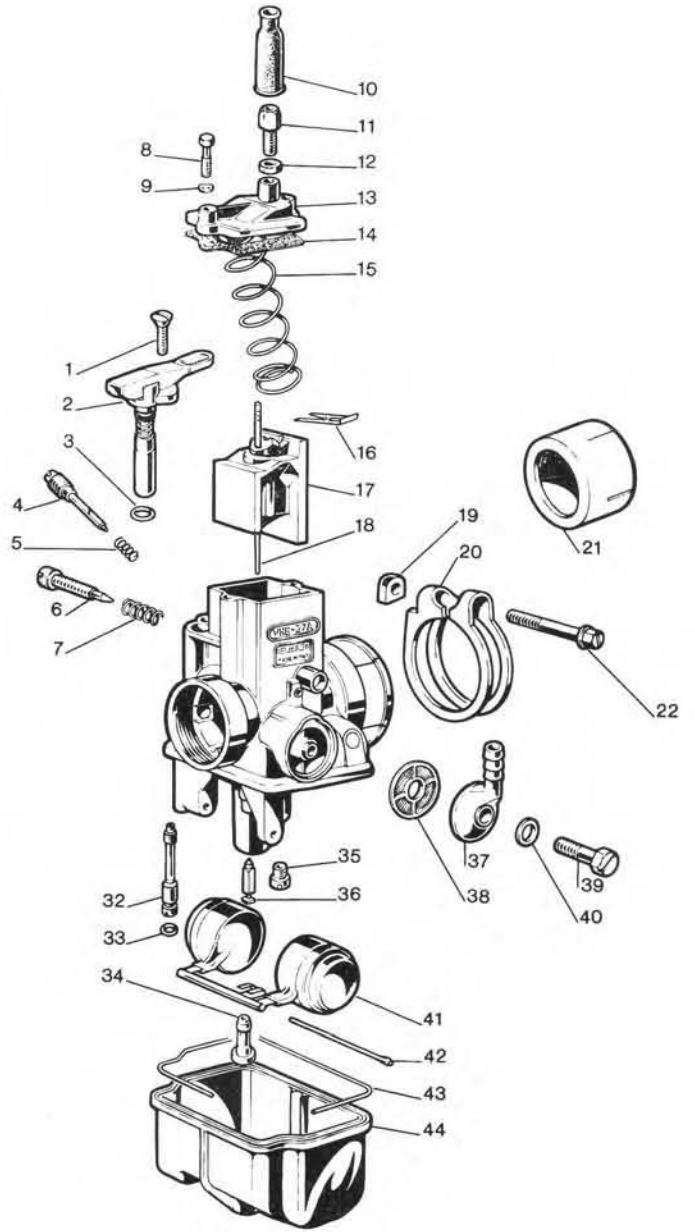
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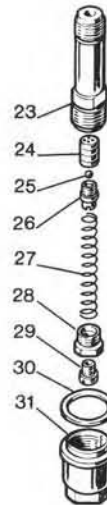
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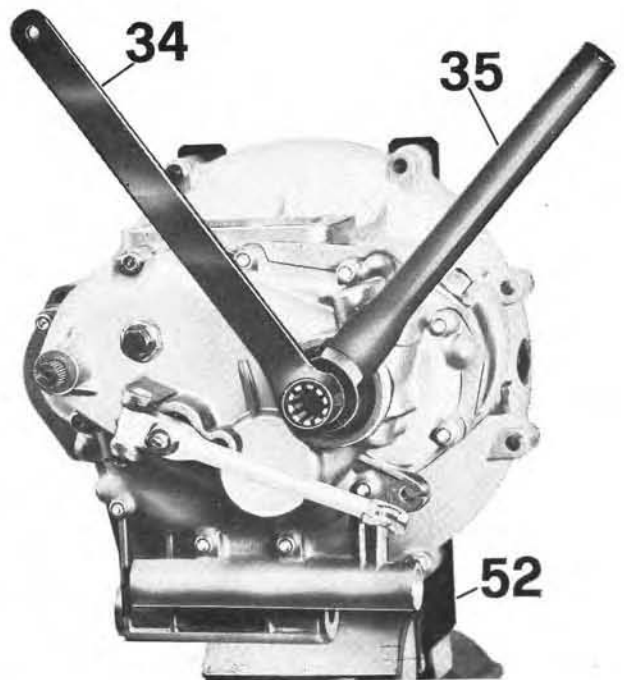
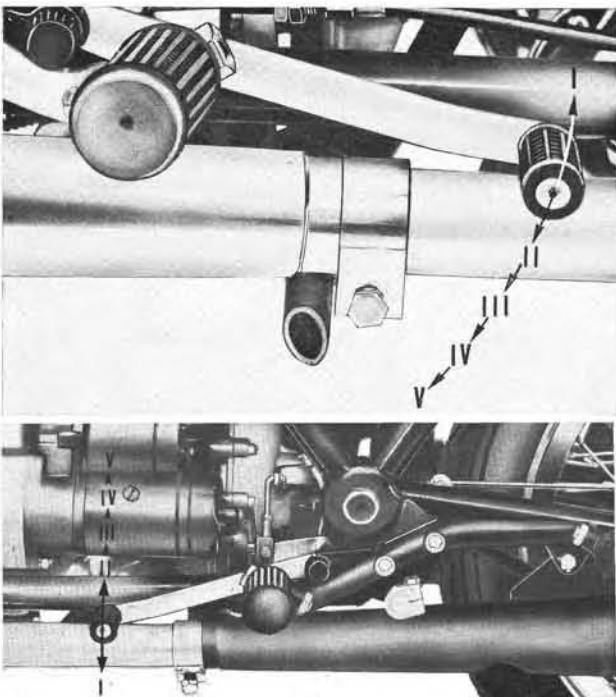
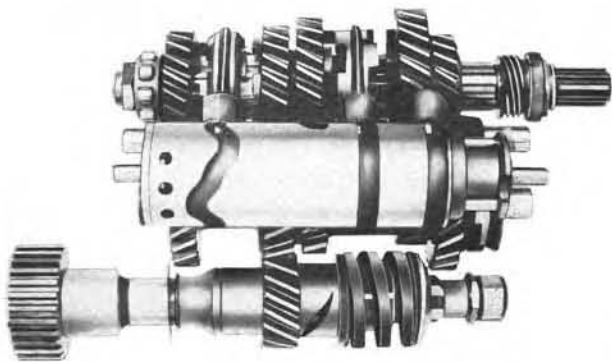
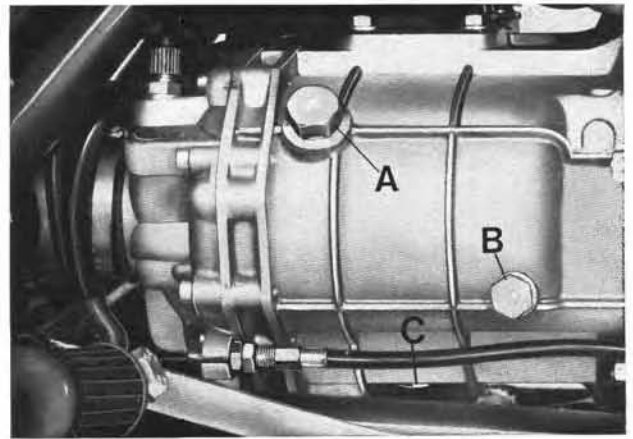
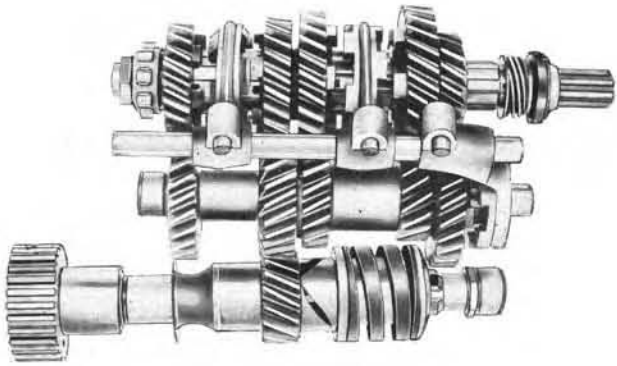
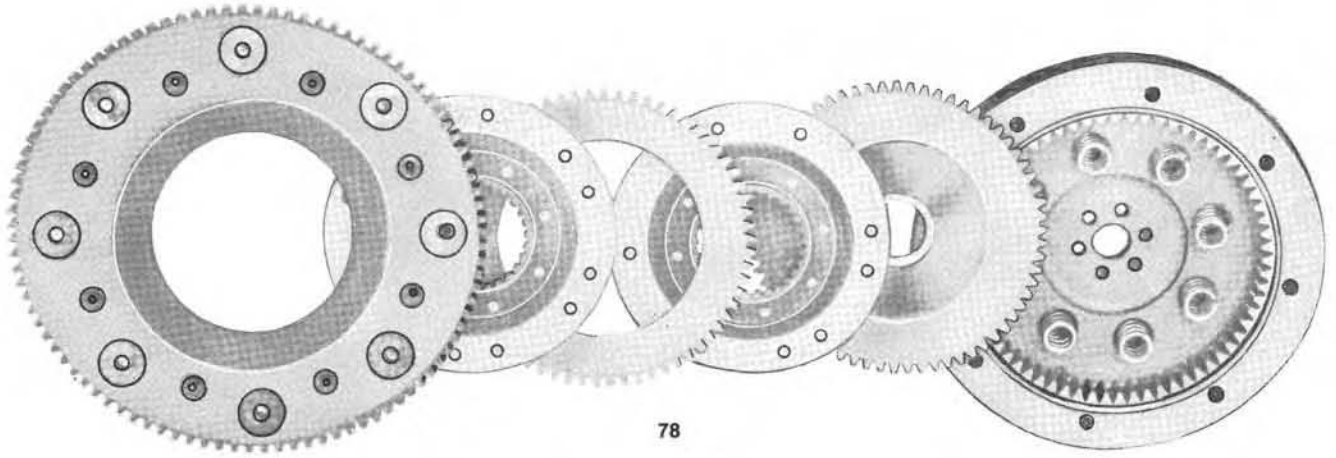


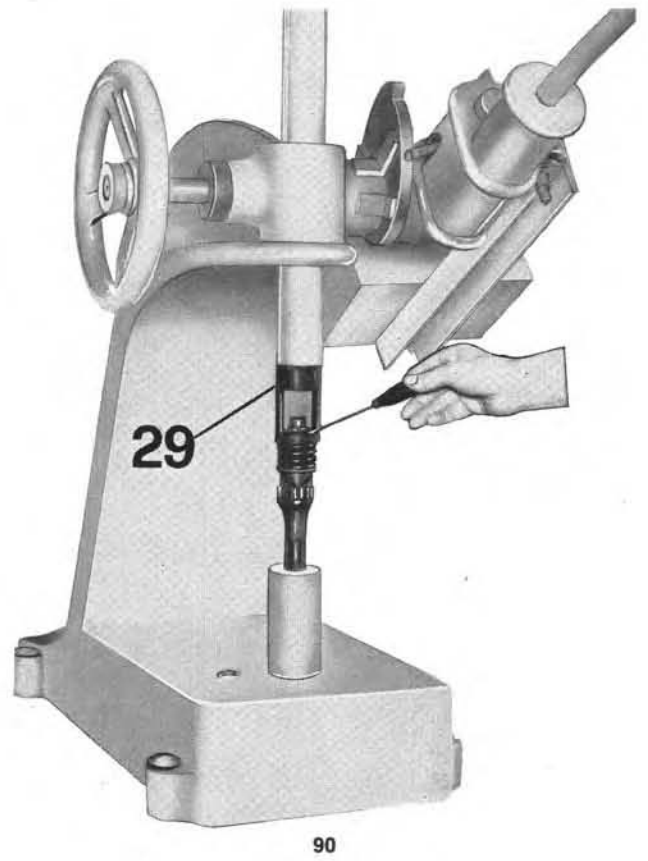
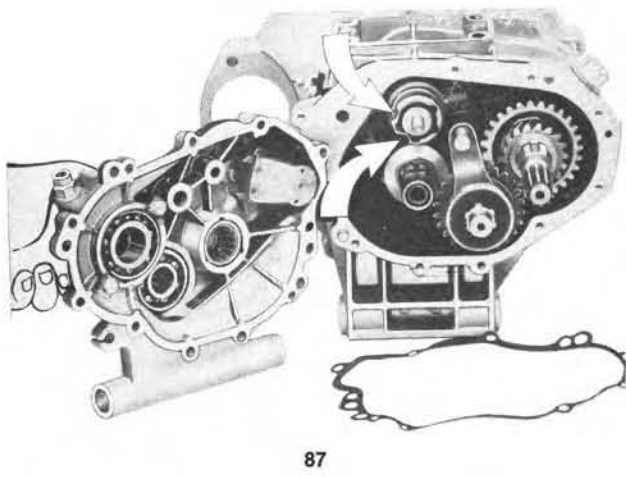
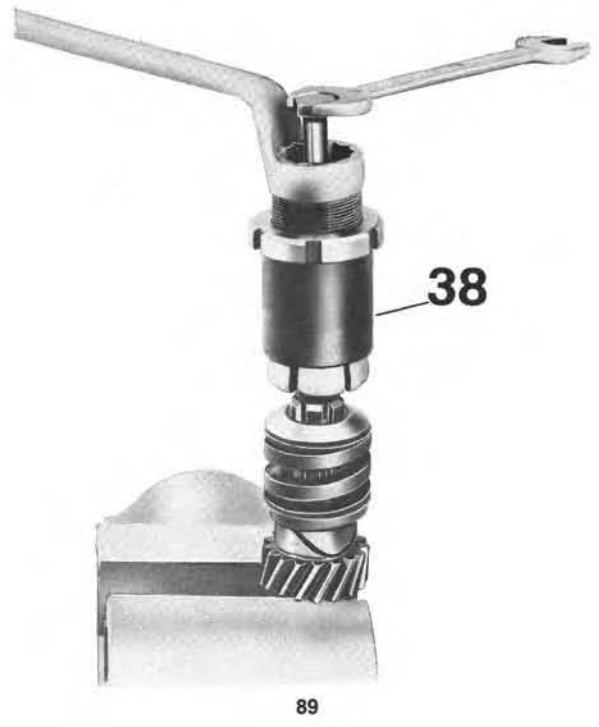
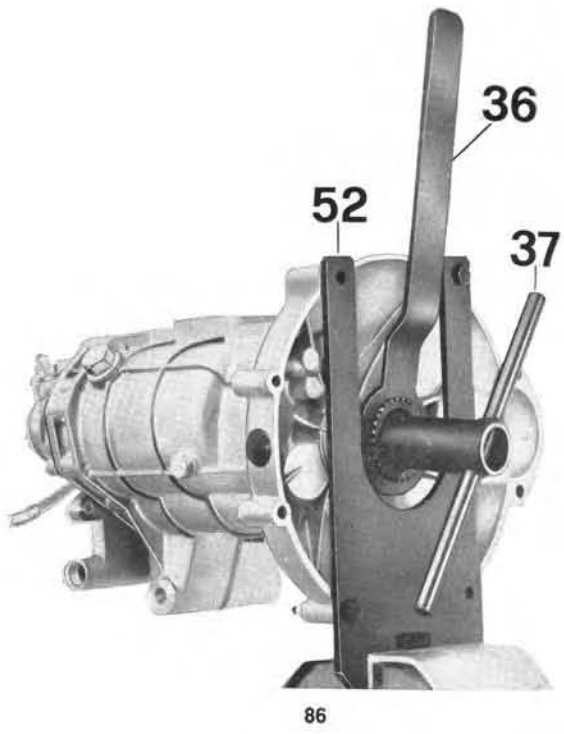
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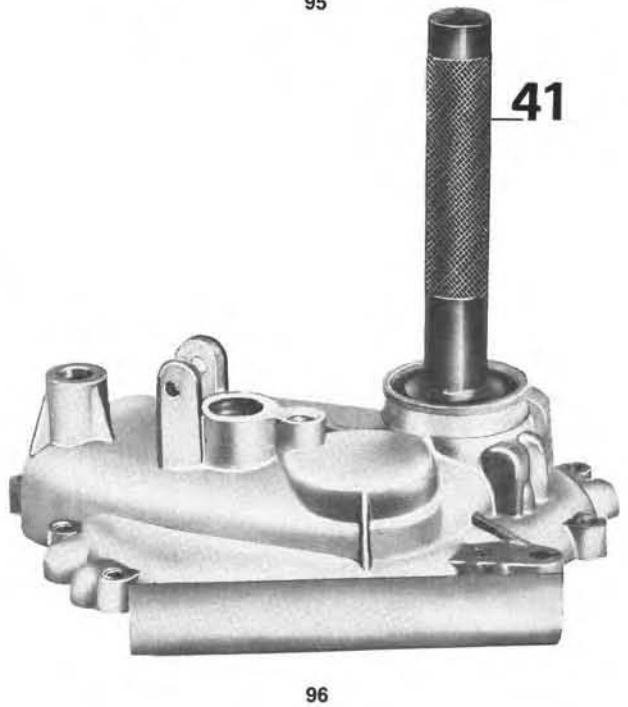
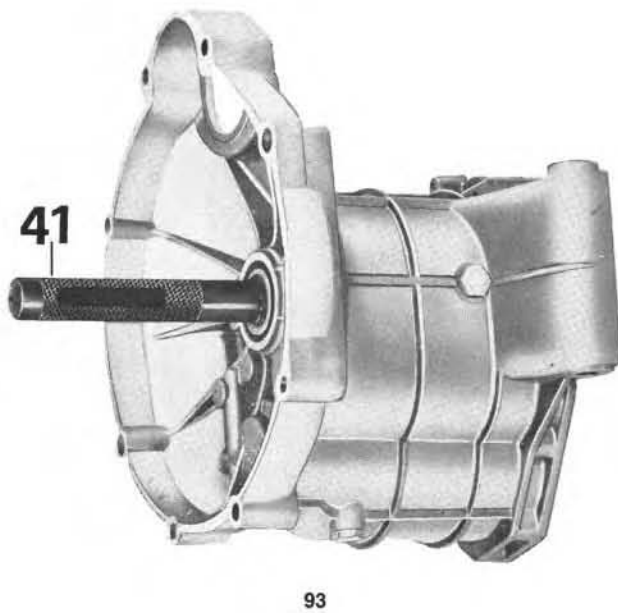
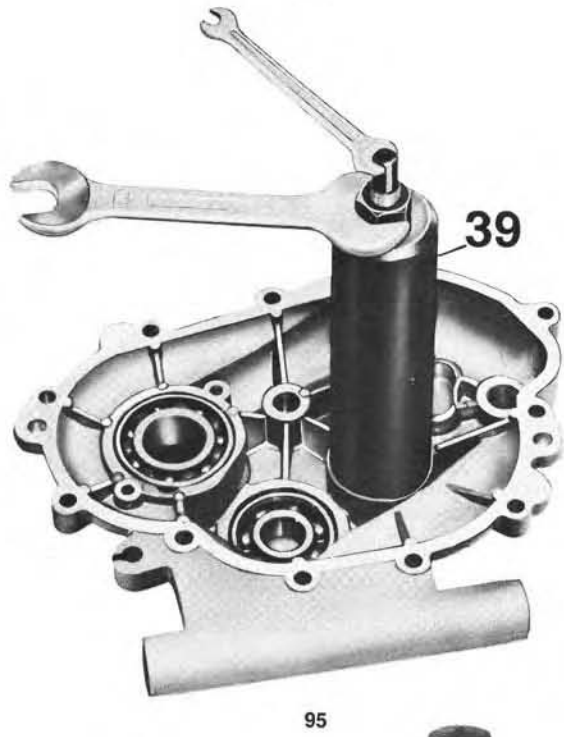
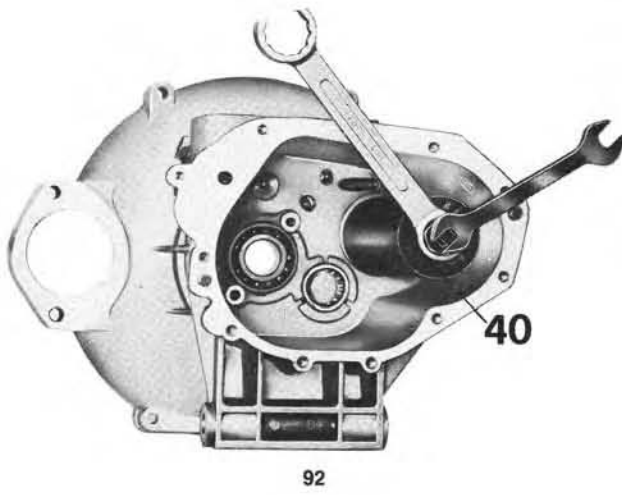
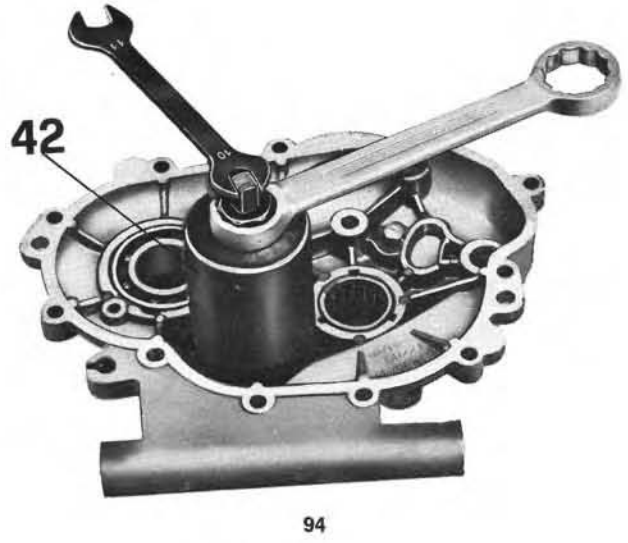
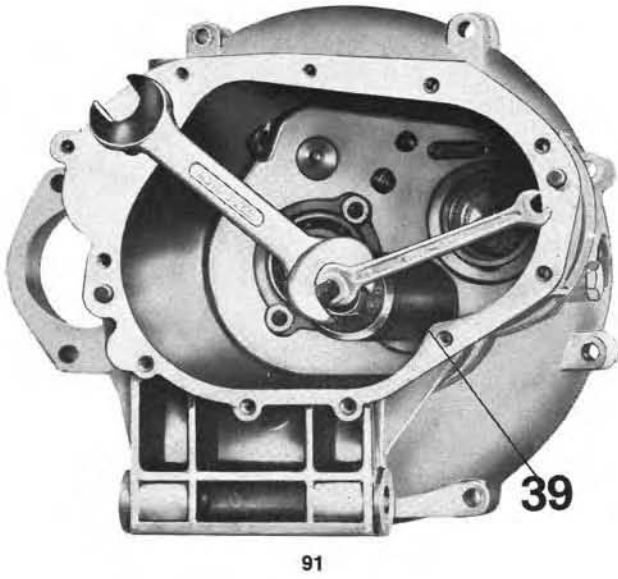


77

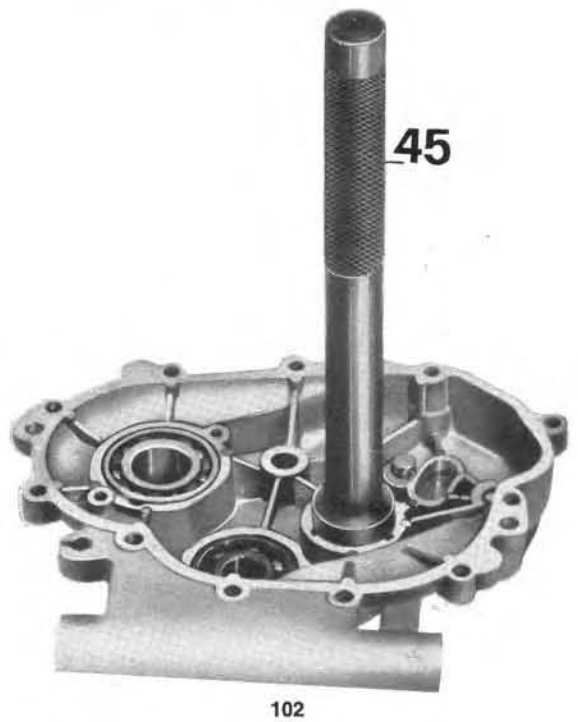
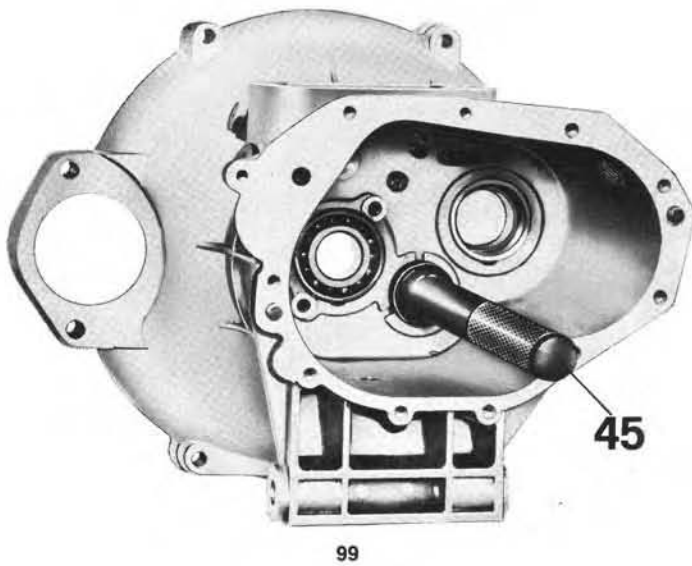
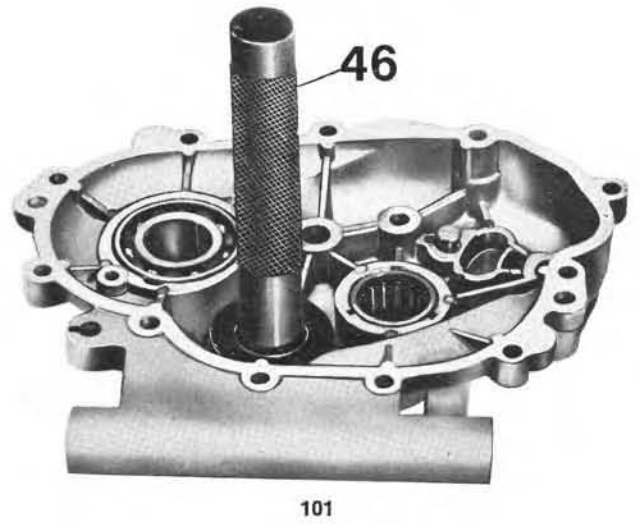
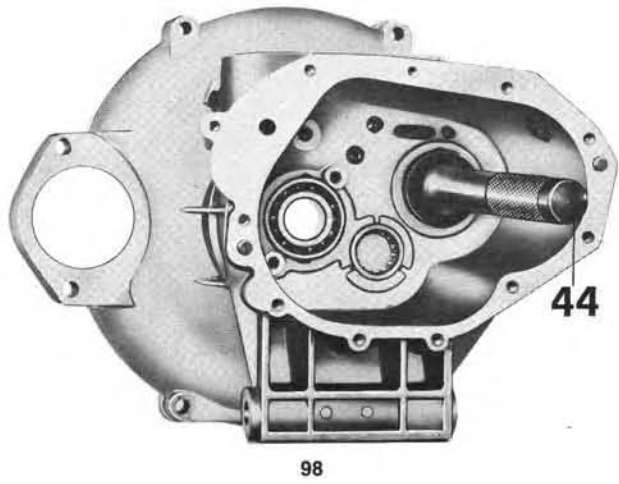
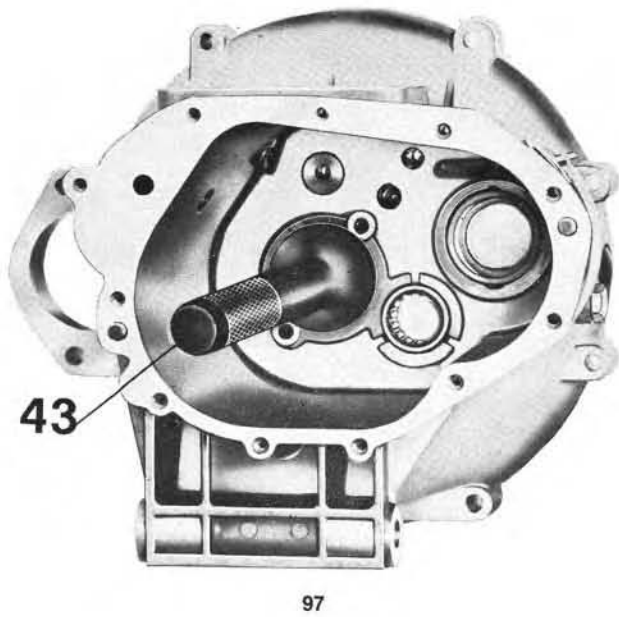




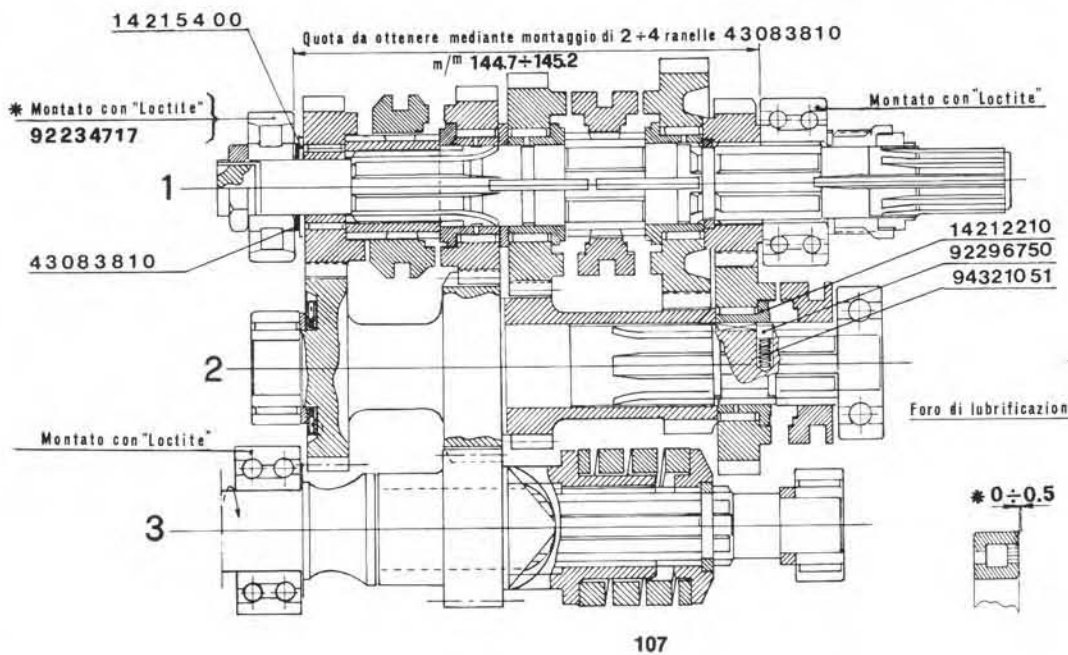
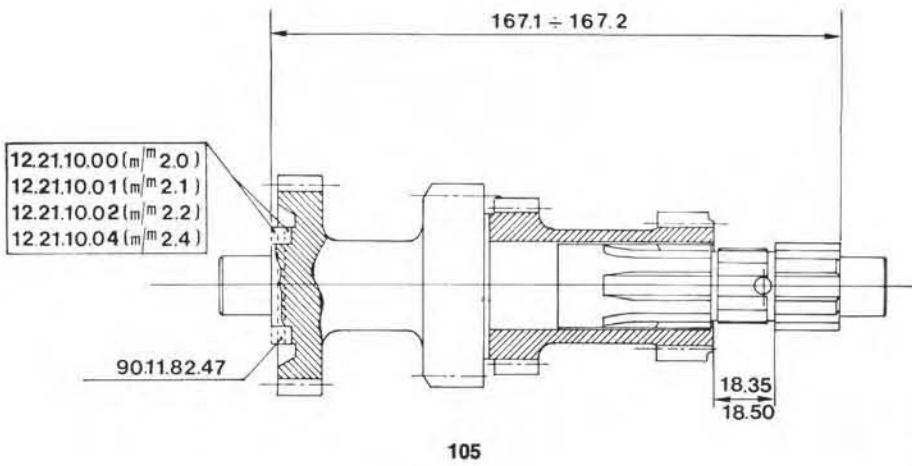
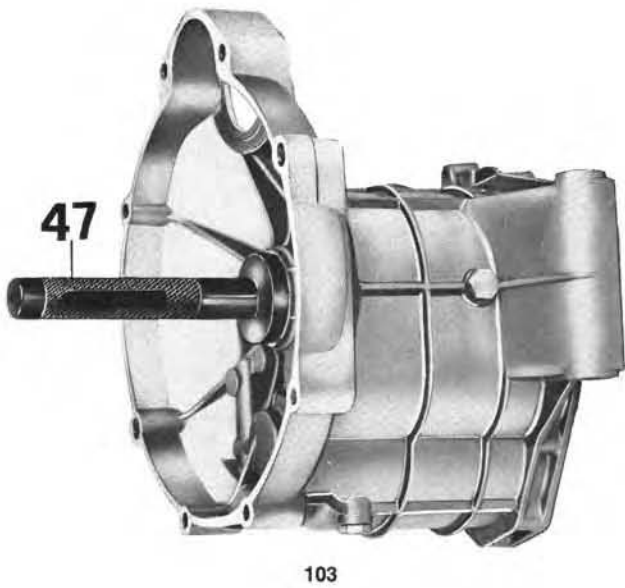


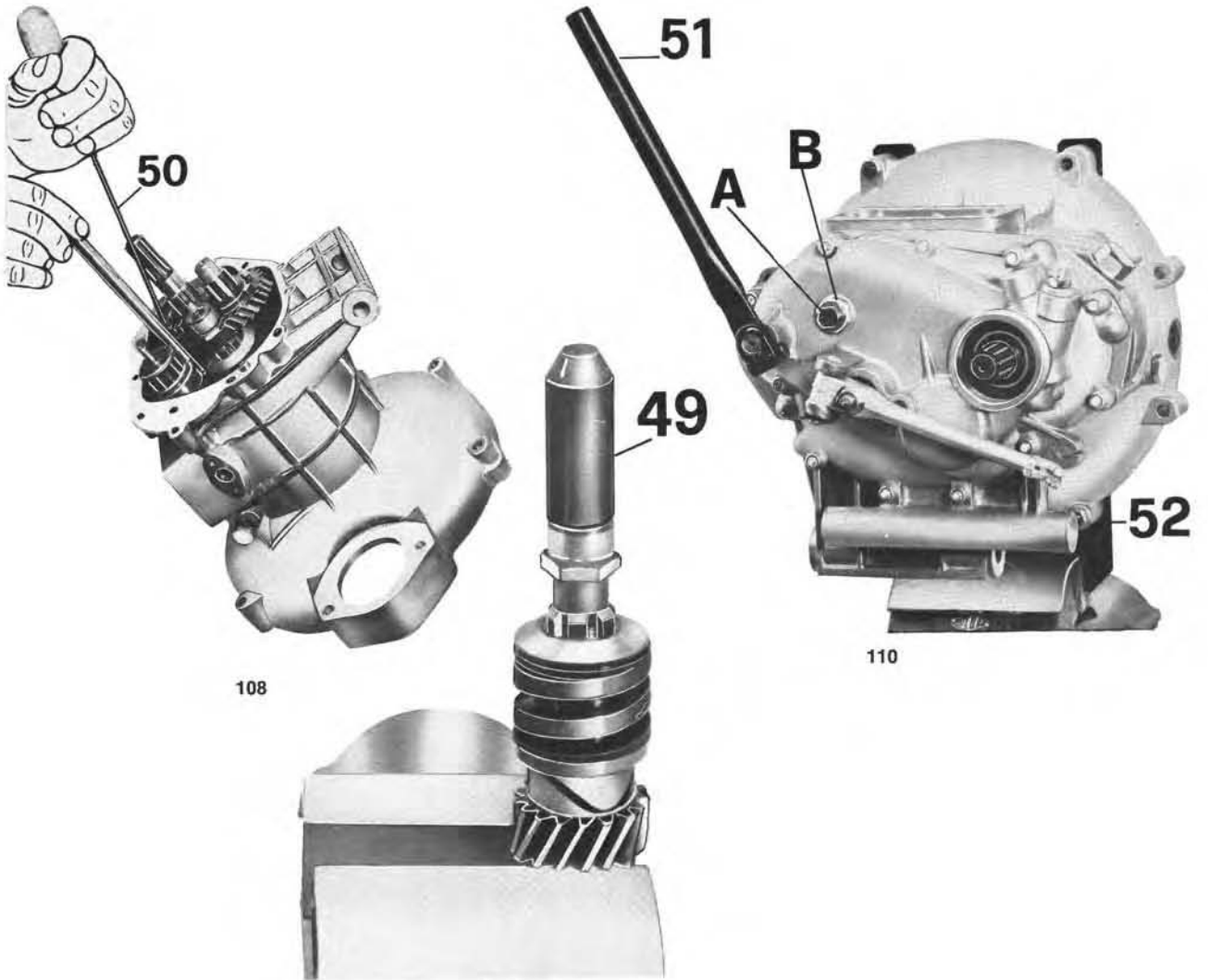








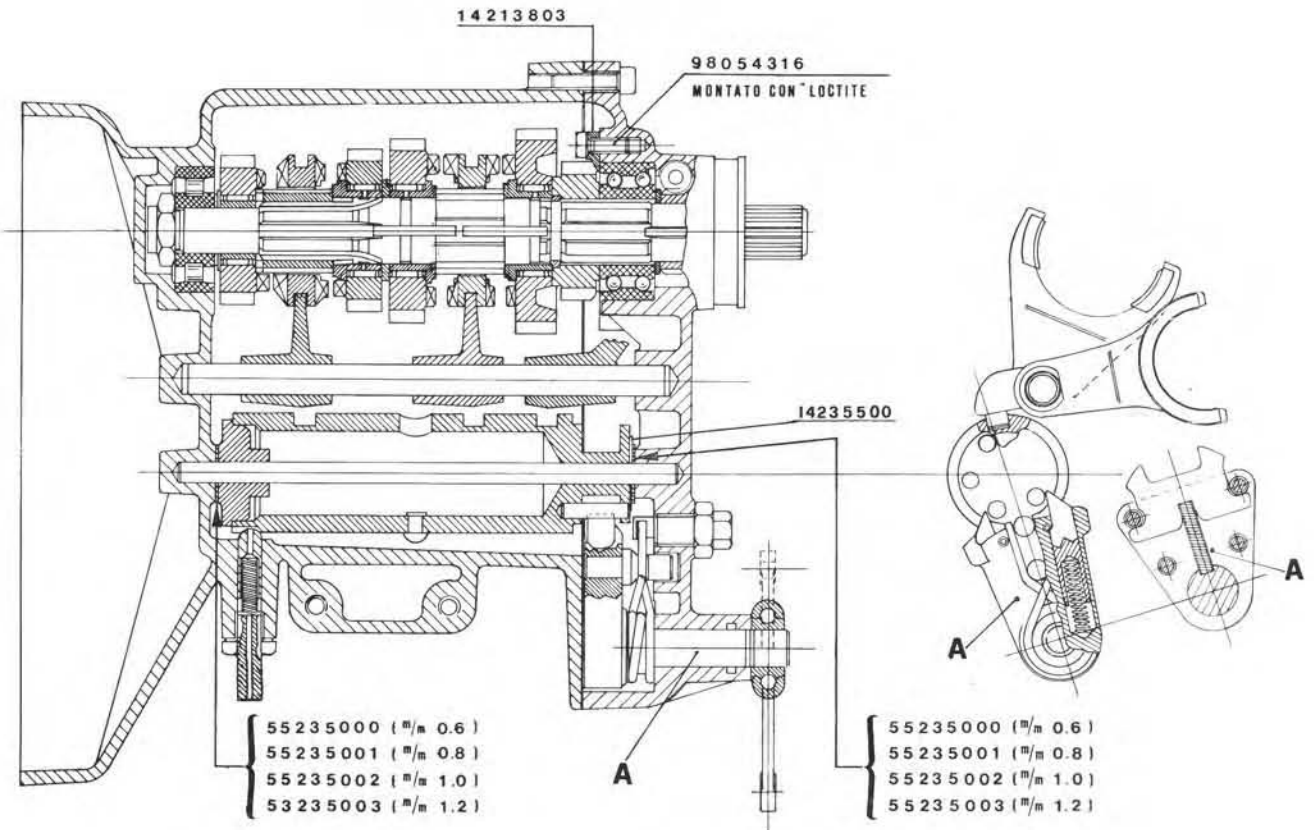




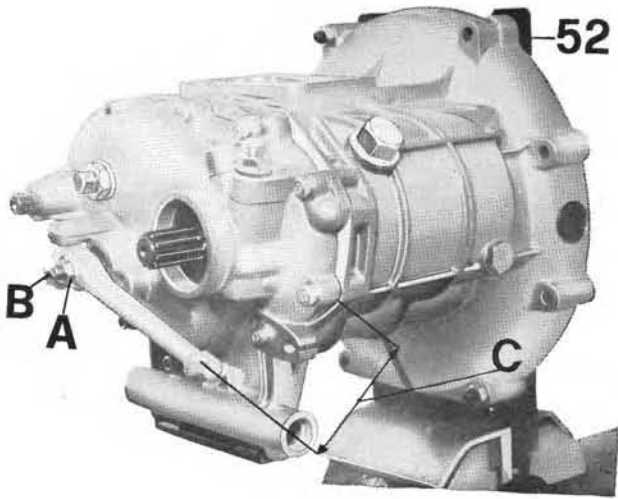
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109

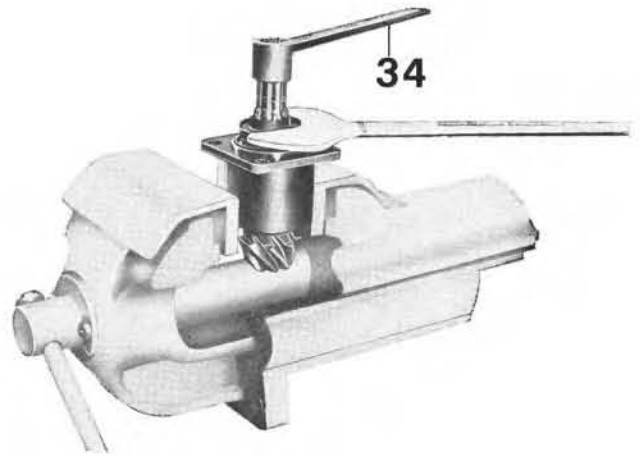
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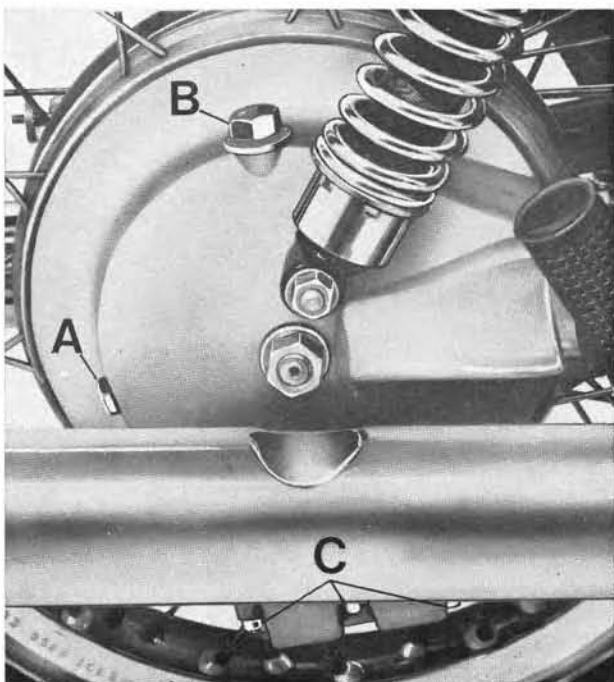
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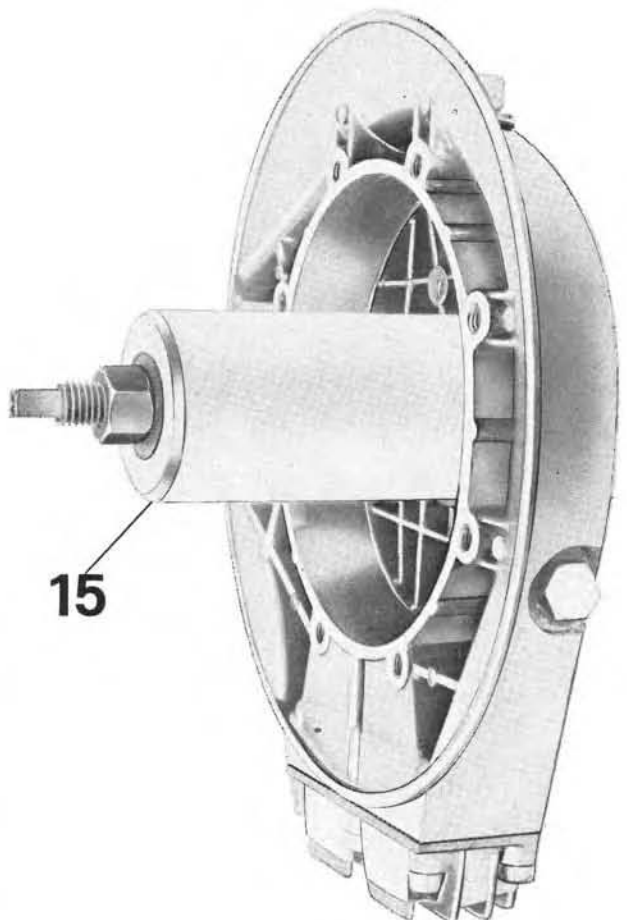
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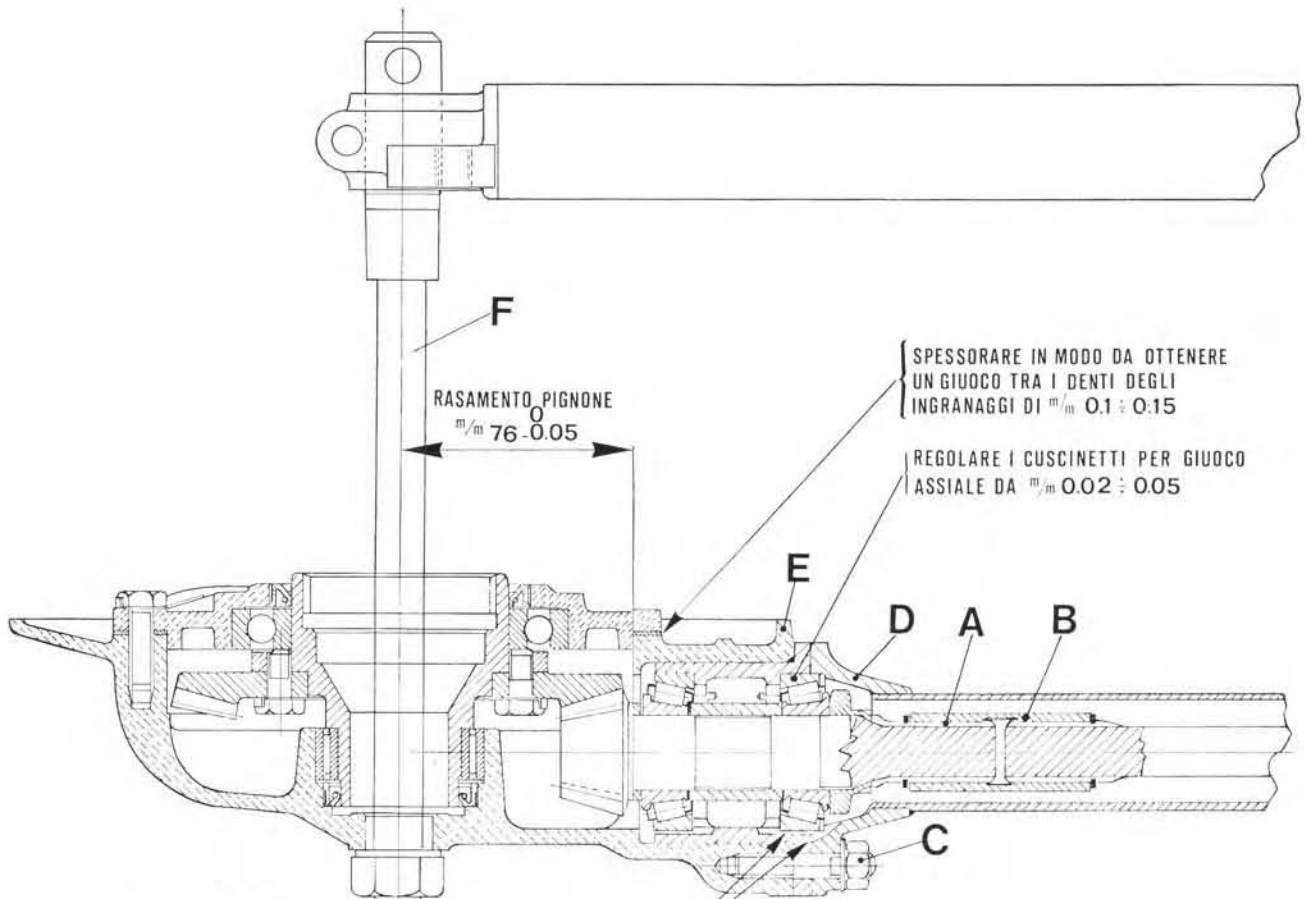
113/1



113

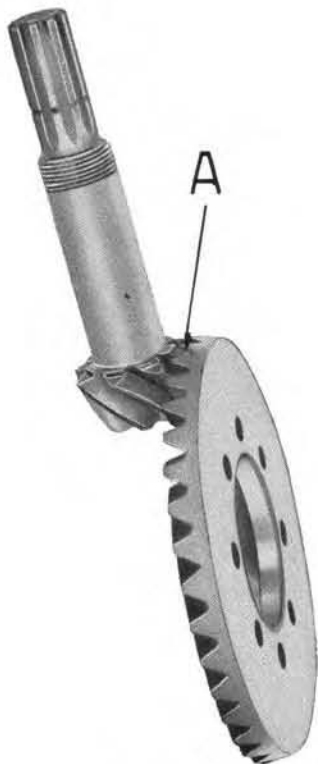


114



NB. NEL MONTAGGIO CURARE CHE GLI SCARICHI OLIO SULLA CUSTODIA E GUARNIZIONE SIANO ORIENTATI CON GLI SCARICHI DELLA FLANGIA FORCELLONE ONDE PERMETTERE IL PASSAGGIO DELL'OLIO.

115



116



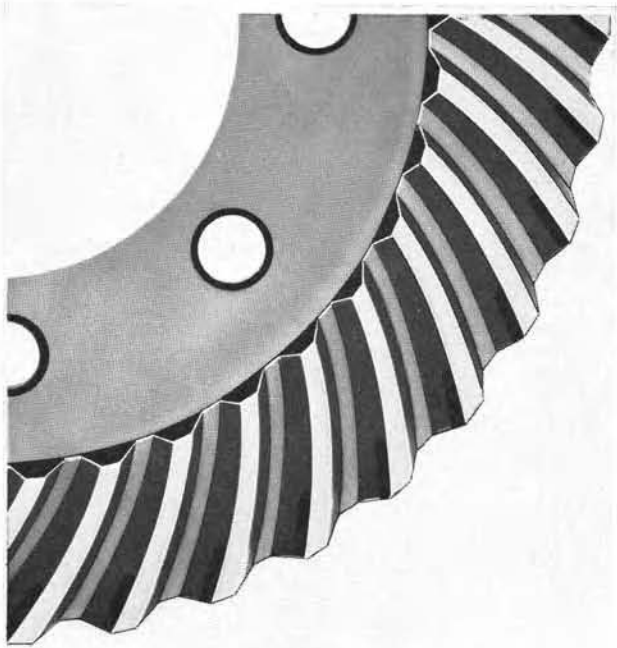
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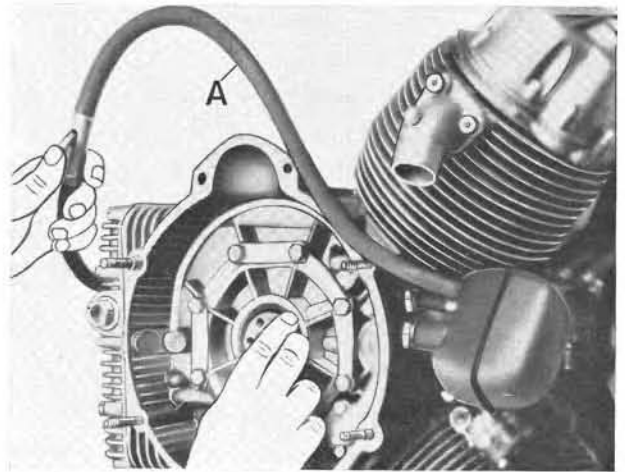
118



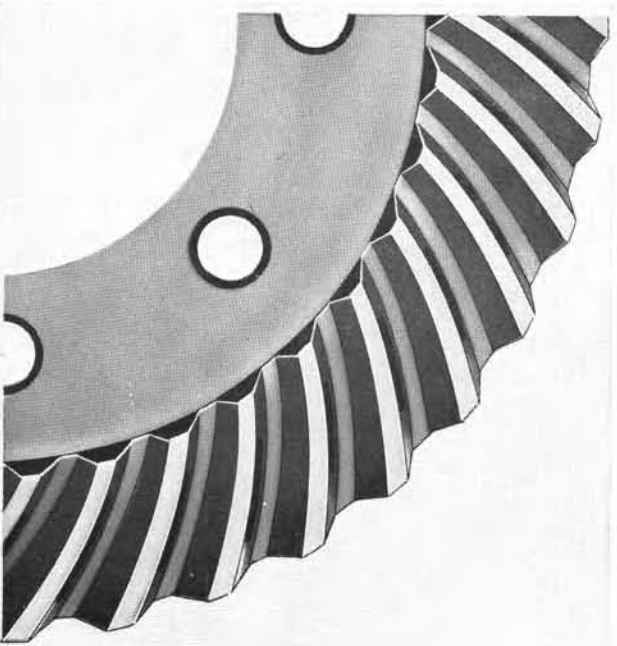
121



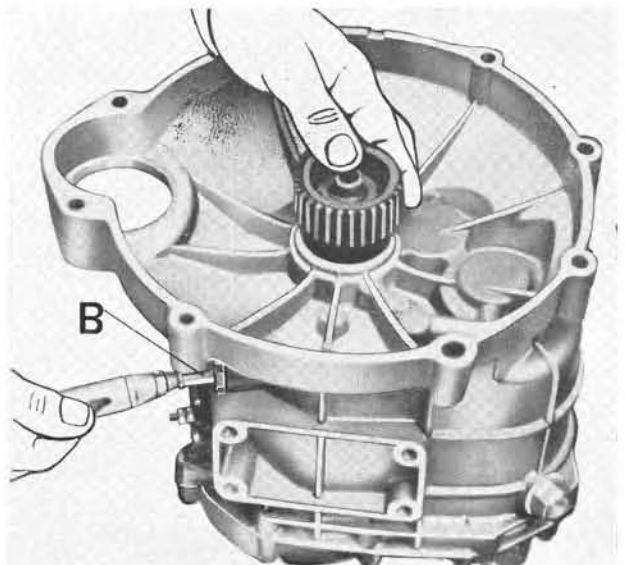
119



122



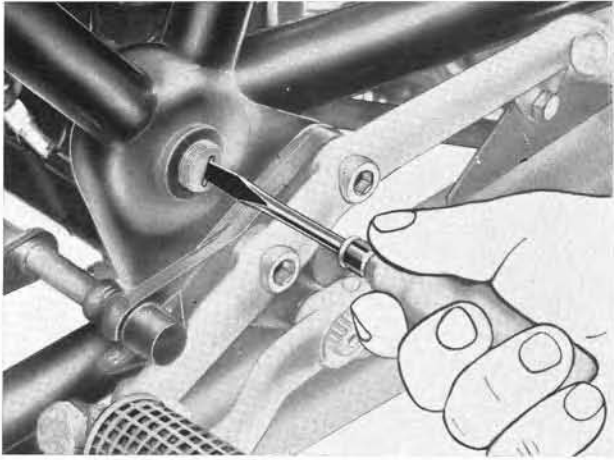
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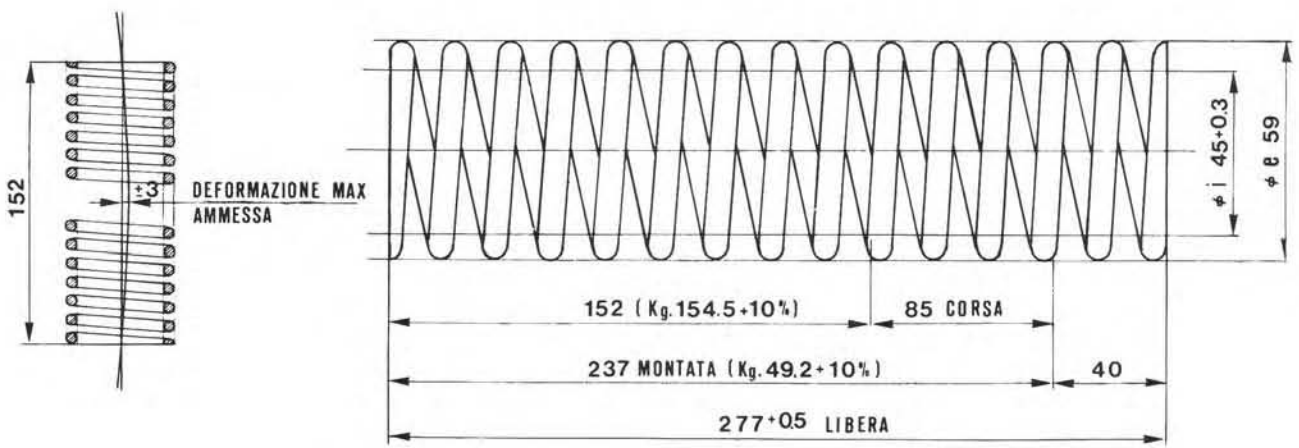
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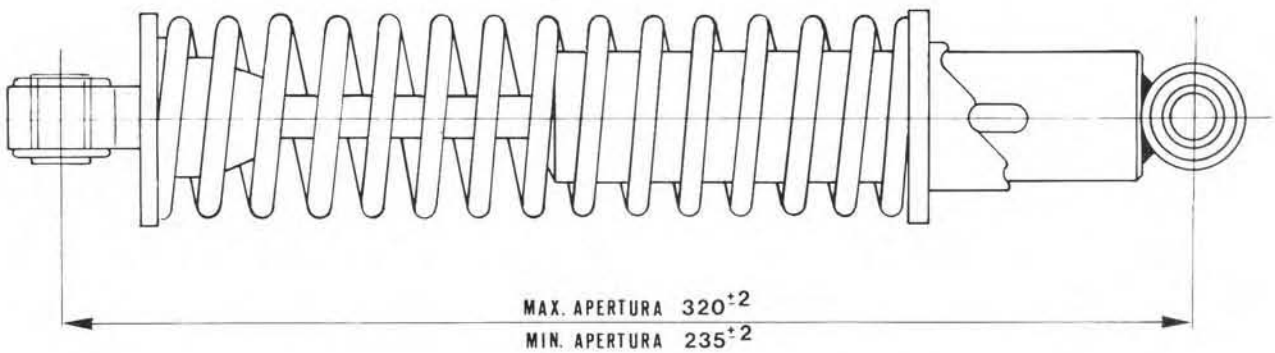




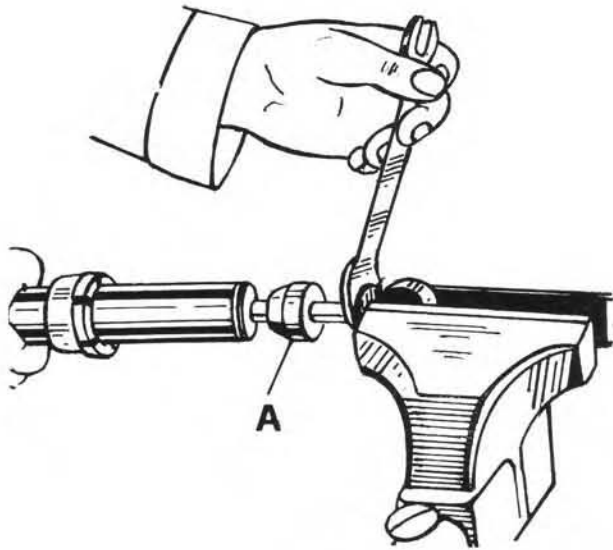
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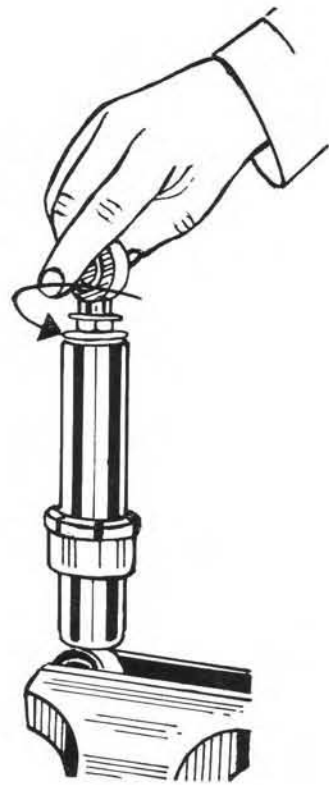
128



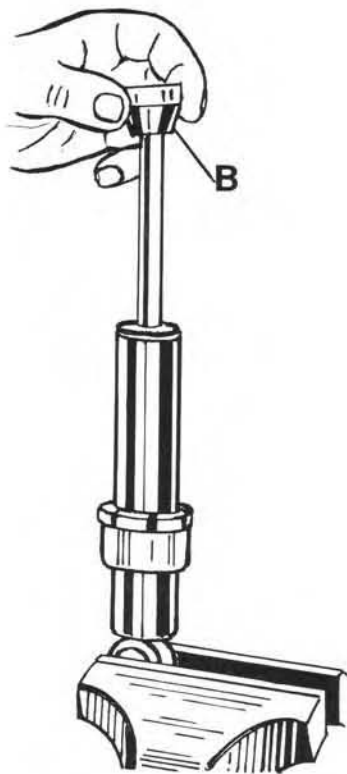
129



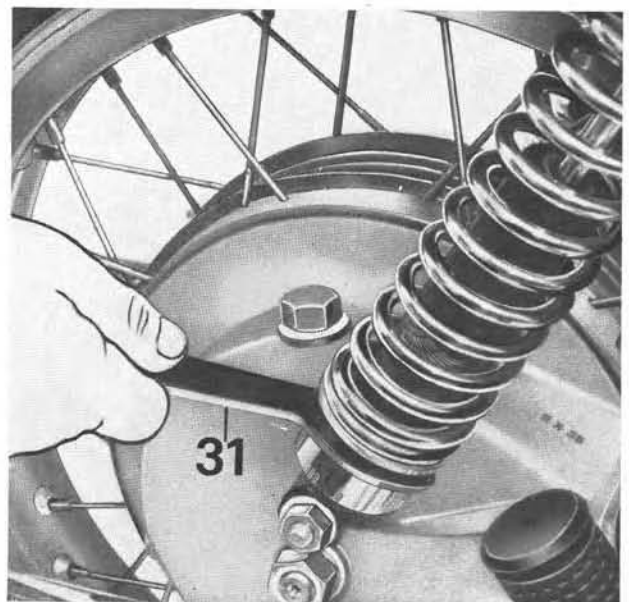
130



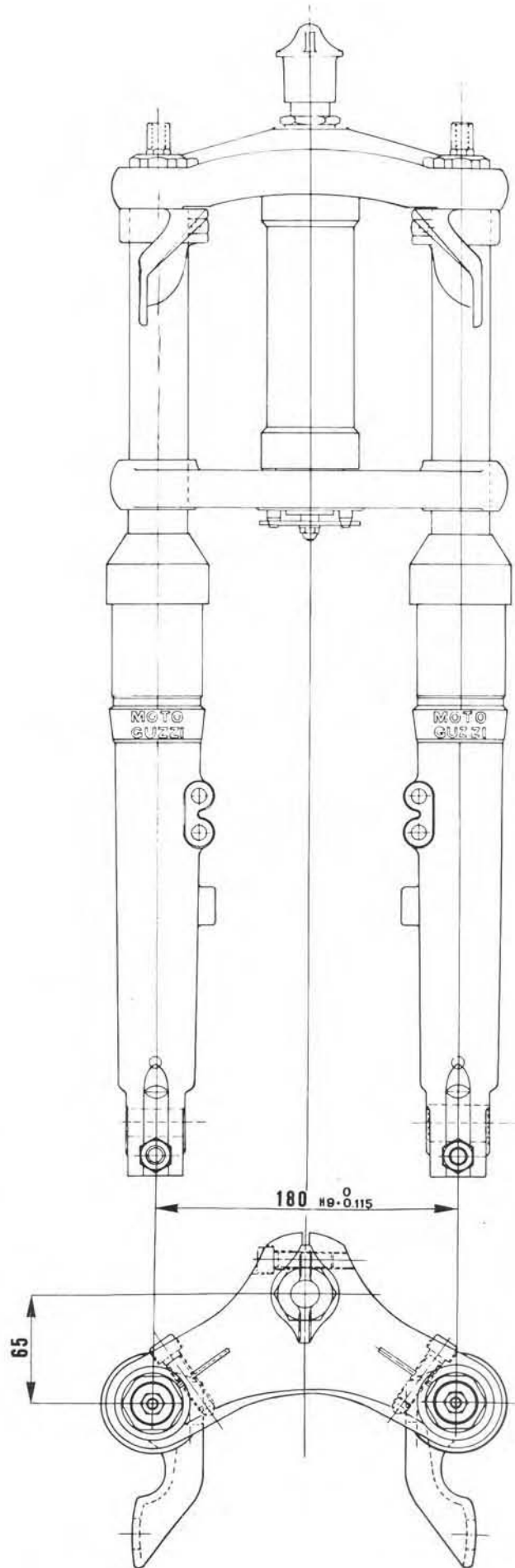
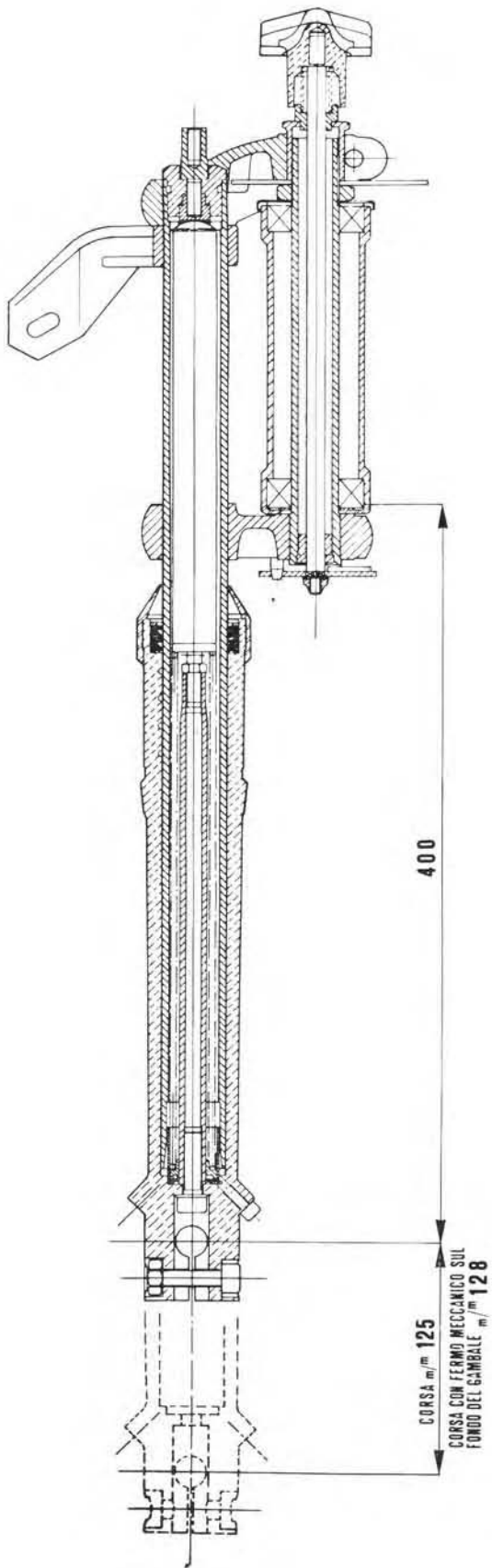
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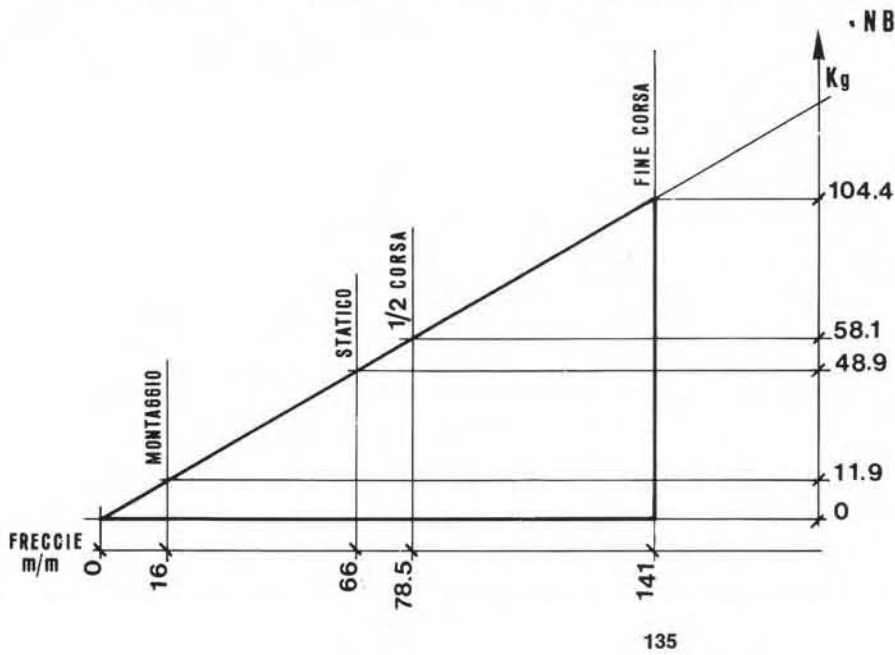
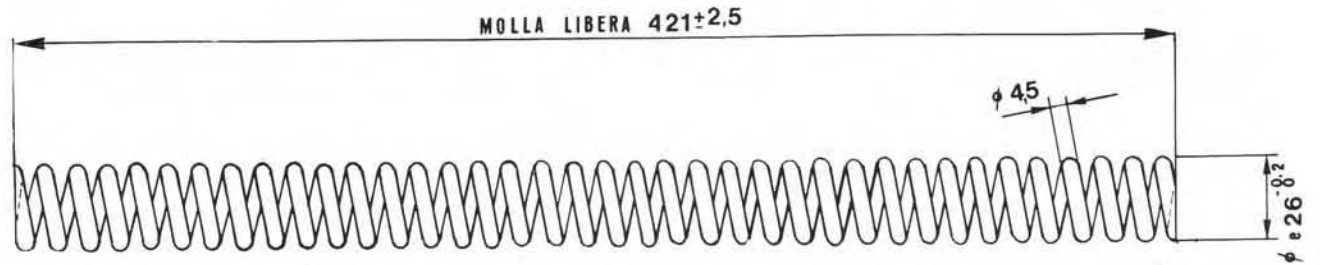


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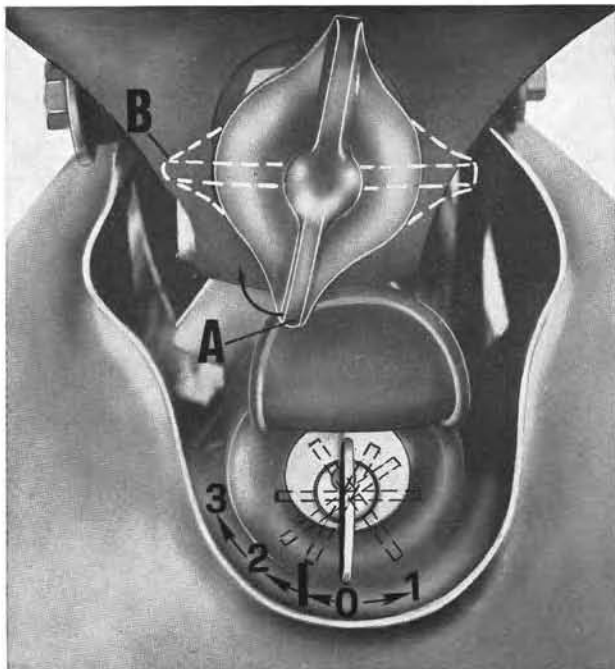


133

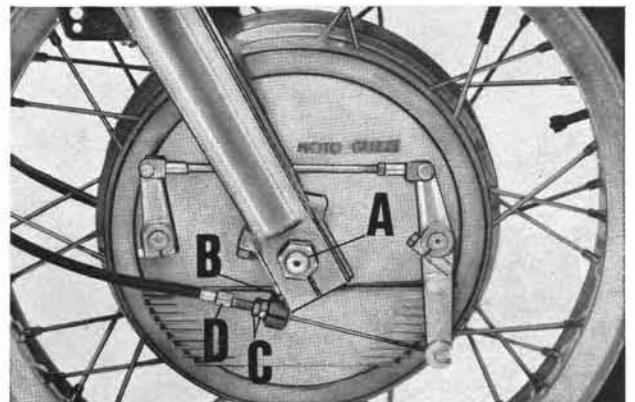
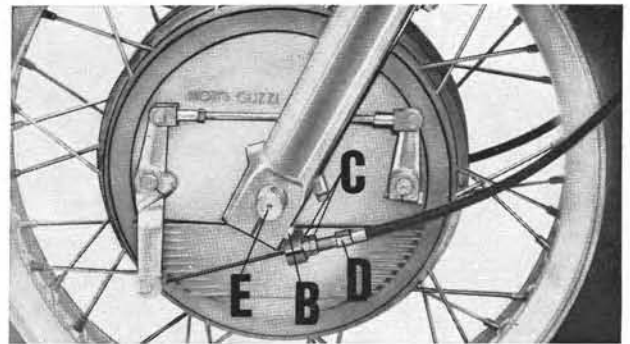




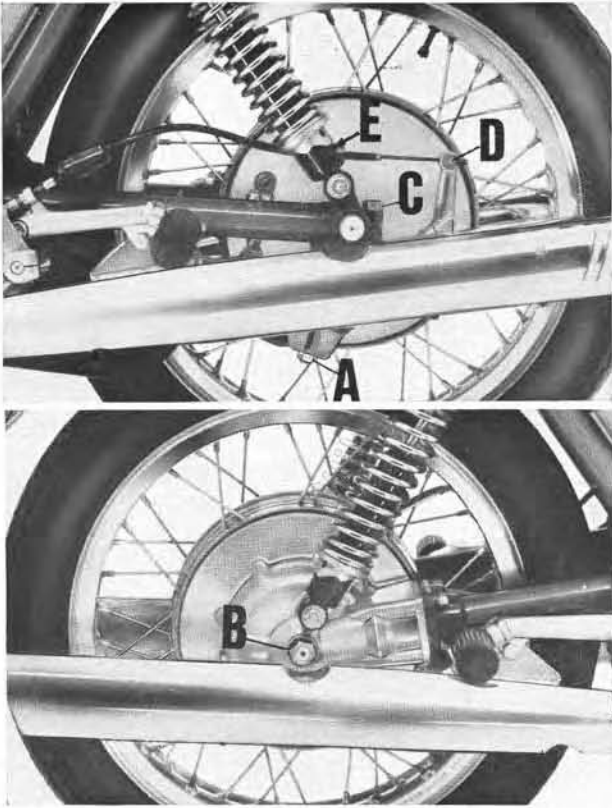
• NB LA MOLLA DEVE ESSERE CONTROLLATA DOPO ESSERE STATATA PORTATA A PACCO (SEDIMENTAZIONE)



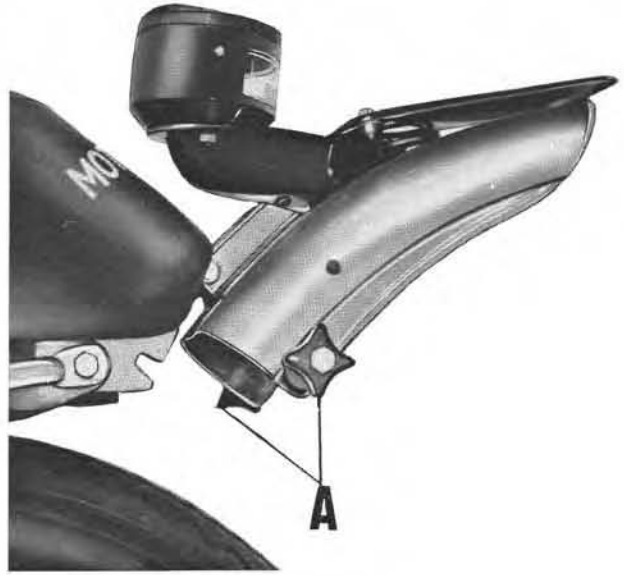
136



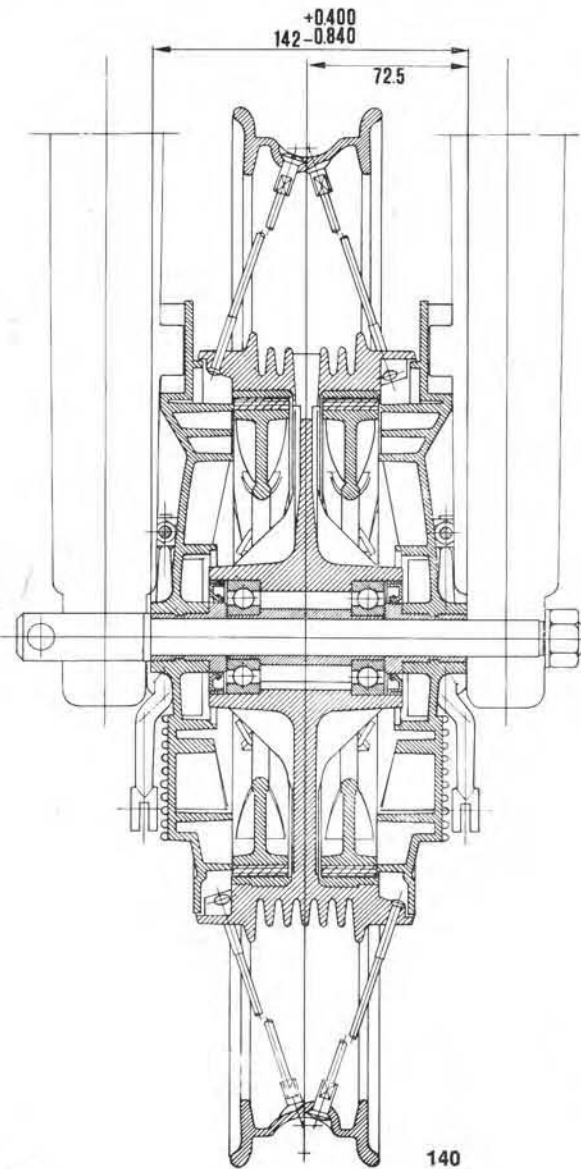
137



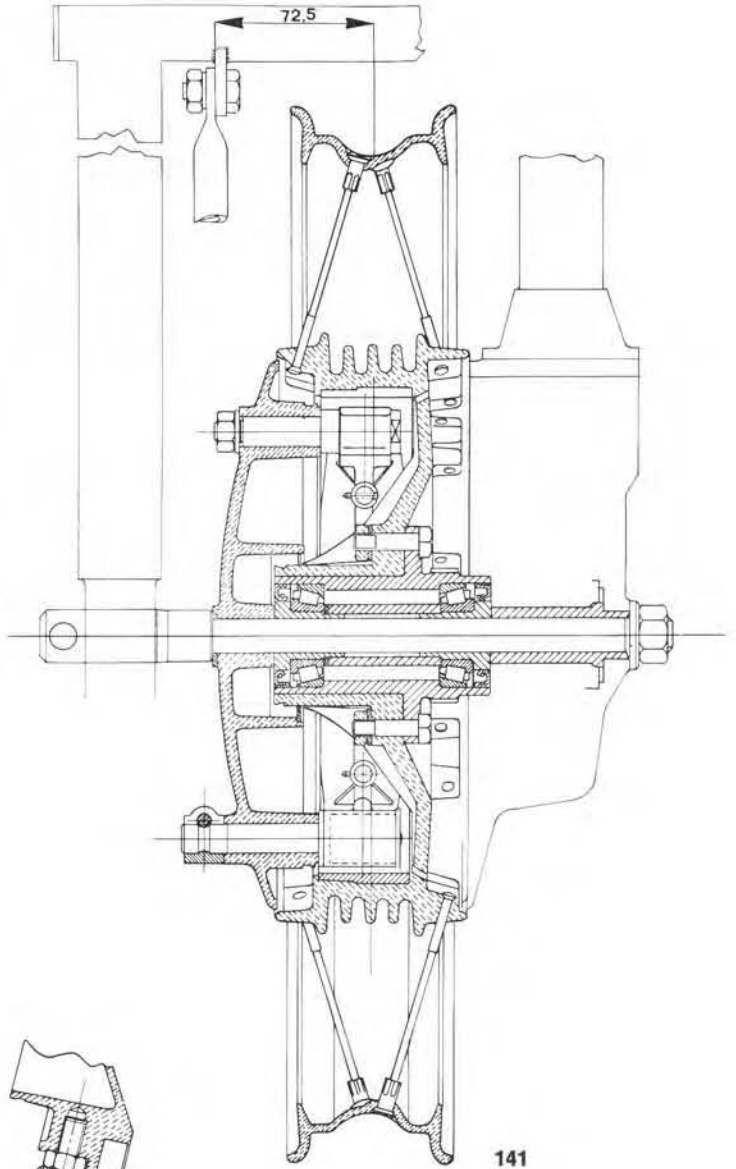
138



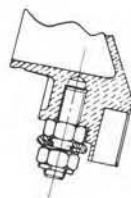
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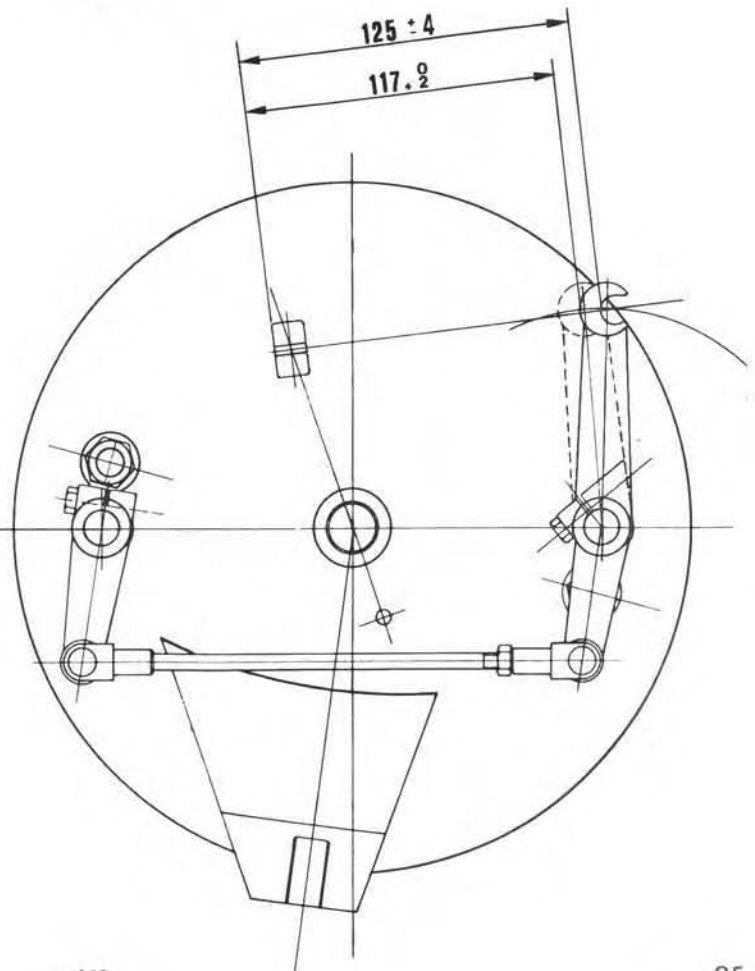
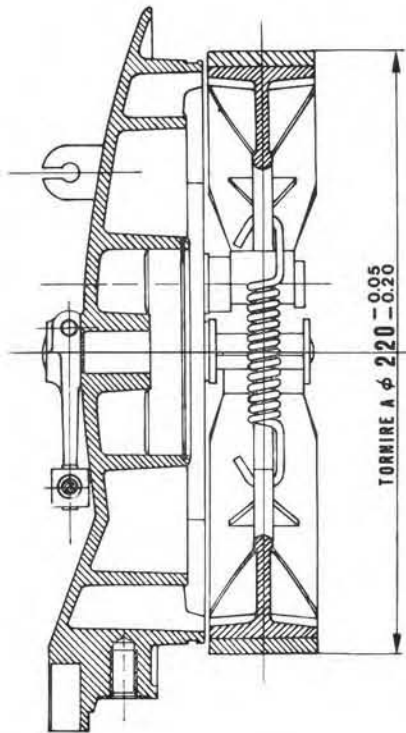
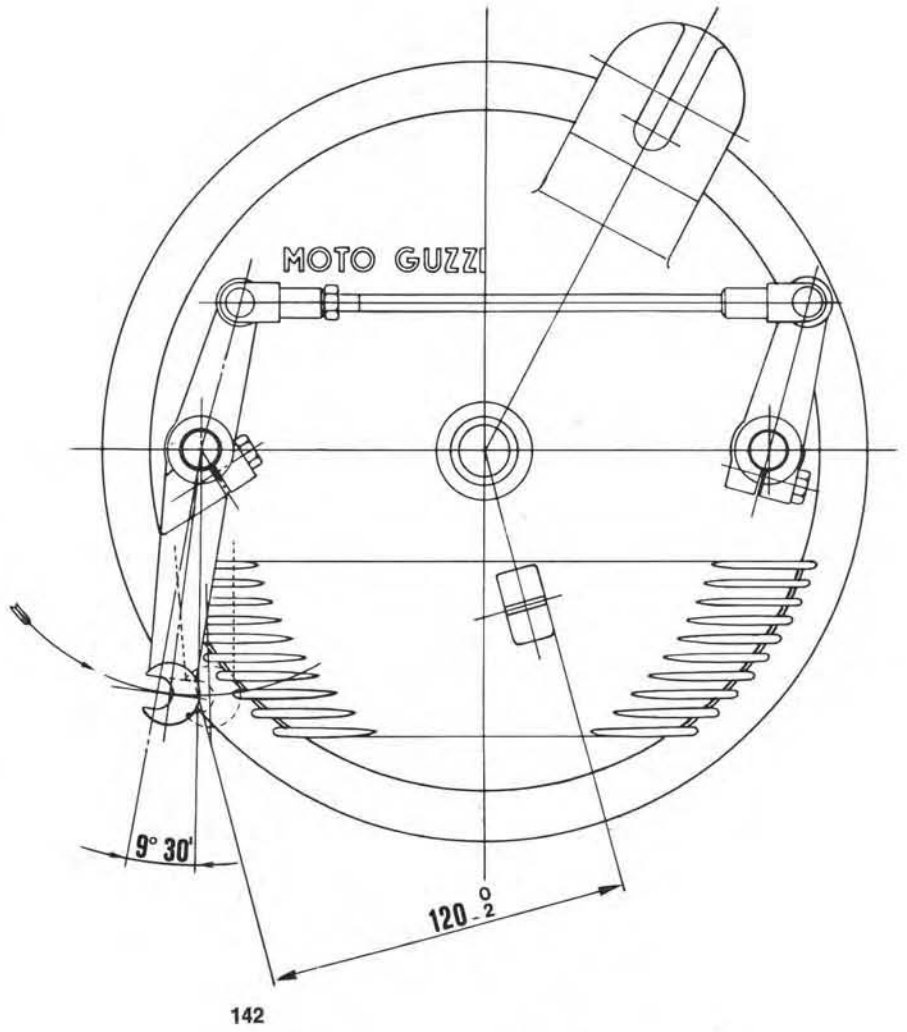
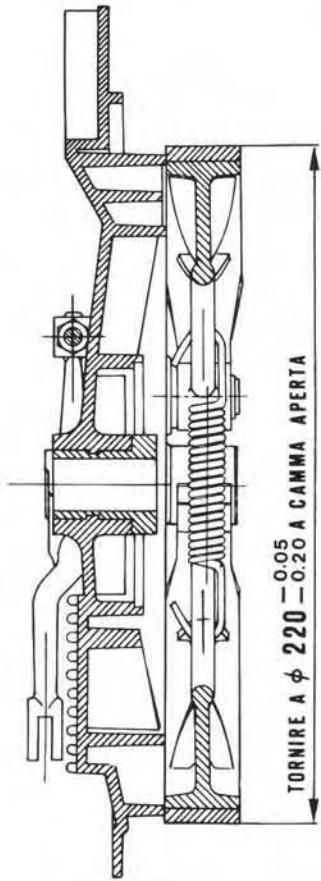


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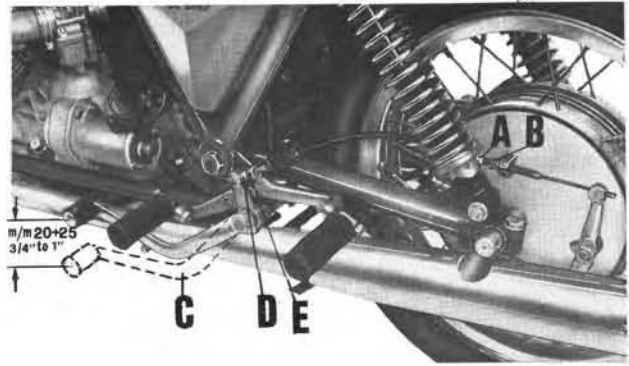
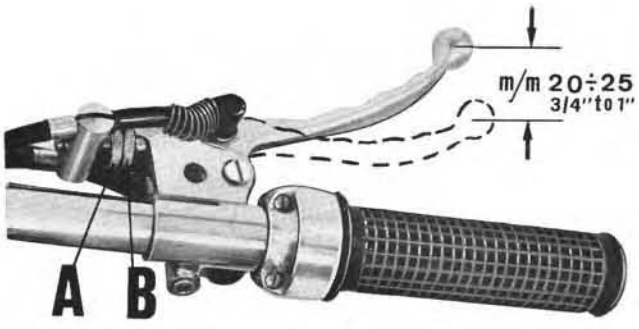


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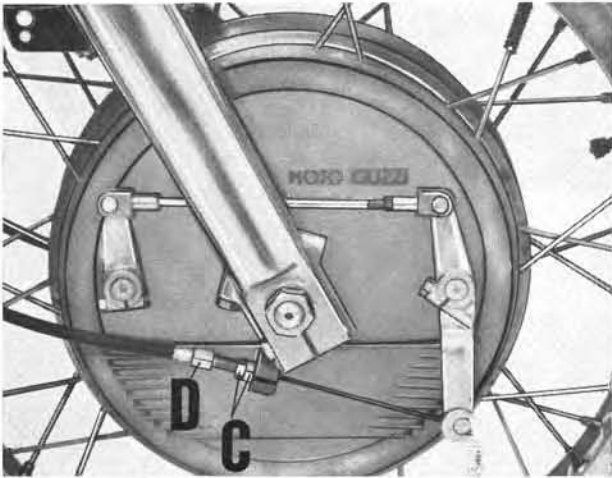




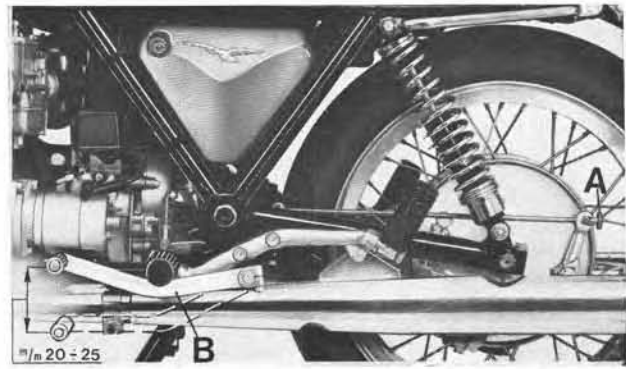




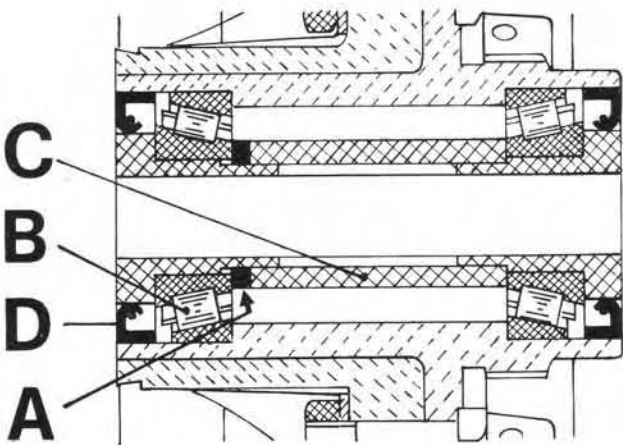
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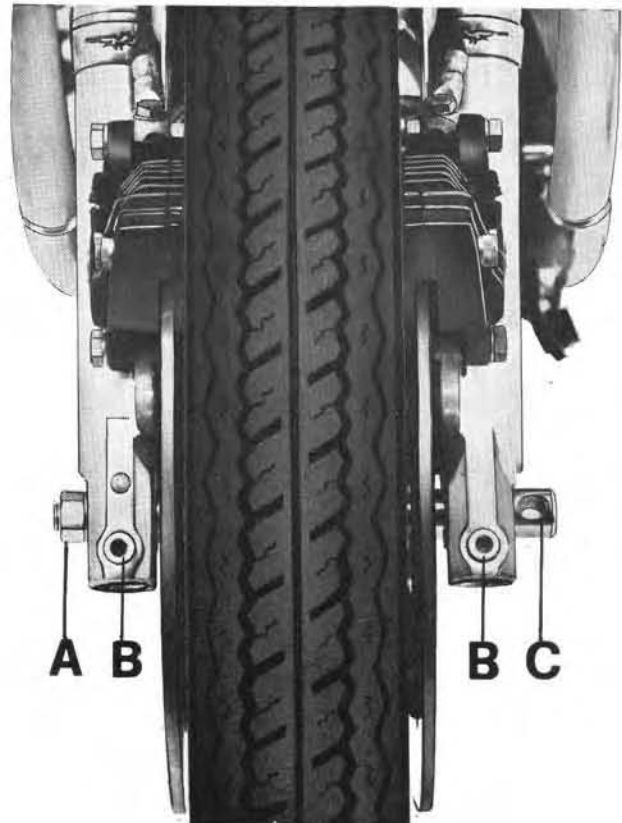
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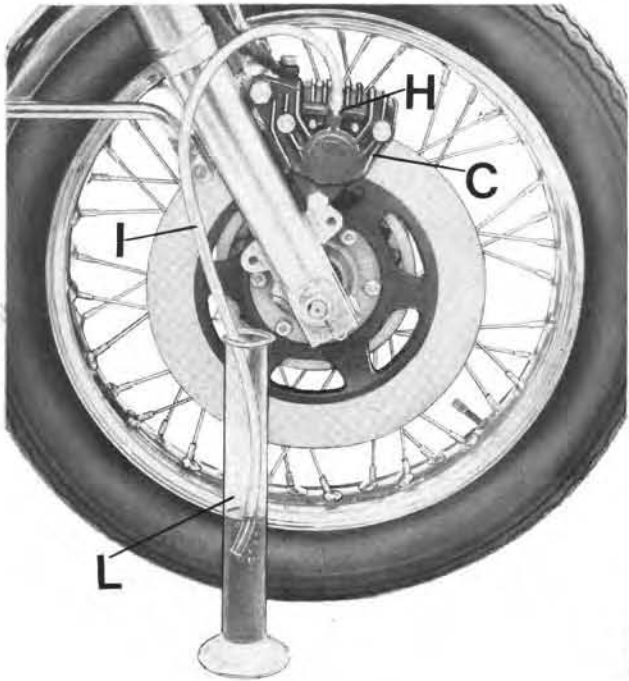
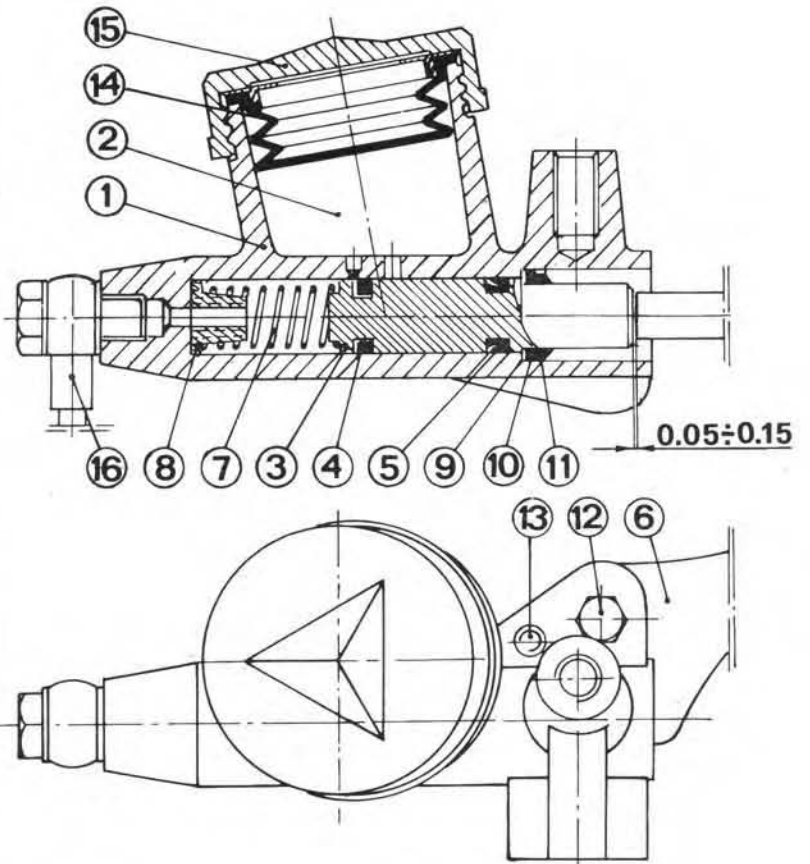
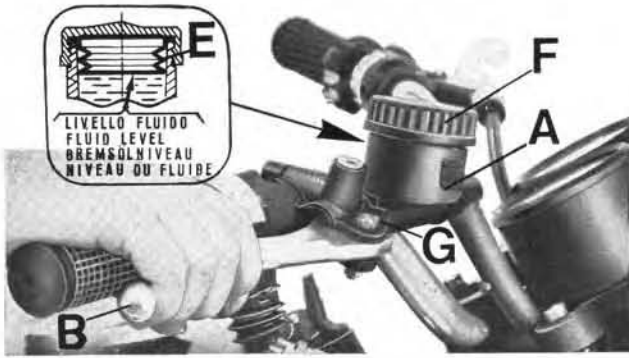
147



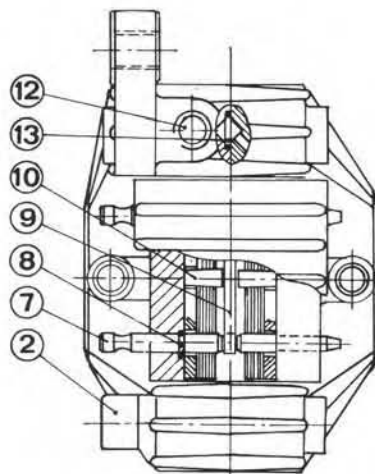
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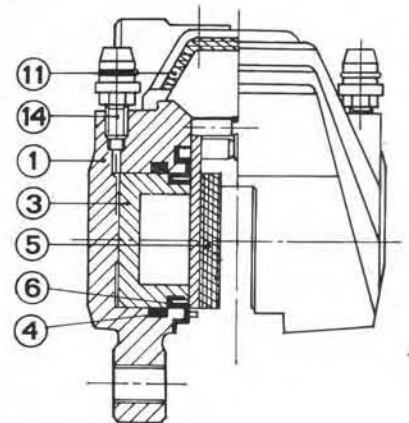
147/1



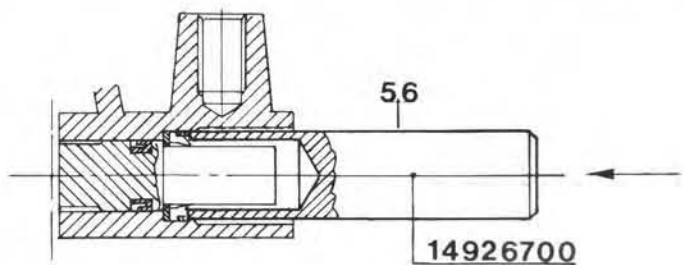
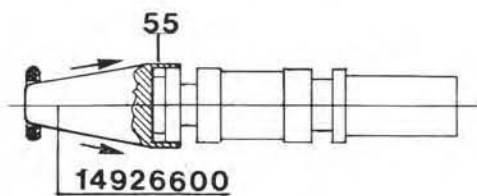
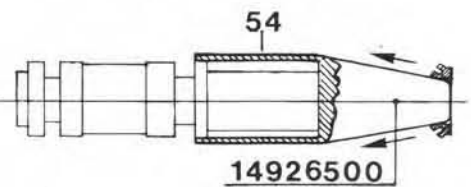
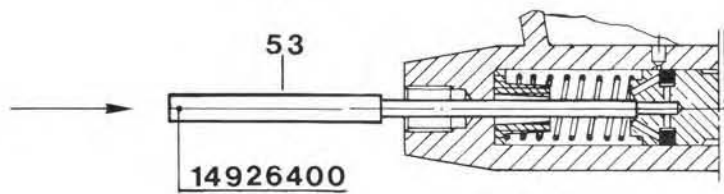
148



149

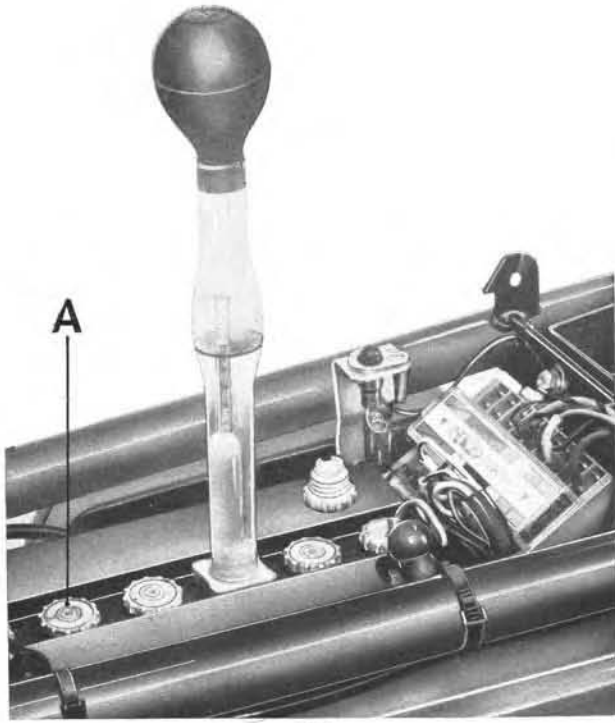


150

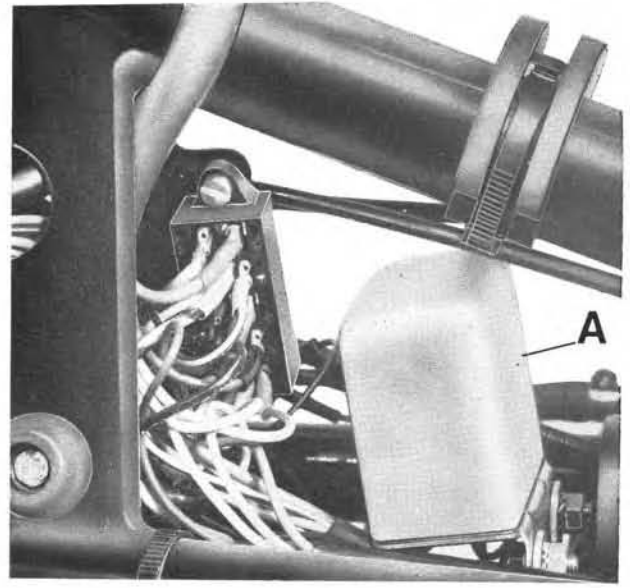


151

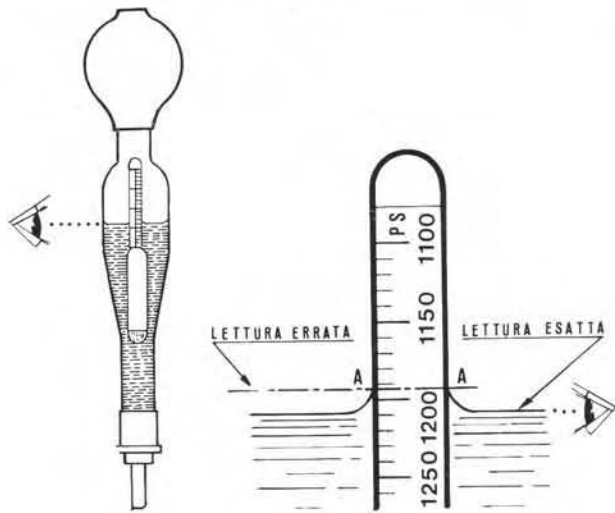




153



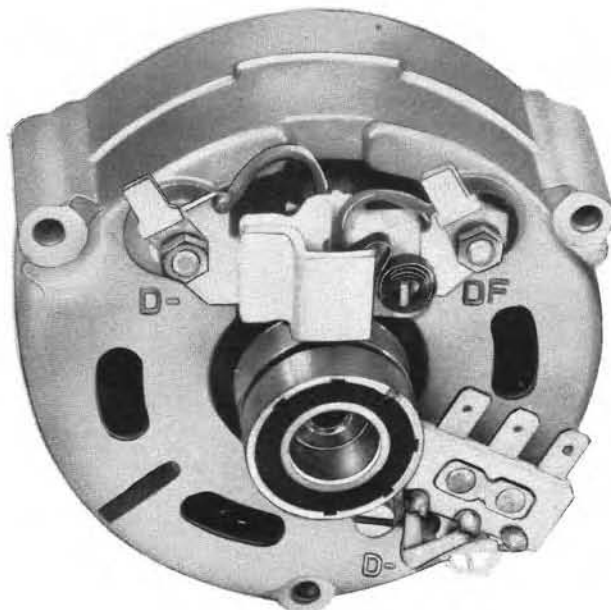
156



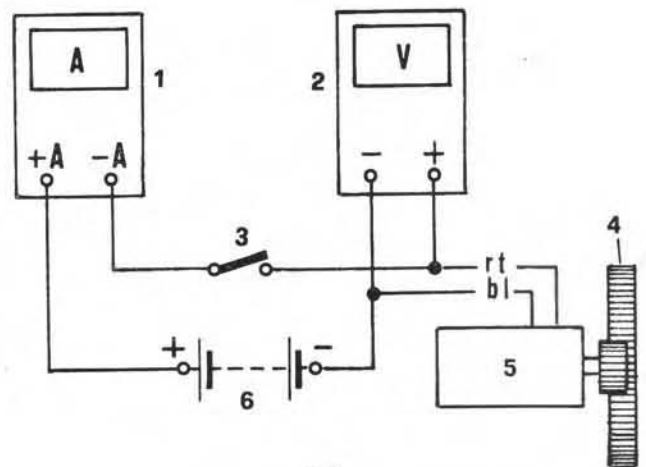
154



157

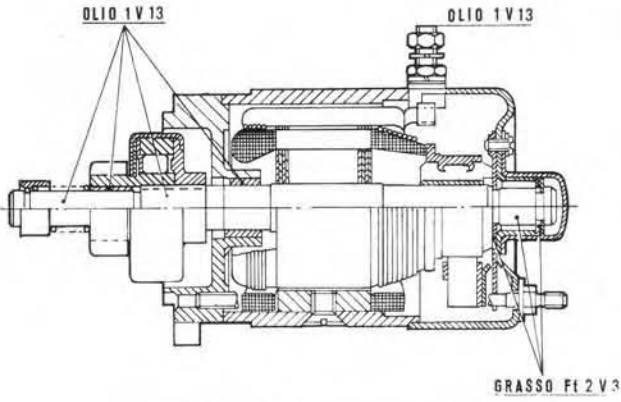


155

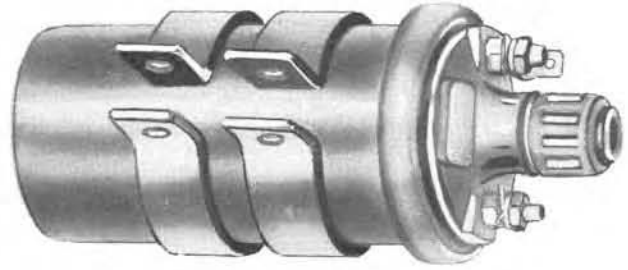


158

- 1 Tester - 2 Volmetro - 3 Interruttore  
4 Corona - 5 Motorino - 6 Batteria

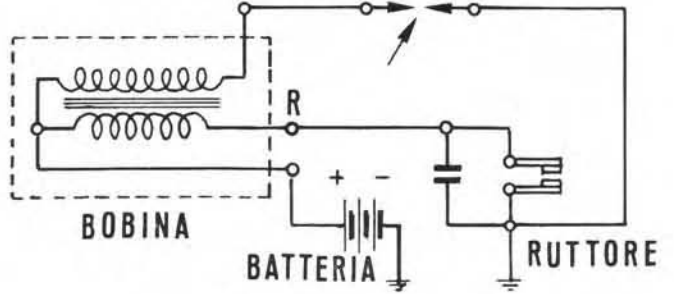


159 Schema di lubrificazione

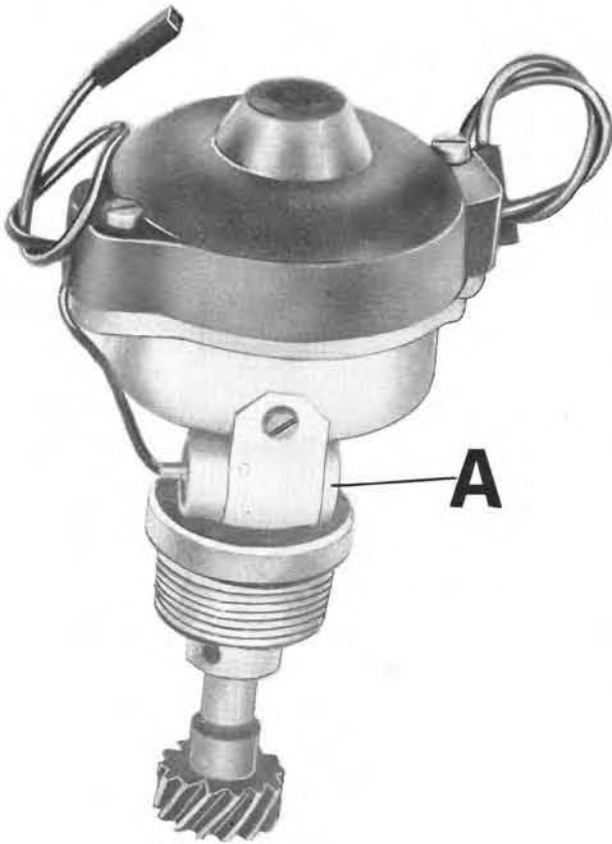


162

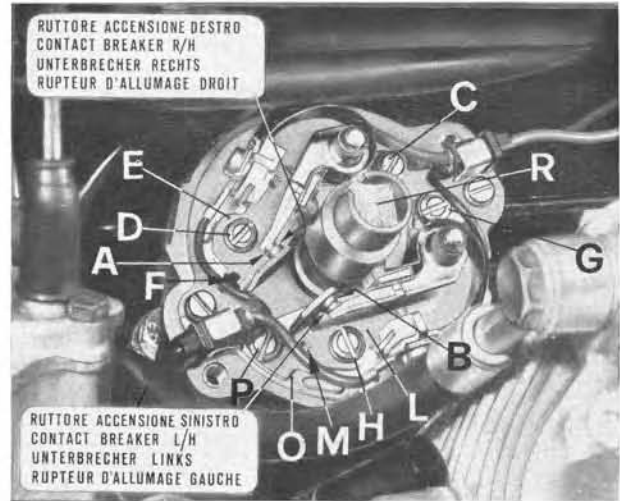
SPINTEROMETRO



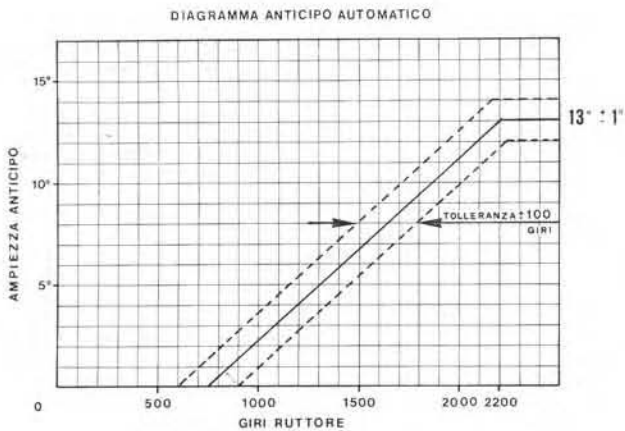
163



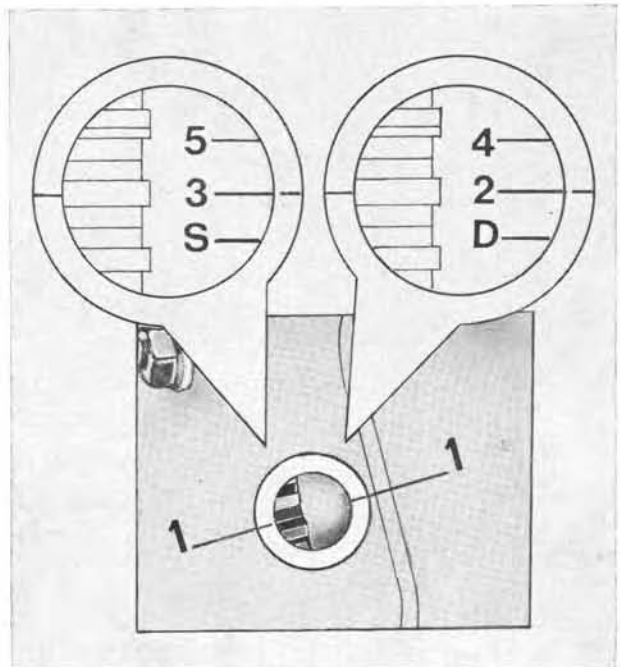
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164

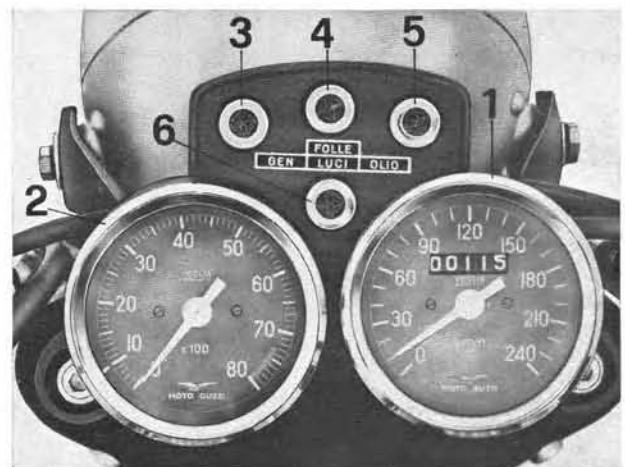
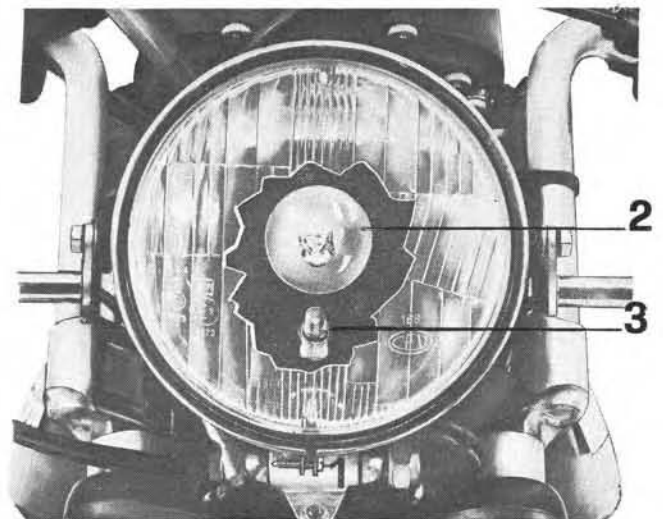
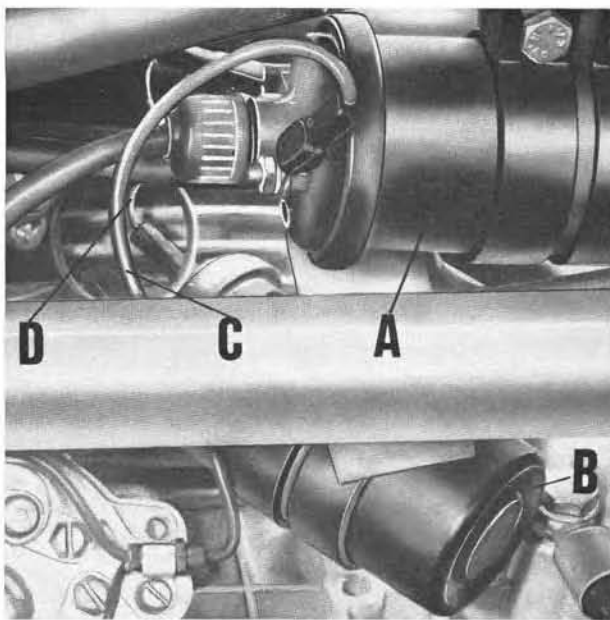
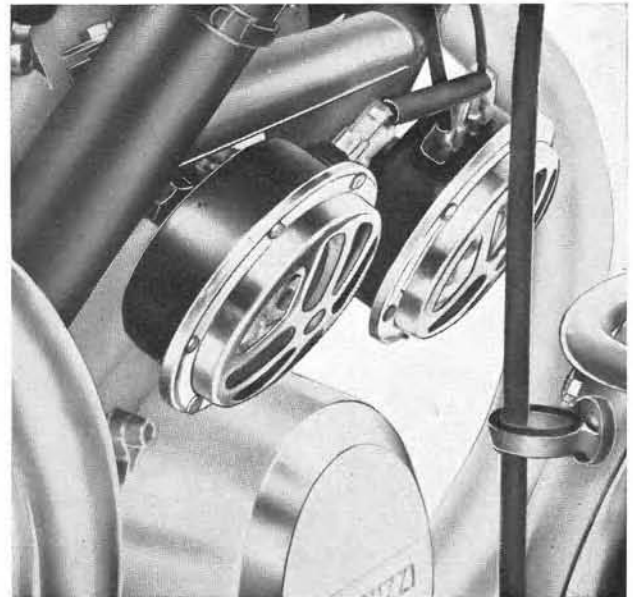
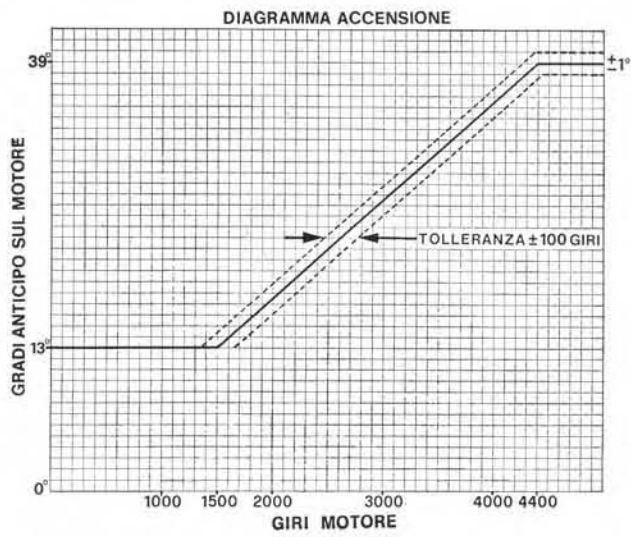


161

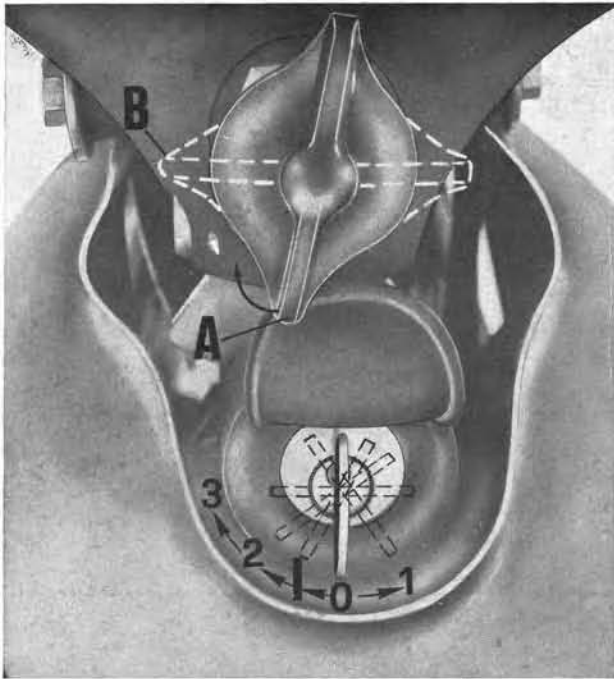


165

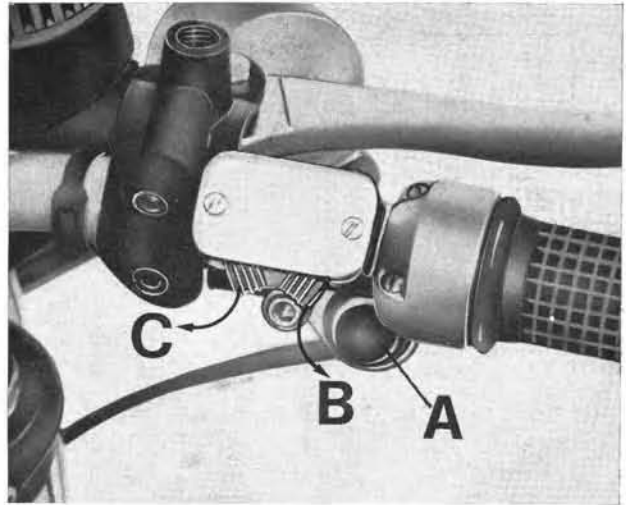




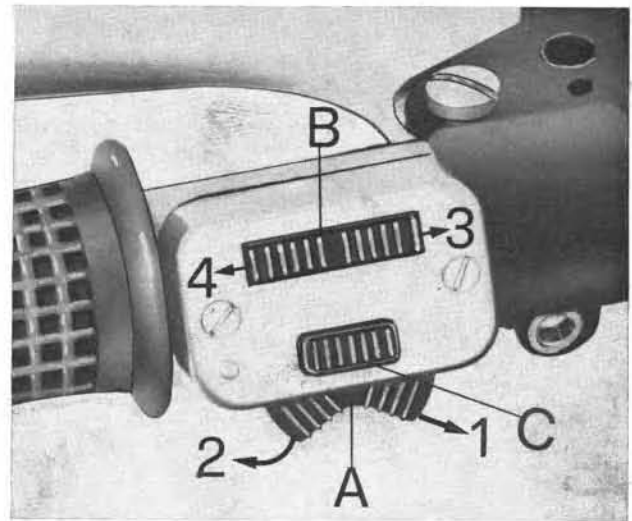




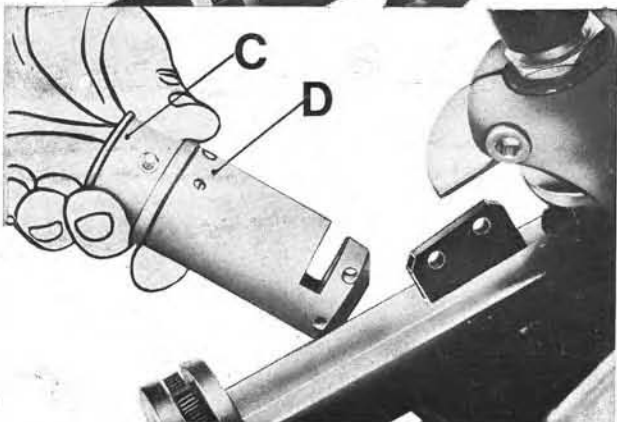
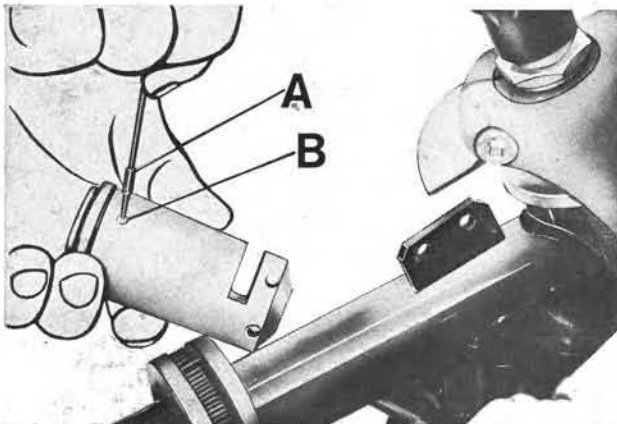
172



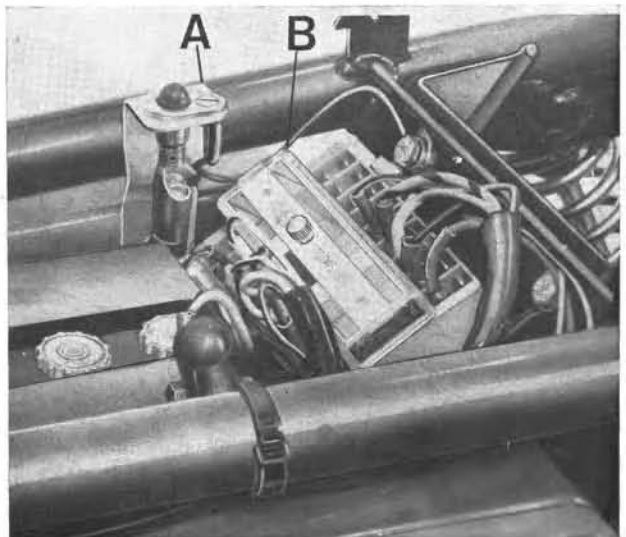
174



175



173



176



# 10 WIRING DIAGRAM

- 1 - Parking light, front 4W
- 2 - Low beam 40W
- 3 - High beam 45W
- 4 - Front turn indicator, right 21W
- 5 - Front turn indicator, left 21W
- 6 - Speedometer lamp 3W
- 7 - Rev counter lamp 3W
- 8 - Parking light, warning light - green 1.2W
- 9 - High beam warning light - blue 1.2W
- 10 - Neutral warning light - green 1.2W
- 11 - Generator charge warning light - red 1.2W
- 12 - Oil pressure warning light - red 1.2W
- 13 - Turn indicator right, warning light 1.2W
- 14 - Turn indicator left, warning light 1.2W
- 15 - Light switch and ignition switch
- 16 - 3-way connector
- 17 - 12-way connector
- 18 - Flashing light, turn indicator and horn switch
- 19 - Engine starting and stop button
- 20 - Oil pressure switch
- 21 - Neutral indicator switch
- 22 - Coil
- 23 - Contact breaker
- 24 - Intermittence
- 25 - Horn
- 26 - Flashing light relay
- 27 - Front STOP switch
- 28 - Rear STOP switch
- 29 - Alternator
- 30 - Current regulator and rectifier
- 31 - Battery
- 32 - Starter motor
- 33 - Starter motor relay
- 34 - Turn indicator, left rear 21W
- 35 - Turn indicator, right rear 21W
- 36 - Number plate and parking light 5 +5W
- 37 - STOP light (21 +21W)
- 38 - Terminal block with fuses
- 39 - Male-female connector 4-way AMP
- 40 - 15-way connector
- 41 - Pick-ups
- 42 - Electronic sets, cylinders 1 - 6
- 43 - Electronic sets, cylinders 3 - 4
- 44 - Electronic sets, cylinders 2 - 5
- 45 - Side stand switch
- 46 - Brake fluid level indicator
- 47 - Brake fluid switch

V - GREEN	V - GR - GREEN - GREY
N - BLACK	AZ - N - SKY BLUE - BLACK
G - YELLOW	BI - N - WHITE - BLACK
M - BROWN	AZ - R - SKY BLUE - RED
R - RED	R - N - RED - BLACK
AZ - SKY BLUE	V - G - GREEN - YELLOW
VI - VIOLET	BL - N - BLUE - BLACK
RO - PINK	V - N - GREEN - BLACK
BI - WHITE	G - R - YELLOW - RED
A - ORANGE	
GR - GREY	

