Lambretta 150 d-ld

INSTRUCTIONS FOR REPAIR SHOPS

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This manual is mainly intended to provide the Service Stations with basic information regarding the dismantling, overhauling, repairing and tuning-up of the « Lambretta 150 D » and « 150 LD ».

The first section comprises the main features of the two models and the description of their most important elements. The sections following explain how the vehicle is dismantled and then reassembled. Wear limits of the various parts are outlined, and the Service Stations helped through additional information in the replacement of worn parts. The rest of the manual indicates troubles which can occur to motor scooters, their causes and remedies. Ultimately we give a list of tools used for dismantling and reassembling operations.

SUMMARY

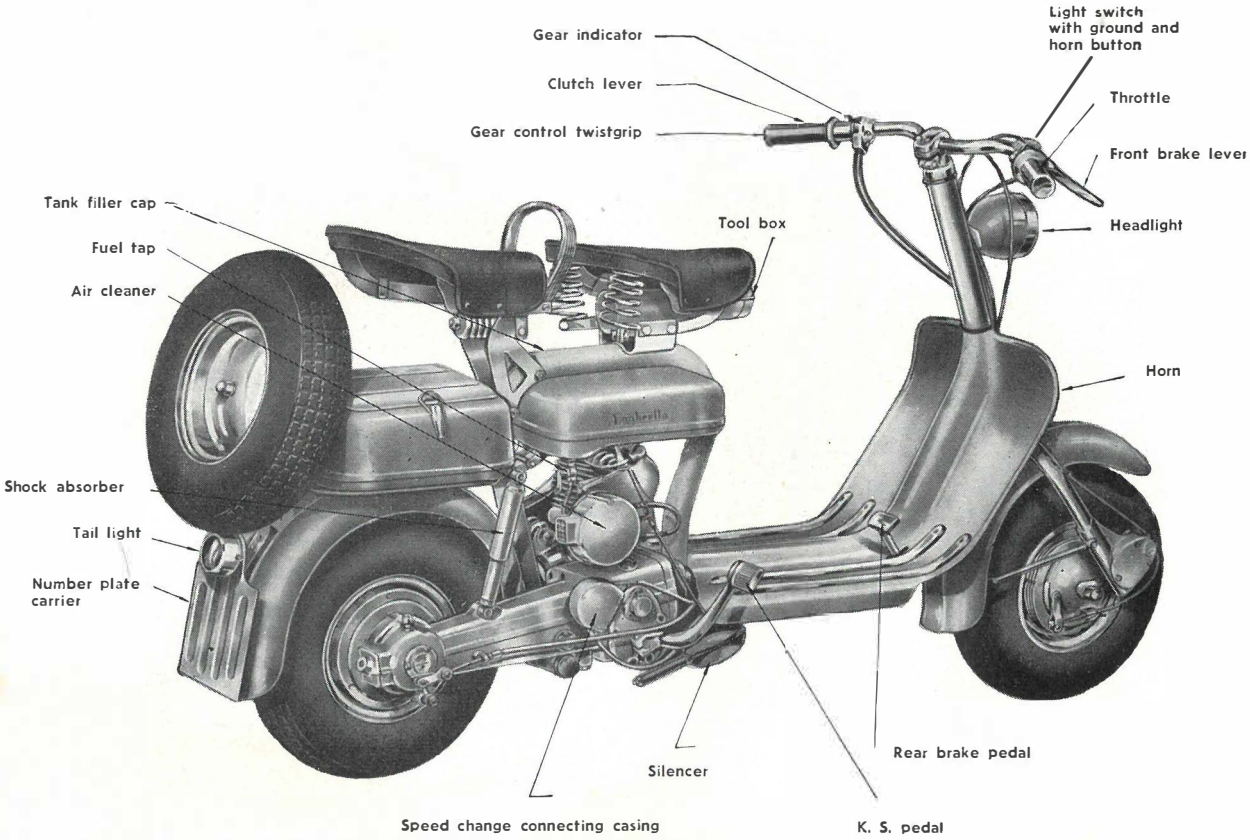

Fig. 1

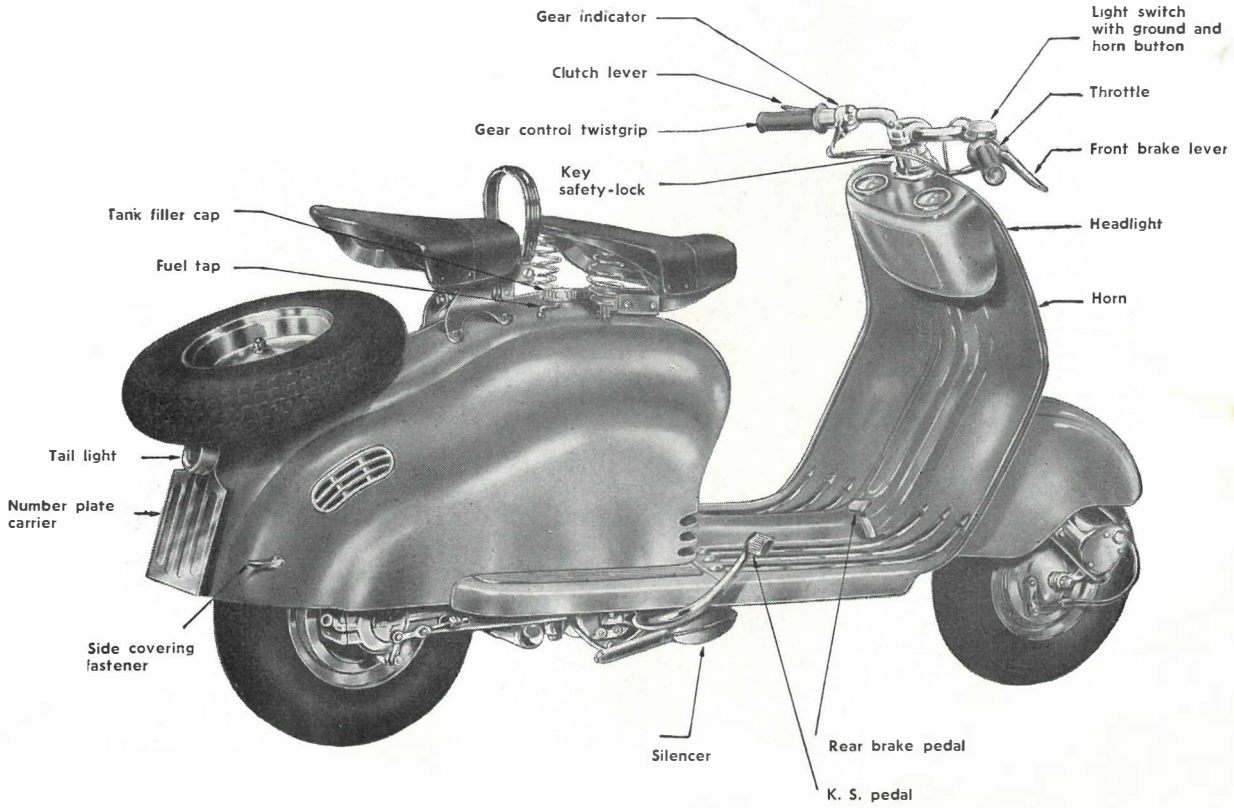

Fig. 2

MAIN FEATURES

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	Mod. « D »	Mod. « LD »
Overall length	70" (1.770 m)	70" (1.770 m)
Overall height	38" (0.960 m)	38" (0.960 m)
Ground clearance	4-3/8" (0.110 m)	4-3/8" (0.110 m)
Width (Handlebar)	29" (0.740 m)	29" (0.740 m)
Wheelbase	50-1/2" (1.281 m)	50-1/2" (1.281 m)
Unloaded weight	165 lbs (75 kg)	194 lbs (88 kg)
Max speed	47-50 m.p.h (75-80 km/h)	
Fuel consumption	140 mpg at cruising speed 31 mph (50 km/h)	

UPHILL

Low gear	35%	gear ratio 1 : 12,9
Second gear	20%	gear ratio 1 : 7,5
Top gear	10%	gear ratio 1 : 4,75

TWO-STROKE SINGLE CYLINDER ENGINE

Capacity	148 c.c.
Bore	2.244" (57 mm)
Stroke	2.283" (58 mm)
Compression ratio	6,5
Hp output max	6
rpm	4750

Cylinder of high quality wear-resistant cast iron.
Cylinder head of light alloy, die cast.
Cast piston of light alloy.
Connecting rod of high-tensile steel with needle bearings on big end.
Built-up crankshaft carried in ball bearings.
Lubrication by petroil.

CARBURETTOR

Dell'Orto MA 19B4 incorporating:

— starter device
— petrol filter
— silencing air cleaner
— choke 0.748" (19 mm); max jet 0.0283" (72/100 mm)

IGNITION

By 4-pole flywheel magneto and outside high tension coil - Advance setting when standing - 28 watt magneto.
Side-located spark plug. Heat range: 225 Bosch Scale.

STARTING

By pedal.

COOLING

Forced draught cooling by fan fitted on the flywheel.

CLUTCH

Multi-plate type running in oil bath; operated by lever on the left twistgrip.
Adjusting device just near the lever (fig. 1-2).

GEARBOX

3-speed. Constant mesh gears in oil bath made of high-tensile steel. Hand control by left twistgrip and flexible cable. Gear position indicator near the twistgrip.

TRANSMISSION

From engine to gearbox by bevel gears; from gearbox to the rear bevel gears by torsion shaft especially efficient against sudden variations of the revolution rate.
The shaft is enclosed in the transmission case; bevel gears running in oil bath.
The connection for the speedometer drive is to be found on the transmission case (see detail n. 32 - fig. 6).

TANK

Fuel capacity:
Mod. D = 1,4 gals (6,3 lt) including 1,1/4 pt. (0,7 lt) res.
Mod. LD = 1,55 gals (7,1 lt) including 1,1/4 pt. (0,7 lt) res.
3-way tap

(for Model D see fig. 12)
(for Model LD see fig. 13)

— C = close
— A = open
— R = reserve

FRAME

The frame is of large steel tube section ensuring highest rigidity and eliminating vibration.

SUSPENSION

The front suspension is realised by means of trailing links. Each trailing link is connected to a lever bearing an end ball which compresses a progressive type spring, located inside the fork tubes.
This group is hermetically protected against water and dust and operates in the grease enclosed within the boxes, the result being longer working life and no maintenance.

The rear suspension is designed with a long swinging arm, consisting of the transmission case, and pivoting on a robust pin incorporated in the frame.
Through its movement the swinging arm loads the suitably

supported torsion bar made of high-tensile steel. The swings of the engine group are transmitted to the torsion bar by means of return levers, which are properly proportioned in order to reduce the torsion bar angle when the load increases. The fitting of a hydraulic damper remarkably increases springing comfort.

WHEELS

Interchangeable and easily detachable from the hub.
The rear wheel is detachable like motor car wheels.
Easy dismantling of the pressed steel sheet rims.
4.00-8" tyres. Inflating pressure: 10/12 lbs/s.i. for the front tyre and 25 lbs/s.i. for the rear tyre with pillion rider.

BRAKES

Internal expanding type brakes with flexible control, operated by hand on the front wheel and by pedal on the rear wheel.

ELECTRICAL SYSTEM

By flywheel magneto.
Headlight with twin-filament bulb 6 V-25/25 W and 12 V-10 W pilot lamp.
Tail light with red gem (6 V-5 W).
Lighting switch, on the right handlebar, of lever type; the lever serves to earth the engine as well.
Horn push button coupled with the switch.
If an illuminated speedometer is fitted the 6 V-1,5 W bulb socket is to be derived from terminal plate located into the head lamp. In such a case the tail lamp bulb must be replaced with a 6 V-3 W one (See Wiring Diagram).

TOOL KIT

1 Double tubular spanner (0.827"-0.551" = 21-14 mm) for spark plug and wheel nuts.
1 Double spanner (0.551" = 14 mm) and for rear wheel hub nut.
1 Double spanner (0.394"-0.551" = 10-14 mm) for cap screws of exagon socket type.
1 Double spanner (0.315"-0.394" = 8-10 mm).
1 Screwdriver.

On the Model D the tool box is placed under the pillion seat; on the Model LD it is located under the covering, readily accessible by dismantling the right side panel.

SAFETY-LOCK

The Id model is provided with key safety-lock.

ACCESSORIES

Model « D »: pillion seat - luggage box - spare wheel - footrests for pillion rider - key safety-lock. (Optional extras)
Model « LD »: pillion seat and spare wheel (Optional extras)
All accessories are supplied with the necessary supports and fittings.

ELECTRICAL SYSTEM OPERATION DIAGRAM

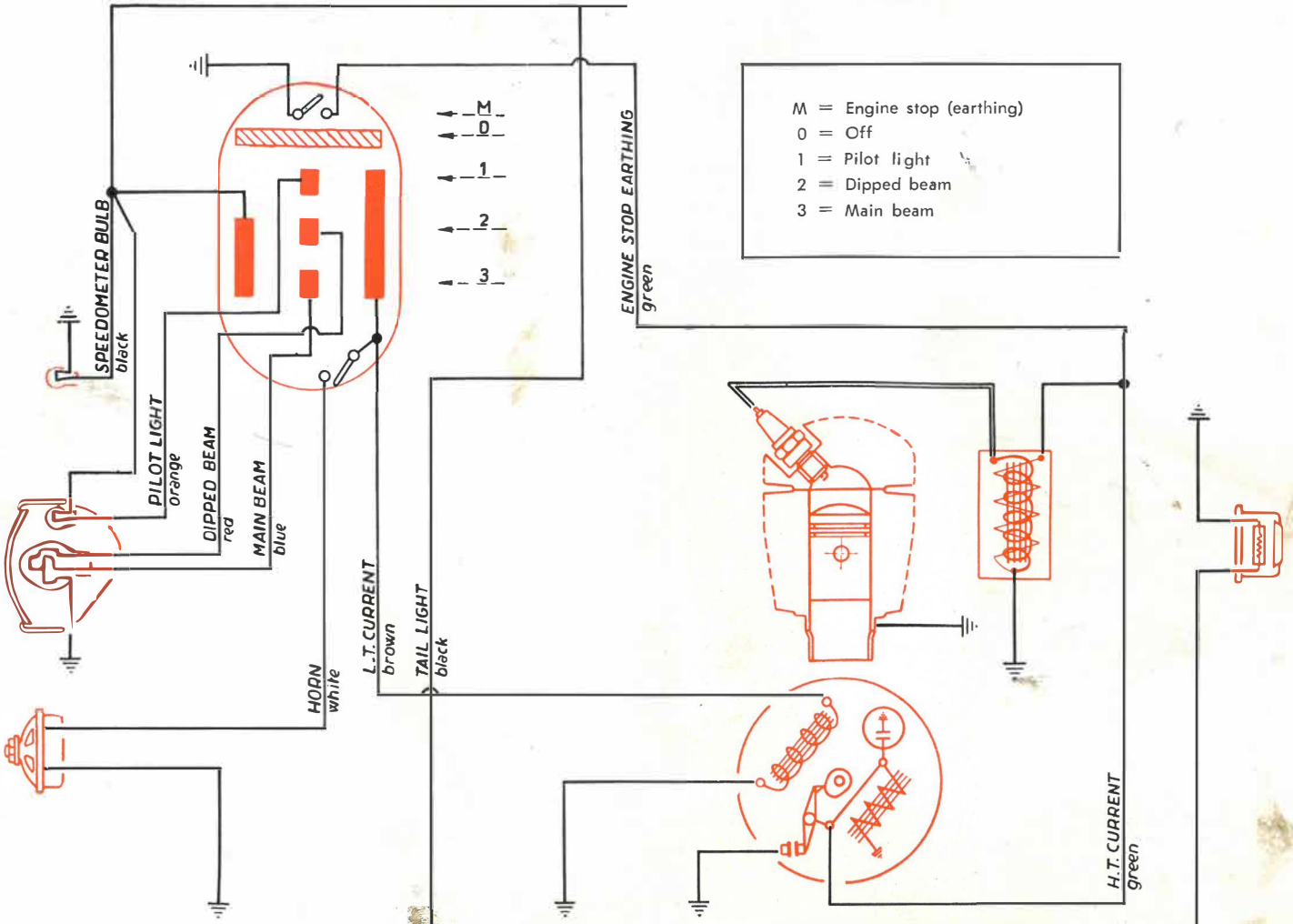


Fig. 3

ELECTRICAL SYSTEM DIAGRAM

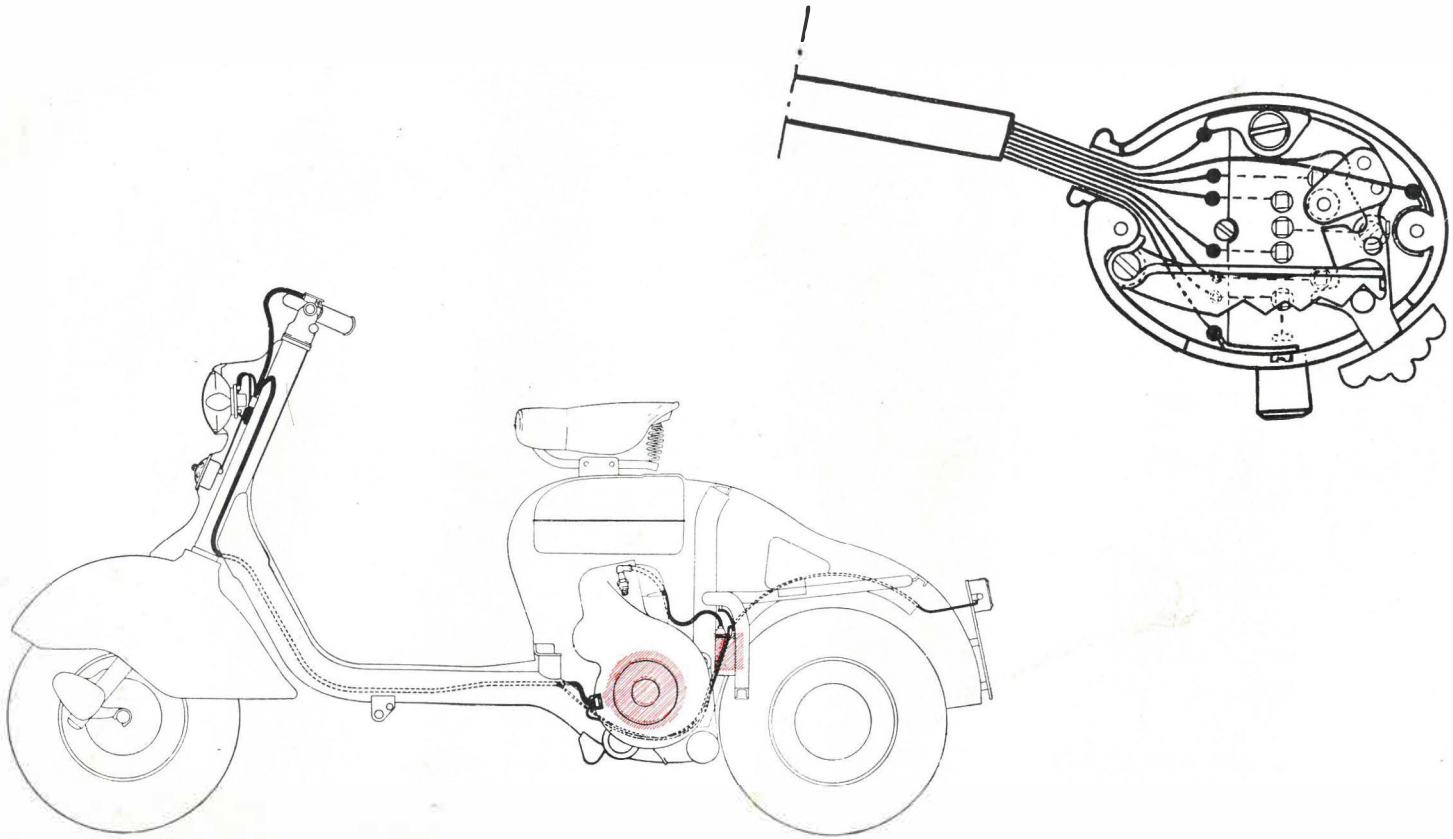


Fig. 4

LUBRICATION

LUBRICATION TABLE

Parts to be lubricated	Operation	Interval	Lubricant
Engine	Mix petrol with 8% oil	For the first 900 miles	BP Energol Two Stroke
	Mix petrol with 6% oil	After 900 miles (1500 km)	
Gearbox	Check level and refill to level mark	Every 900 miles (1500 km)	BP Energol Motor Oil SAE 30 (in Summer months and hot regions BP Energol Motor Oil SAE 50
	Drain and refill oil	After 300 miles; then every 1800 miles (3000 km)	
Clutch control cable knuckles Rear brake cable knuckles Front brake cable knuckles Control and lever knuckles on the handlebar Front brake pin	Lubricate	When assembling	BP Energrease A1
	Lubricate with oiler	Every 900 miles (1500 km)	BP Energol Motor Oil SAE 30
Cavity for ball bearing seat (flywheel magneto side)	Grease	When assembling and every 4000 miles (7000 km)	BP Energrease A1
Rear bevel gears	Restablish level	Every 1800 miles (3000 km)	BP Energol Transmission EP SAE 140
Front suspension springs Side covering fasteners	Coat with grease	When assembling	BP Energrease A1
Rear brake pin Rear brake pedal pin	Grease gun	Every 900 miles (1500 km)	BP Energrease A1
Rear suspension lever knuckles and torsion bar lever	Grease gun	Every 900 miles (1500 km)	BP Energrease A1
Steering ball bearings Front wheel bearings	Grease gun	Every 1800 miles (3000 km)	BP Energrease L3
Front suspension casings	Grease gun	Every 1800 miles (3000 km)	BP Energrease A1
Speed change connecting casing	Coat with grease	When assembling	BP Energrease A1

See 2.nd variation

LUBRICATION DIAGRAM

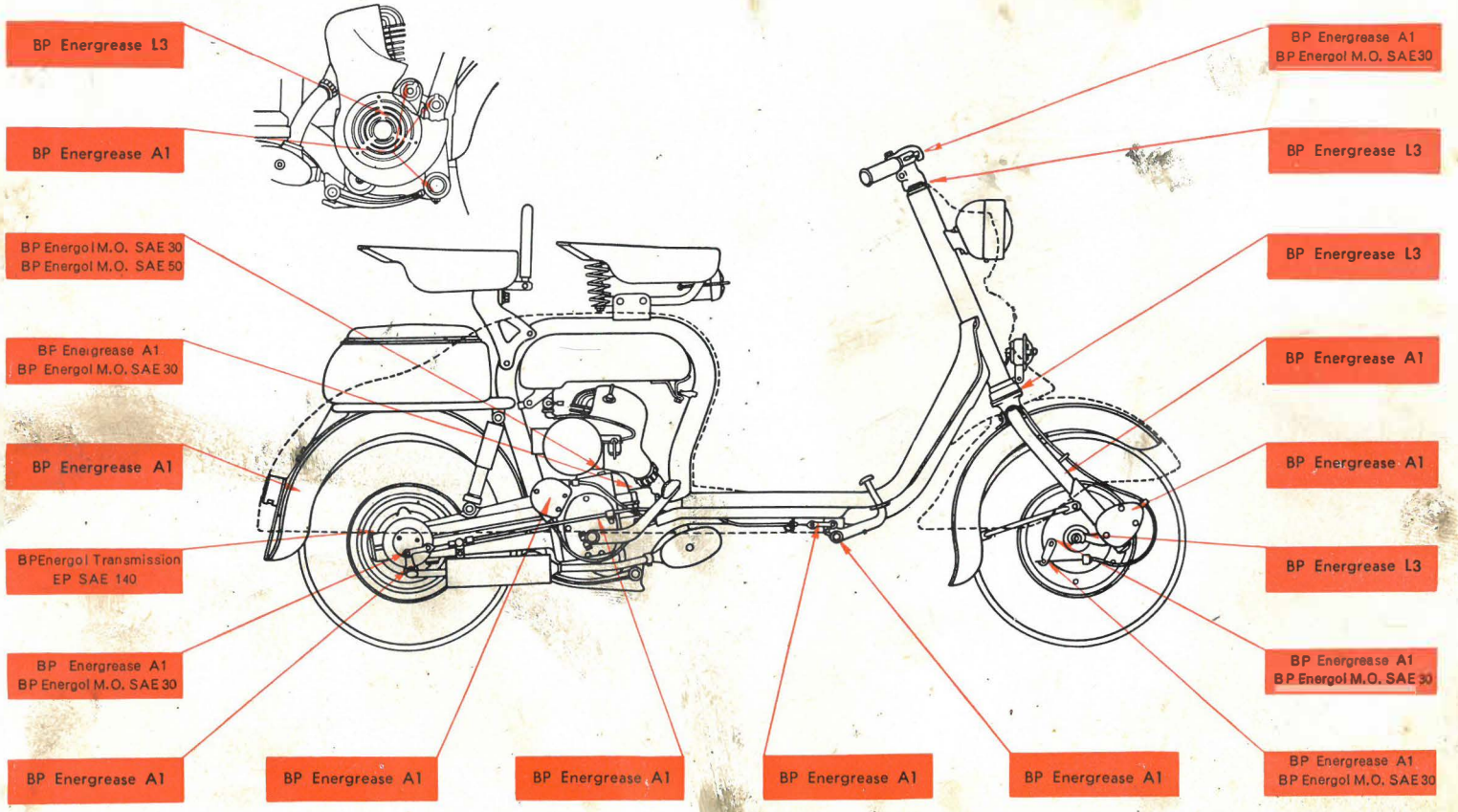


Fig. 5 - For points marked with two types of lubricant, see table page 16.

DESCRIPTION

ENGINE OPERATION

The outline of the new « Lambretta D » and « LD » is similar to the preceding models but the engine capacity has been increased to 150 cm^3. Further innovations comprise the improvement of the springing and gearbox.

The connection of the engine, transmission case and wheel group to the frame has been obtained by means of a sturdy pin on which the engine group is pivoted swinging with large deflection, so ensuring smooth riding and dependability.

The crankcase and transmission case are of cast silumin heat treated and, besides performing the function previously indicated, serve to enclose the main engine components. On the left side of the crankcase the flywheel magneto is placed (1) - see fig. 6 - which together with the H.T. coil generates the H.T. current for the petroil ignition and provides also the L.T. current to supply lamps and horn.

On the r.h. are located: clutch, gearbox and transmission elements. The engine group is fitted to the center.

The main engine components are: crankshaft (8) working on heavy duty ball bearings, connecting rod (6) made of special steel with needle roller big-end bearing (7) and the gudgeon pin seat (5) on bronze bushings (4), pressed or cast piston of light alloy, cylinder (2) of special cast iron and die cast cylinder head (3) of light alloy.

KICK STARTER

As shown in the diagram, the starting device consists of a bevel pinion (12) engaging with the bevel engine gears, jaws (13) and notched sector (14). The pedal (15), push and return springs and other smaller parts complete the assembly.

CLUTCH

The clutch, operating in oil bath, comprises: steel plates (19) - driving discs - set alternately with plates (18) faced with patented rubber-compound - driven discs. - The driven discs (18) are keyed to the slotted drum (17) and the driving discs (19) are set on six grooves on the clutch bell housing (16). The bevel gears, placed at the right hand of the crankshaft, actuate the clutch bell, driving through the inner plates the slotted drum and the main shaft (20) connected to it. The clutch assembly is properly supported by ball bearings and bronze bushings.

GEARBOX

The gearbox consists of two control groups and one gear group. The gear group control, incorporated in the left twistgrip, operates by means of a rotating sleeve and two cables the lever placed in the gear connecting casing. The lever together with the selective fork provides for shifting the sliding gears and put in the selected gear.
The engagement of the gears is ensured by a device provided with compression spring.

GEAR SHIFTING

Low gear - The main shaft (20), in constant mesh with neutral gear (23) on layshaft (21), transmits movement to the layshaft.

The second gear pinion (25) slides and engages with the neutral gear, locking it to the layshaft. The layshaft causes the neutral gear to turn on the main shaft (22), which through the torsion bar (28) and the rear bevel pinions (29-30) transmits revolving power to the rear wheel (31).

Second gear - The two sliding gears, (24-25) moved forward into the first speed position, slide backward until they reach the middle of the run and engage the four splines provided on both shafts. (20-21) Successive reductions occur as for low gear.

Top gear - The second gear pinion on the main shaft (24) sliding further backward in the splines (20) engages its dogs with the tooth spaces of the neutral gear on main shaft (22) so that the engine is put in direct drive, connecting the clutch to the rear bevel gears (29-30) through the torsion bar (28).

The general operation diagram shows the gearbox in second gear position.

The entire group is supported by bearings and bronze bushings. The main shaft is mounted on ball bearings on the forward side, on uncaged needle rollers on the rear side, being located in the neutral gear. The secondary shaft works on paired bronze bushings placed within the crankcase. The clutch driving bevel gear with the remaining speed change components, and the neutral gears on main and secondary shaft are provided with bushings made of powdered metal.

GENERAL DIAGRAM REGARDING ENGINE GEAR SHIFTING AND TRANSMISSION OPERATION

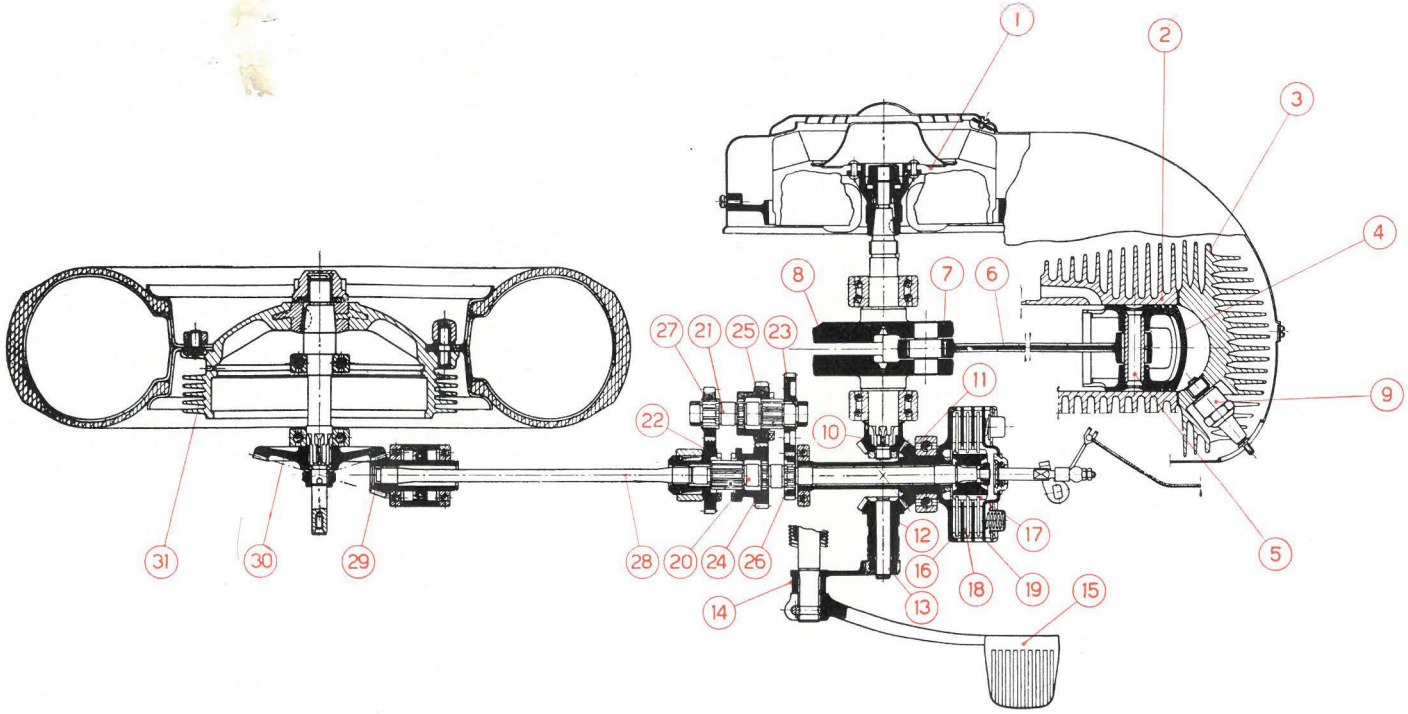


Fig. 6

LEGEND

1) Flywheel Magneto
2) Cylinder
3) Cylinder Head
4) Piston
5) Gudgeon Pin
6) Connecting Rod
7) Connecting Rod Big-end Needle Rollers
8) Crankshaft
9) Spark Plug
10) Crankshaft Bevel Pinion
11) Clutch Bevel Pinion
12) K.S. Bevel Gear
13) Jaw Spur Gear
14) K.S. Notched Sector
15) K.S. Pedal
16) Clutch Bell Housing
17) Clutch Splined Drum
18) Clutch Driven Discs
19) Clutch Driving Discs
20) Main Shaft
21) Secondary Shaft
22) Neutral Gear on Main Shaft
23) Neutral Gear on Secondary Shaft
24) Second Gear on Main Shaft
25) Second Gear on Secondary Shaft
26) Keyed Gear on Main Shaft
27) Keyed Gear on Secondary Shaft
28) Torsion Bar
29) Rear Bevel Pinion
30) Rear Bevel Gear
31) Rear Wheel, complete

ENGINE COMPONENTS

The **torsion bar (28)** meshing on one side with neutral gear inner teeth fitted on the main shaft (22) is constructed of special steel to absorb shocks caused by sudden accelerating or braking.

The **rear bevel gears** cut with special profile are made of the same high tensile material as the other Lambretta gears; smooth performance is ensured by ball bearings with high load capacity and proper lubrication.

When mounting bevel gears, care should be taken that the gears mesh exactly; after dismantling and replacement of such gears always recheck interposition of the different washers and spacers (fig. 59).

The **light-alloy rear wheel hub** incorporates the steel bush coupling with the transmission pin and the brake drum ring.

ENGINE COOLING SYSTEM

In the new Lambretta models the cylinder and cylinder head are kept cool by conveying air over the outer cylinder walls and upon the cooling fins.

Air circulating is ensured by a fan keyed on the flywheel which, as a consequence of the machine's motion, conducts air through the baffle plate to the hottest engine areas.

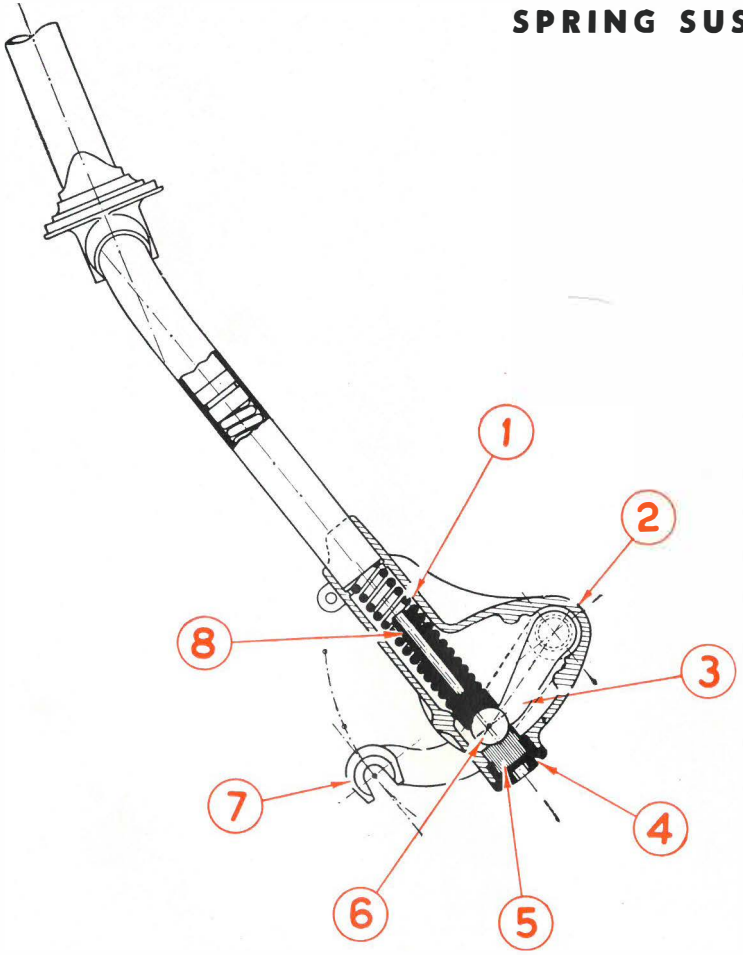


Fig. 7 - Front suspension assembly.

FRONT SUSPENSION

The suspension elements of the « Lambretta 150 D » and « LD » are placed within grease tight casings in order to ensure long life and perfect efficiency.

The front suspension, as shown in figg. 7-8, is effected by means of two trailing links and two progressive type springs (1) located inside the fork tubes; their lower end is placed on a push block against which the ball (6) operates.

The connection of the levers (3) with the trailing links (7) is obtained by engaging the latter with the splined pin of the former; locking is ensured through one screw. The levers and the push blocks are enclosed within grease tight casings (2) of malleable cast iron welded to the fork tubes and provided with bronze bushings forced into them; in the lower casing portion a threaded hole is drilled, into which a brass cap (4) is fitted carrying the rubber pad.

The front wheel pivoting on the trailing links transmits the road shocks to, the latter and these, through the levers to which they are rigidly connected, push the balls against the push blocks carrying the springs.

The rubber pads have been fitted to damp the rough return shocks.

The special design of the springs permits their progressive adaptation to the load and road asperities.

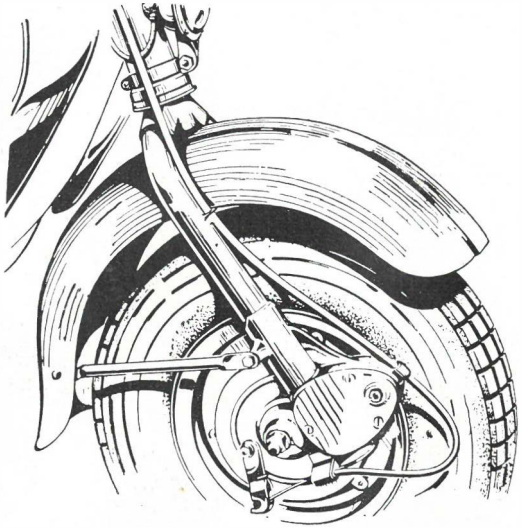


Fig. 8 - Front suspension assembly.

REAR SUSPENSION

The rear suspension is obtained as follows: engine, gearbox, transmission and rear wheel form together a unit swinging on a strong pivot incorporated on the frame rear end.

The rear wheel when traversing rough surface is controlled by torsion bar fitted under the engine, transversally to the frame, through the engine group and a pair of levers completing a four-link mechanism.

To this end well dimensioned and reinforced extensions on the lower crankcase portion have been cast in; they connect the engine group to the frame and the double extensions attaching the return lever to the torsion bar on the upper crankcase portion, flywheel side.

The connection between engine and frame is obtained as follows: transversally to the frame (5) a tube with tapered ends is welded on which the two clamping cones (1) of the engine centre axle (3) are seated, held in place by the nut (4).

Swinging is ensured through the silentblocks (2) fitted in the crankcase extension holes.

The tie rod of the torsion bar (9) is fitted on the two extensions carrying a bore (fig. 10).

The torsion bar is enclosed and consequently protected against foreign matter grease lubrication through the greaser placed in the lower portion of the torsion bar housing. The torsion bar housing, of malleable cast iron, is welded to the frame; on the right hand side the torsion bar is clamped by a claw coupling. The torsion bar is made of special steel and designed to obtain a progressive stiffening of the rear springing, as a consequence of the ample displacement of the swinging arm (7) engaged with the torsion bar left end. The swinging arm is fitted with a heavy duty bronze bushing (8) inserted in the torsion bar housing to promote the torsion movement on a single axle without deflections, which might decrease efficiency and life of the entire system. The coupling of the swinging arm and cranckase with the shackle is obtained by means of sturdy pins (11) and steel needles (10) grease-lubricated through pressure guns.

Fig. 9 - Engine connection to the frame.

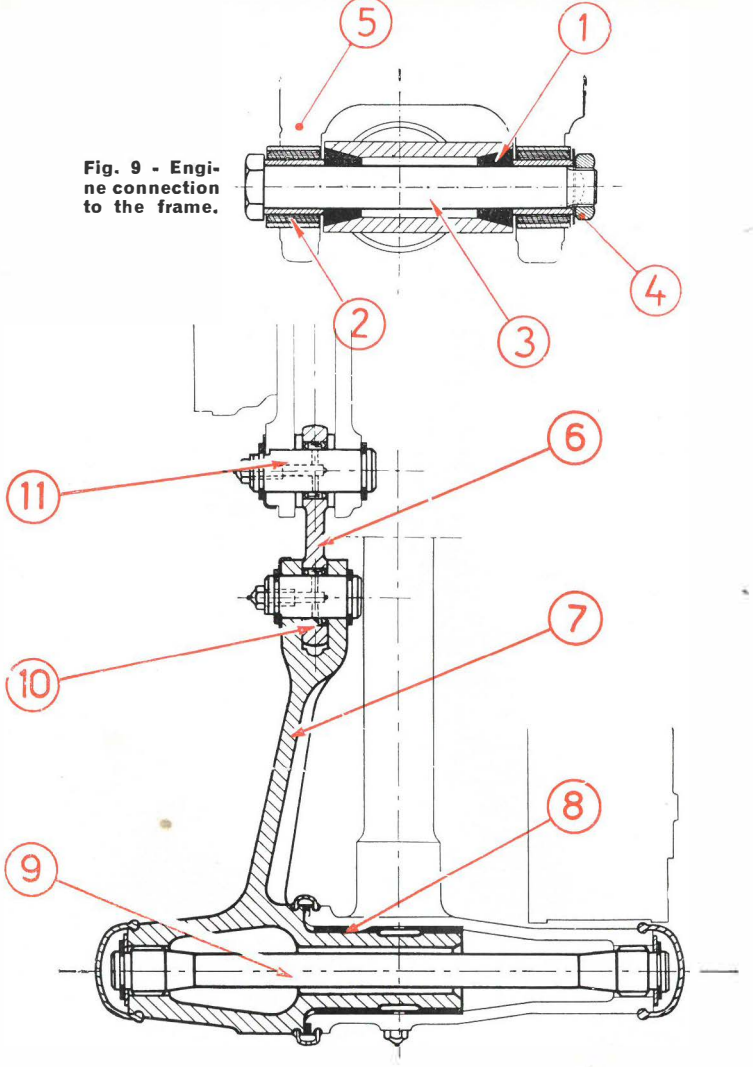


Fig. 10 - Detailed drawing showing the torsion bar and the rear suspension system.

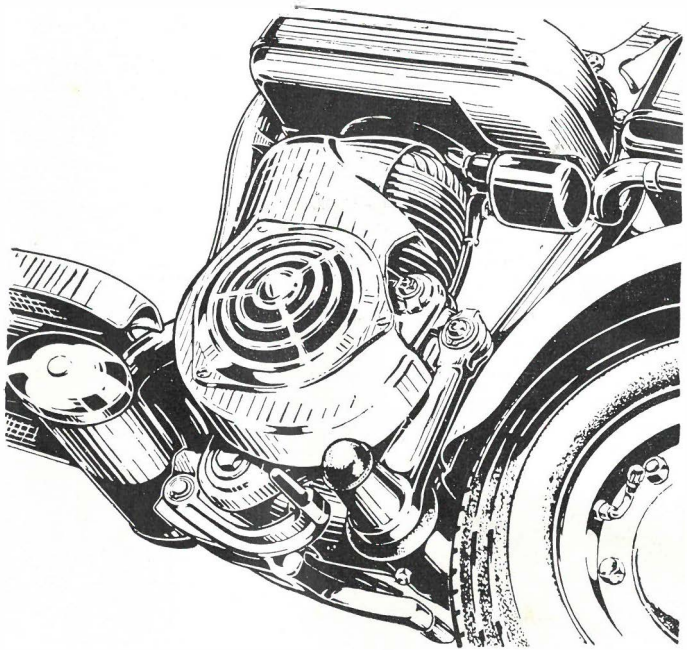


Fig. 11 - Rear suspension assembly.

A cylindrical damper, which minimizes swing and vibration of the engine-wheel group when the machine runs and increases the static load of the entire rear suspension is fitted between the transmission case and the frame (fig. 11).

Two rubber pads, one fitted on the rear lower portion of the crankcase and the other enclosed within a malleable cast iron case, act as shock absorbers.

GENERAL INSTRUCTIONS

The Dell'Orto carburettor, 19 B 4 type, is provided with starter, bowl filter, air filter with wire wool and special air inlet for reducing the intake noise.

Starter device

The starter device is a ready means to enrich the mixture for starting purpose when the engine is cold. In the D model the starter is controlled by a lever fitted at the top of the carburettor (see fig. 12 and Detail 1 fig. 14).

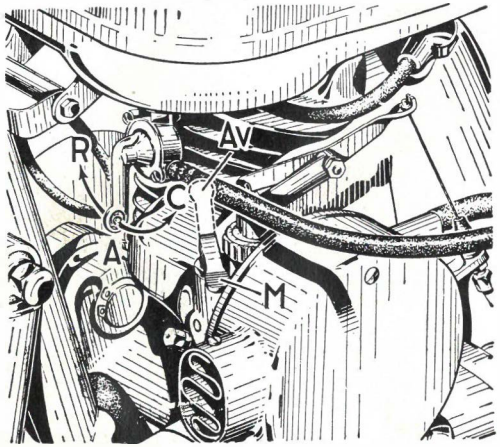


Fig. 12 - D Model - lever AV Position = Starting - M Position = Running.

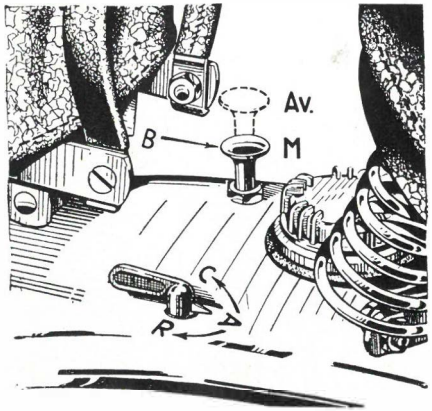


Fig. 13 - LD Model - Button AV Position = Starting - M Position = Running.

In the LD Model the starter is controlled by a button situated just behind the rider's seat (see fig. 13 or Detail 2 fig. 14).

As the control lever or the button is raised to the AV Position, the starter is immediately connected to the choke.

To obtain an easy starting it is advisable to keep the throttle closed and fully raise the starter lever.

Once the engine is running and tends to accelerate, move the starter lever down (M Position) and slightly open the throttle.

Idle adjustment

Adjust idle with the engine warm. Adjustment is achieved by means of two screws: the throttle control screw (Detail fig. 14) and the mixture strength control screw.

First adjust the screw (3) - see fig. 14 - so that the engine turns over slowly; **then adjust the horizontal screw (4) -** fig. 14 - to obtain an engine running as smooth as possible, bearing in mind that with rich mixture the engine has a tendency to accelerate while on the other hand a weak mixture causes the engine to stop.

In the first case unscrew in order to weaken the mixture; in the second case screw up to enrich it.

Remember that proper idle adjustment is an important factor for a low fuel consumption.

SERVICES INTRUCTIONS

— Be sure the **carburettor is properly fitted to petrol** (gasoline) **inlet pipe** and in perfect vertical position.

— Check for **tightness of carburettor piping and fuel tap.**

— Inspect float level both when machine is standing and running. If carburettor is flooded look for following causes:

— foreign matter in petrol interferring between float needle and float chamber bottom with consequent leakage. Clean carburettor thoroughly and check for efficiency of fuel filter and tightness of the gaskets.

— Float needle point is worn or damaged with possible leakage. Replace with a new needle.

— Float has got heavy through fuel infiltrations, or has been crushed; clip fixing the needle to the float is damaged, or not placed accurately. Replace by a new float. The needle should be accurately put in, round end first, otherwise the clip would damage the needle surface with consequent lack of tightness.

— Make certain the air cleaner is in good condition. An air cleaner choked with dust and dirt increases the fuel consumption. As a rule wash the part in petrol frequently to eliminate possible trouble.

— Make sure that the starter controls slide in their seats freely and allow the valve to close perfectly. Otherwise a lower mileage per gallon and difficulty in idle adjusting may be experienced.
For all normal running on road keep the starting device closed.

Atomizer

Ascertain if the hole is not enlarged or deformed and after every 10-15.000 km (6.000-9.000 miles) replace with a new genuine part, marked « 255/B » (referring to hole dia. 2,55 mm. = 0.1023")

Needle

Make sure it is in good condition and does not afford any distorsion or diameter reduction caused by wear.
Check whether the clip is properly fitted and matched with the second groove (from top down).

Replace the needle if it has worn. To this end examine the needle every 5.000-6.000 km (3.000-4.000 miles) **Bear in mind that to weaken the mixture the needle must be moved down to the first groove and to enrich the mixture the needle should be raised to the third groove.**

Throttle valve

Ascertain if throttle valve is in good condition and in case of lack of tightness which could determine incorrect idling, replace with a new genuine part, marked « 75 ».

Main jet

Check for proper fitting of the jet into threaded seat and for exact gauging. If necessary, replace with a new part, gauge « 72 ».

Idling jet

Be sure idling jet is correctly screwed into its seat and the tapered end not damaged or the gauge worn. If necessary, replace with a new genuine part marked « 40 ».

Starter jet

Examine whether the jet is properly fitted in the threaded seat and the gauge is still in sound order. Otherwise replace with a new genuine part marked « 75 ».

FEATURES OF DELL'ORTO CARBURETTOR MA 19 B 4 TYPE

Valve	N. 75	Main jet	72
Needle	D 3 at the second groove	Needle jet	40
Atomizer	255/B	Starter jet	75

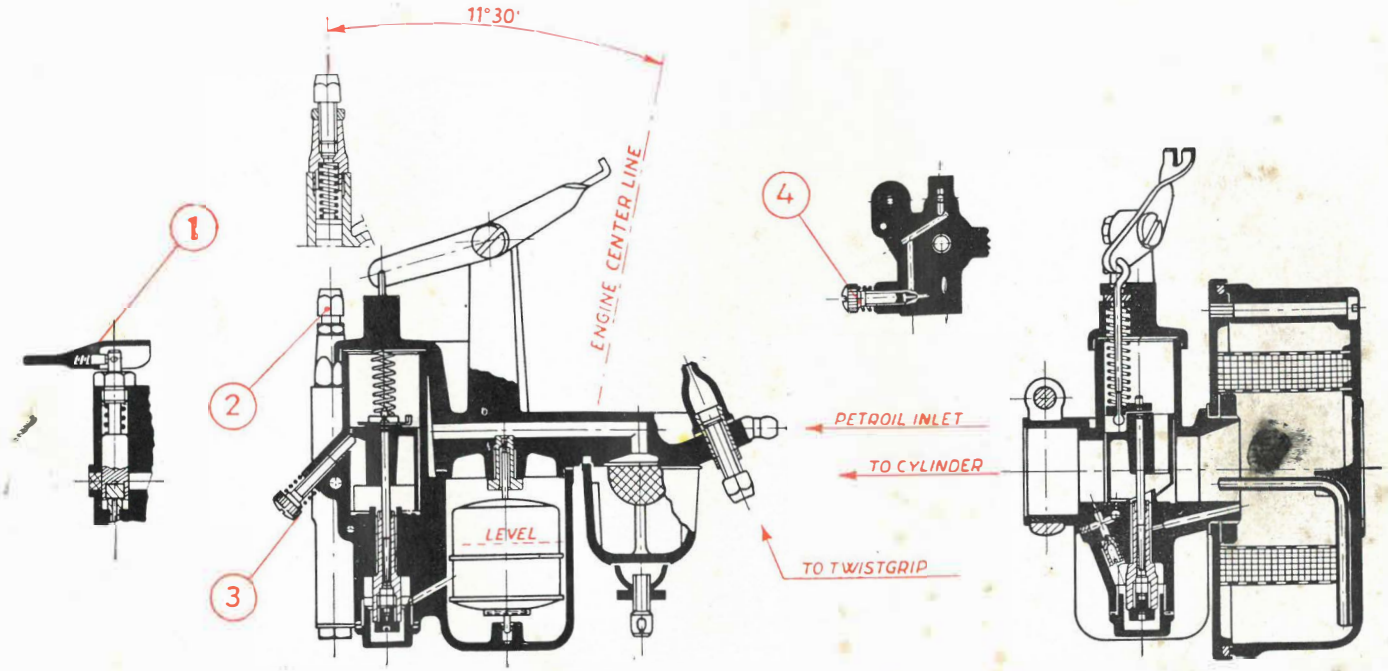


Fig. 14 - A detailed drawing showing the carburettor operation.

SPARK PLUG

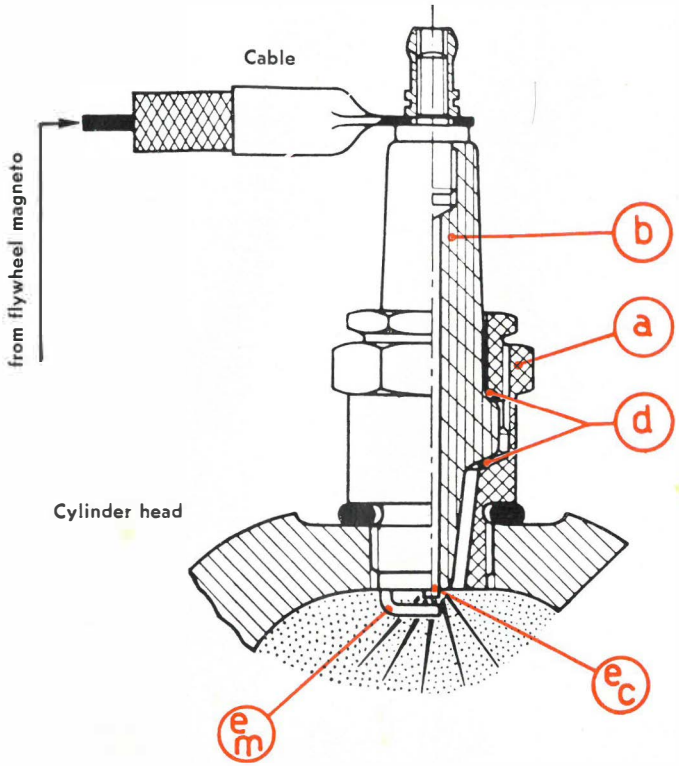


Fig. 15 - How to install the spark plug.

Spark plug is one of the most important engine components. In effect correct performance of engine depends in a great degree on the spark plug.

The spark plug (fig. 15) is screwed to the cylinder head and is connected to the current-source by means of an insulated cable; the spark fires the fuel mixture, which is under high compression in the combustion chamber.

Spark plug consists of two essential elements:

— **the body** (a) provided with threaded stem to be fitted to the cylinder; on its lower end an extension (em) is welded, which constitutes one of the electrodes (earth electrode). The spark jumps between the two electrodes. The body is screwed to the cylinder.

— **the insulator,** (b) fitted to the shell (a); at the centre the second electrode is incorporated (ec) which through the terminal is connected to the cable supplying current. The copper rings (d) are designed to lock the insulator to the body and to ensure a gas tight seal. If gas escapes through the spark plug, troubles may result.

The insulator efficiency is of great importance in spark plug operation, as the insulating element must be able to withstand severe conditions due to internal strains. The lower end of the spark plug projecting into the combustion chamber is provided with smooth surface to prevent oil adhering and carbon sediment.

The shape of the electrodes and the gap between the points are exactly designed so that, when the spark plug circuit is supplied with current, the spark can jump during the last compression phase.

During operation, the spark plug must be able to maintain a constant temperature which, for a correct performance, has to remain within exactly specified limits. The lower limit is established by a temperature range of approx. 500° C. (930° F) ensuring that carbon and oil sediment can be turned and eliminated with the exhaust gases.

The upper limit is called spontaneous ignition temperature, beyond which the fuel mixture burns before the spark has occurred. This temperature is approx. 850° C (1500° F).

Contact breaker points gap: 0,0196"÷0,0236"

Spark-Plug heat range: 225 Bosch Scale

FLYWHEEL MAGNETO

Two different flywheel magneto types are fitted on similar but they have not interchangeable parts besides the two Lambretta models: FILSO and MARELLI. Both are H.T. and L.T. terminals.

FLYWHEEL MAGNETO MARELLI « MVB4A » WHIT SEPARATE IGNITION COIL B 20 A

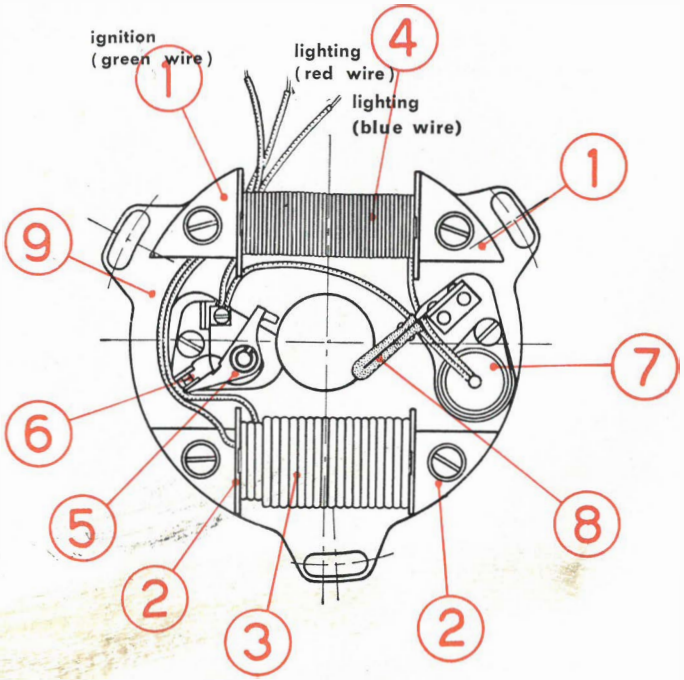


Fig. 16 - Stator Plate

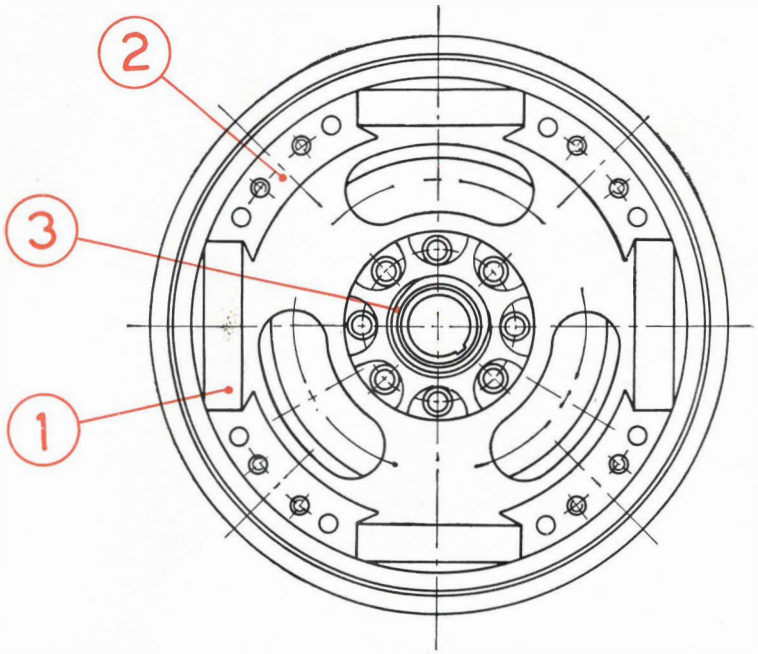


Fig. 17 - Rotor

The flywheel magneto « MVB 4 A », better described as an alternating current generator, provides the electric current for the ignition and lighting.

All components are assembled in two distinct groups:

— stator plate

— rotor

The stator plate, made of light alloy, is fitted to the crankcase and by means of screws allows a proper advance adjustment.

On the stator plate are housed (see fig. 16):

— the lamellar soft cores, around which the coils of wire are wound, in order to transform the magnetic flux to alternating current for the lighting system and the ignition (after transforming the alternating current to direct current by means of the separate coil B 20 A).

— the contact breaker consisting of the breaker arm (5) carrying the adjustable contact point, and the stationary point (6) fixed to the plate. The contact breaker is synchronized with the ignition phase of the engine cylinder.

— the condenser (7) in oil bath contained in tight metal box.

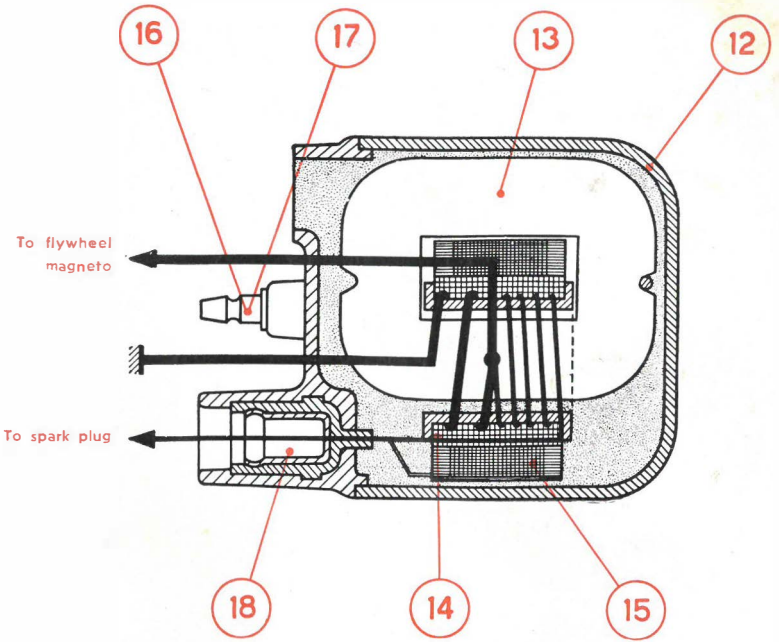


Fig. 18 - Operation of the coil B 20 A.

The flywheel or rotor is fitted on one end of the crankshaft and comprises the following elements (fig. 17):

— one steel sheet housing (8), inside which four permanent magnets are placed (9);

— four pole-pieces

— one cam (11) actuating the contact breaker.

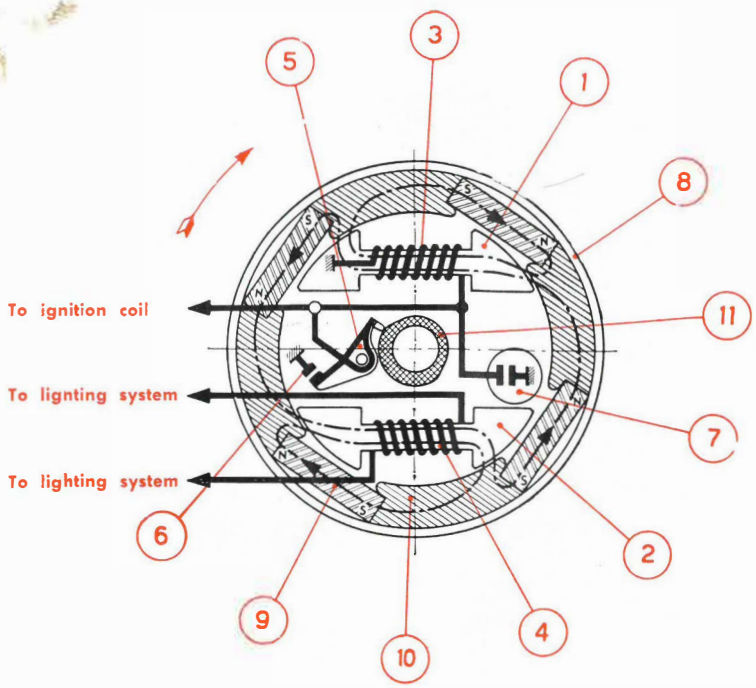


Fig. 19 - Wiring diagram.

Separate ignition coil B 20 A (fig. 18)

The external ignition coil B 20 A comprises an insulated box containing a lamination set (13), on which the primary (14) and the secondary winding (15) are located.

The ends of the primary winding are connected to the l.t. terminals (16-17), the breaker arm and the earth point of the machine. One end of the secondary winding is linked to that end of the primary winding connected to the rotor and the other to the socket (18), serving as attachment for the spark plug cable.

Maintenance

Every 2000 km (1200 miles) check if the flywheel cam is clean and coated with grease, so that the breaker arm does not become worn. If necessary, wipe the cam with a clean rag, adding some oil to the lubricating felt.

The breaker arm must slide freely on its pin; if any difficulty is experienced pour a drop of oil on the surface of the pin. However do not allow the oil to reach the breaker points, to avoid the possibility of the points being damaged. Use preferably MARELLI lubricants.

The opening of breaker contacts must be 0,4±0,05 mm (0,0158"±0,00197").

If the gap is larger or smaller, adjust it by slackening the screw on the fixed contact plate.

Before adjusting breaker points, look for contact surface conditions. It should be smooth and clean; if found in bad condition file the contact surface carefully with a very fine file, removing any metallic dust.

The pressure of breaker contacts must be 650±50 gr (1,44 ±0,110 lbs.).

Check the contact pressure by applying a dynamometer to the surface of the adjustable contact.

For cleaning the ignition coil use petrol only and very clean rags.

USE

The « MVB 4 A » flywheel magnetos are designed for two-stroke monocylinder motor-cycles: - rpm 3000, compression ratio up to 1 : 6 - 6 V Lighting system with 27 W output. The unit generates two distinct low voltage currents:

1) the low voltage current, which is transformed by the ignition coil B 20 A to high voltage current - provides the desired spark, once every revolution of the engine, at the points of the spark plug.
2) the low voltage current (6V-27W) for lighting.

TEST DATA

Mechanical test

— Contact gap 0,4±0,05 mm (0,0158"±0,110 lbs)
— Contact pressure 650±50 gr (1,44 ±0,00197")

Electrical test

With a short-circuited generator, the flywheel magneto, connected with a proper spark meter adjusted for 5÷8 mm (0,197"÷0,315") gap, must produce a correct spark for a speed range from 200 up to 3000 r.p.m.

The lighting current specifications are as follows:

— Tension 6 V

— Power 27 W

The Filso flywheel magneto « A.V.S. » 30.6/140/F.0176.C. and the H. T. ignition coil are similar to the Marelli makes, previously described. However they are not reciprocally interchangeable.

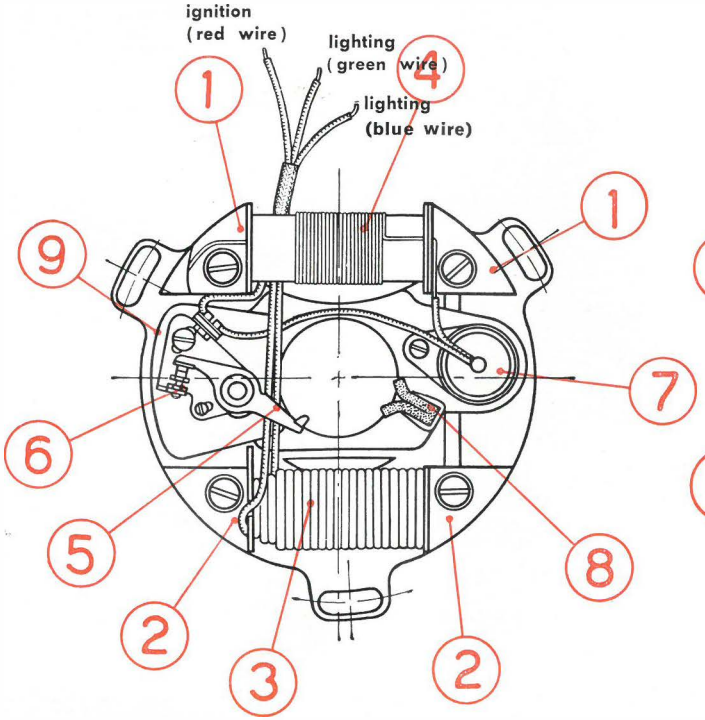


Fig. 20 - Stator

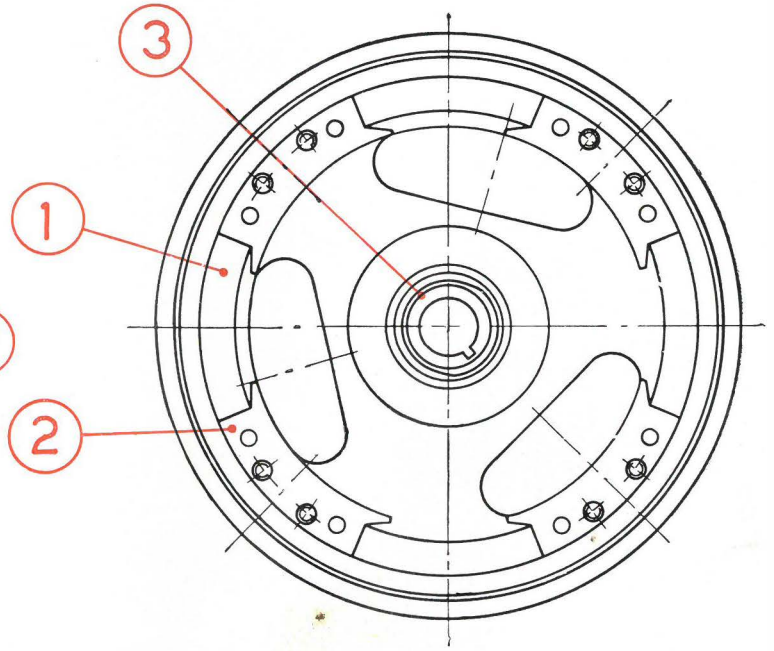


Fig. 21 - Rotor

Main components:

— Stator Plate
— Rotor

The stator plate comprises:

1) } cores
2) }
3) lighting coil
4) ignition coil
5) breaker arm for adjustable contact
6) stationary contact
7) condenser
8) felt oiling pad
9) plate

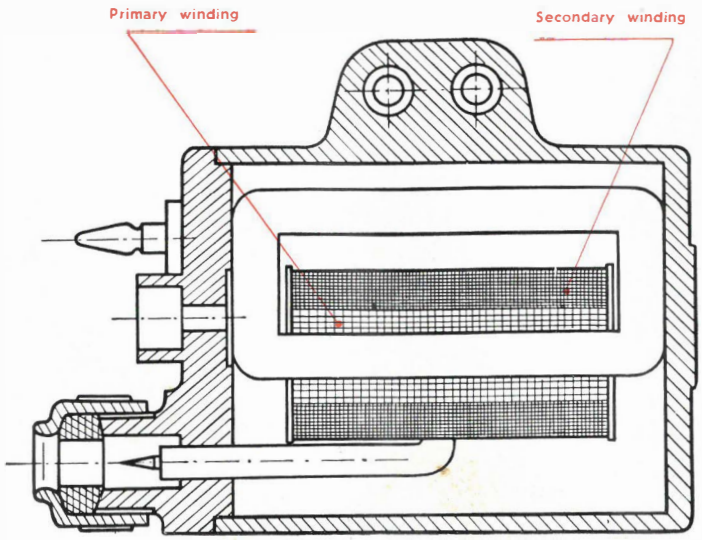


Fig. 22 - « Filso » separate H.T. coil.

The flywheel carries:

1) permanent magnets
2) pole-pieces
3) cam

Filso separate H.T. coil

The Filso external H.T. coil, like the MARELLI external coil, transforms the low tension current to high tension current needed for a correct ignition.

TEST DATA

Mechanical test

Max r.p.m.	6000		
Contact gap	0,4±0,05	mm	(0,0158"±0,00197")
Contact pressure	850±50	gr	(1,90 ±0,110 lbs)

Electrical test - H.T.

Min = (with standard 3 electrode spark meter, opening 5 mm (0,197") 170/200 revolutions - lighting generator shorted

Electrical test - L.T.

Voltage at 3000 r.p.m. with a load of 1,33 ohms on the resistor: 6 volt/min.
Voltage at 6000 r.p.m. with a load of 1,5 ohms on the resistor: 8,4 volt/max.

Contact breaker adjustment

When the machine has covered the first 1500 km (900 miles) it is desirable to check the contact breaker gap to see whether it tallies with the one already specified.
If the gap is larger or smaller, slacken the screw on the fixed contact plate, move the eccentric until the gap at the points is correct. Finally tighten up the screw.

DISMANTLING

When removing or installing motor-scooter parts use the proper tools, and make sure that the parts are clean.

Unsuitable tools can cause troubles or failure, which may require replacement of the parts. Wherever possible, use tubular wrenches instead of normal wrenches; never use monkey wrenches. Also avoid employing hammers and mallets. Use only leather or rubber mallets or interpose a lead spacer between part and tool.

During removal, mark matching parts position to be sure to return them to their proper places; assemble screws and their nuts and put all parts belonging to the same motor scooter in a case or separate place in order to avoid mixing them up with other parts.

Wash the removed parts with paraffin or petrol (gasoline); to this end use two containers, one for a preliminary washing and the other for ultimate cleaning; dry carefully. In the event of complete removal of the main elements (engine, clutch, gearbox, transmission) for overhauling or repairing purposes, keep to the following operation sequence.

If only partial repairing is needed, refer to the instructions reported for such part.

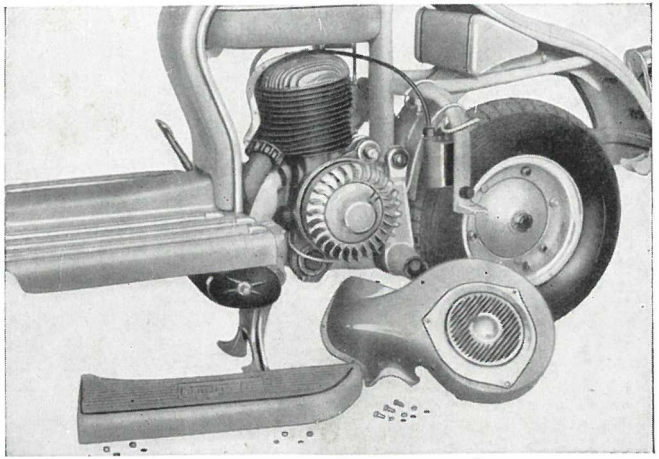


Fig. 23 - How to remove the side boards and the baffle plate, flywheel magneto side.

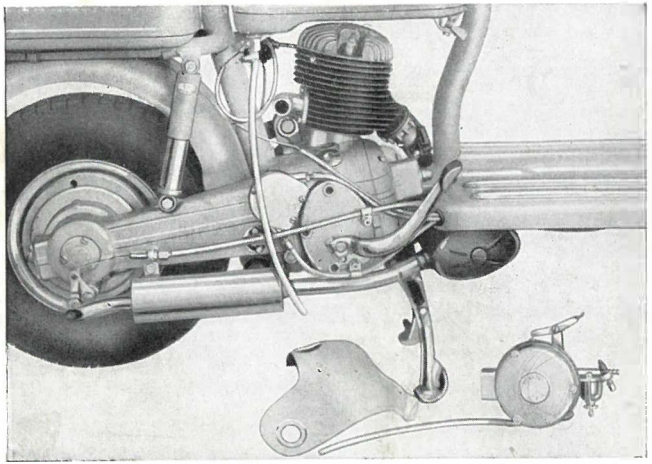


Fig. 24 - Removing the carburettor.

ENGINE DISMANTLING

To remove the engine from the frame it is necessary, in the case of the « LD » model, first to detach the side panels and the side boards.

Following dismantling operations are common to both models.

The first task, before dismantling the cylinder, is to remove the spark plug; next detach the high voltage cable, close the petrol tap and remove the carburettor after slackening the fixing screw; finally take out the baffle plate.

To detach the fuel tank from the frame on « D » model, extract the fixing bolts.

On « LD » model instead unscrew the cap locking ring and the tap clip.

To slide off the cylinder head, unscrew the four lock nuts and the washers.

SILENCER AND CYLINDER DISMANTLING

Slacken the ring between the cylinder and the exhaust pipe and unscrew the nut fixing the silencer to the engine

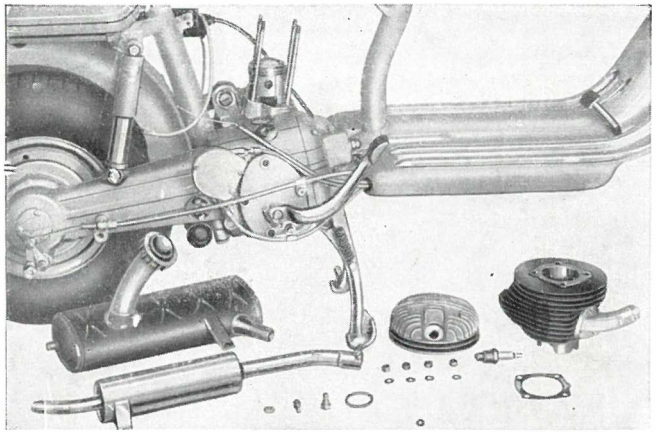


Fig. 25 - To remove the cylinder, silencer and expansion chamber.

stud bolt. Free the expansion chamber after loosening the screws locking it to the crankcase.

To clean the silencer from carbon formations developed by exhaust gas, loosen the safety nut and the bushing fixing the bottom and drive out from the other end the bottom and the rod; remove the inner pipe with diaphragm and clean thoroughly.

Remove the cylinder from the bolts and turn the crankshaft upwards until the piston is entirely out of the crankcase.

FLYWHEEL MAGNETO REMOVAL

Take out the magneto cover, held in place by a spring ring. To remove the rotor use the spanner 49210; apply it to the holes, preventing in this manner any rotation. Next unscrew the lock nut. Use the puller 37058 tc free the rotor from the crankpin.

Disconnect the cables from the terminal. After dismantling, care should be taken to reinsert each screw in its hole.

Remove the flywheel magneto locking key from its seat on the crankshaft. By loosening the three screws, core and coil are being freed. To take out the lock nut on the crankshaft it is necessary to prevent first any rotation of the latter. To this end insert the 27 mm (1",06) exagonal spanner and the locking tool 49628; next apply the puller 49188 and screw it to the stationary flange.

Turn the threaded pin, and the flywheel is entirely freed. **Match the rotor and the stator plate immediately after removal,** to avoid the pole pieces losing their electromagnetic characteristics.

Removal of bearings and gaskets placed inside the stator flange must be performed by means of proper punch.

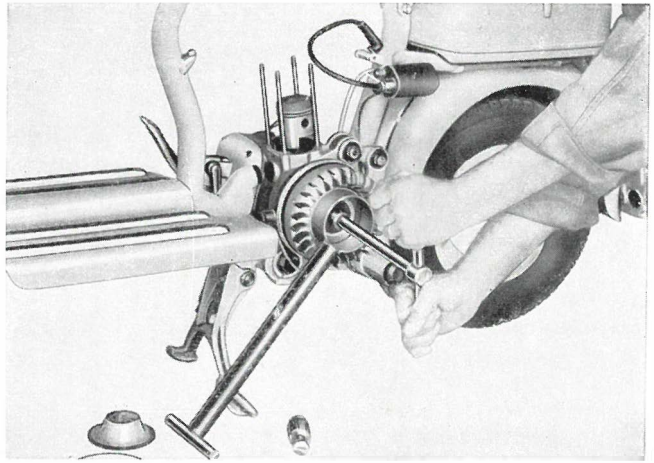


Fig. 26 - Removal of the flywheel magneto rotor.

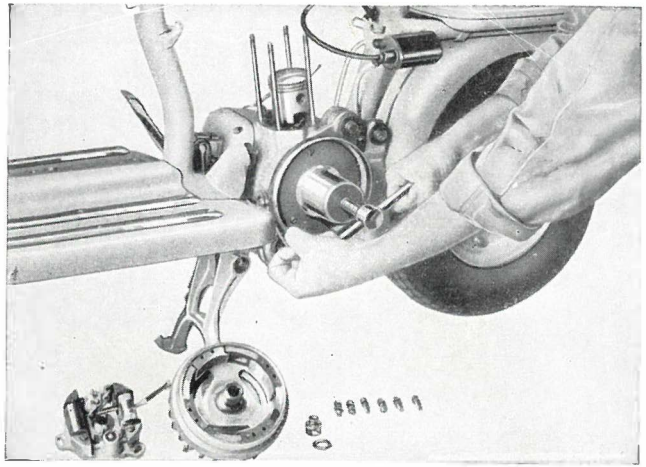


Fig. 28 - Removal of the flywheel stator.

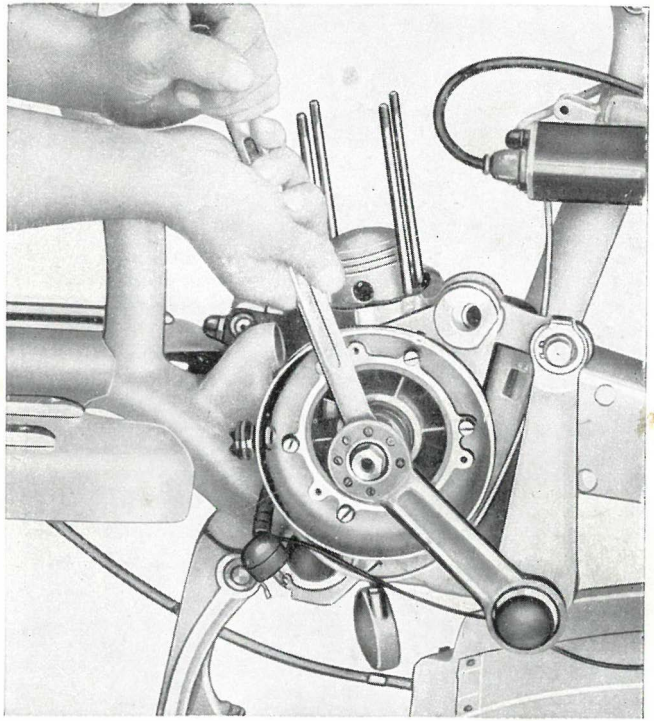


Fig. 27 - Pulling out the nut of the flywheel flange.

First take the Seeger ring off holding the gasket in place, and to avoid damaging the outer gasket diameter strike with the punch on the opposite side only, operating the outer bearing.

REMOVAL OF K.S. CASE

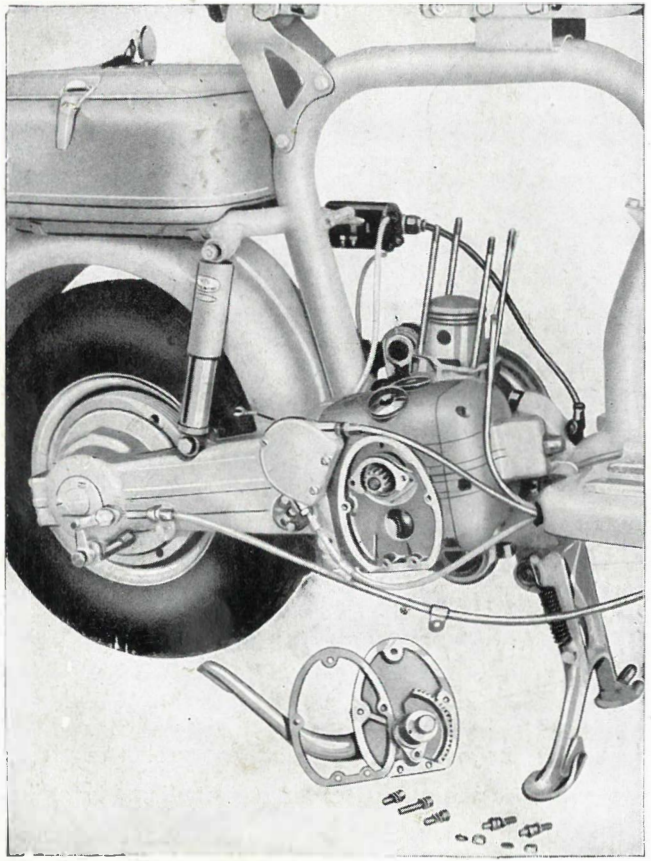


Fig. 29 - Disassembling the K.S. case.

The K.S. unit of the motor scooters « D » and « LD » consists of two groups which have to be dismantled by following operations:

Loosen the five exagonal bolts fixing the K.S. cover to the crankcase by using the spanner 37380 ; loosen the two screws holding the bevel pinion support and remove this group. (fig. 27).

These operations are necessary to dismantle the engine bevel gears and to drive out the clutch bearing; but for partial overhauling of above groups first operate the pedal return spring fitted with three turns pre-loading and fixed to the locking sleeve.

The pedal is locked on the splined coupling by means of screws with nut and washer; after removal of these the pedal can be withdrawn.

To disconnect the second group take out the spring ring on the shaft and remove the washer and pinion.
Slide the Seeger ring out, holding the starter bevel pinion in place, and disconnect it from support.

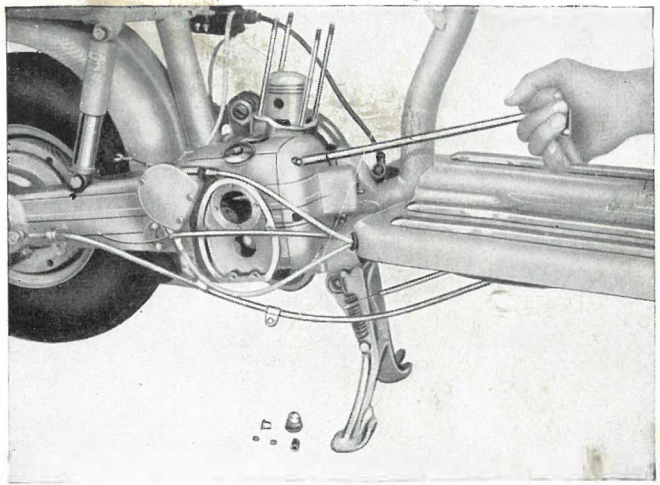


Fig. 30 - Clutch cover removal.

Disconnect the brake control cable by unscrewing the nut fixing the cable to the shoe control lever; free the release spring of the clutch lever and disconnect the cable from the latter; slacken the threaded cap protecting the tie rod attachment; take out the nut, counternut and bushing; loosen the 5 screws fixing the cover to the crankcase using the spanner 37380; slacken the two locking screws and detach the outer cable control support from the cover.

The disconnected cover carries the two clutch control levers (inner and outer); it is easy to dismantle them.

Next dismantle the clutch discs using the tool 49753 (fig. 31) and driving the clutch control rod into the tool center hole.

At the rod end screw in a nut, which will push the spring assembly in such a manner that the disc retaining ring placed into the bell inner groove is freed and can be easily driven out.

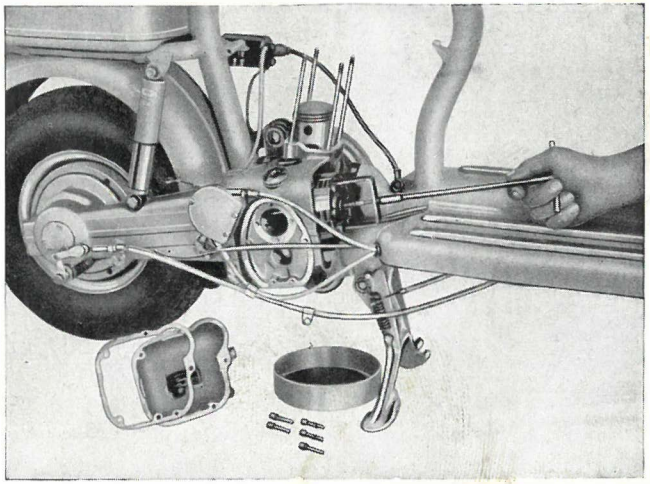


Fig. 31 - Clutch disc removal.

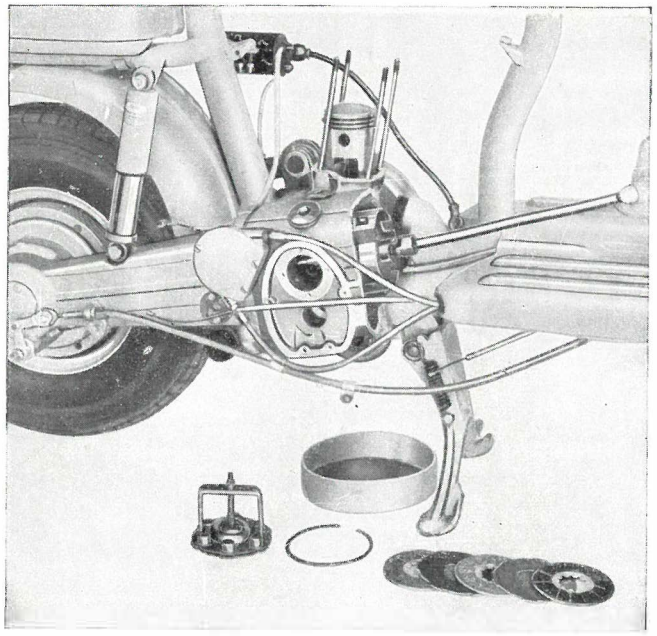


Fig. 32 - Removing the clutch slotted drum.

After ring removal, pull out the fork, extracting discs, cups and springs fitted in the second group, still under compression.

If further dismantling of this group for repairing purpose is not necessary, do not remove the puller, as reinstalling of the group will be easier.

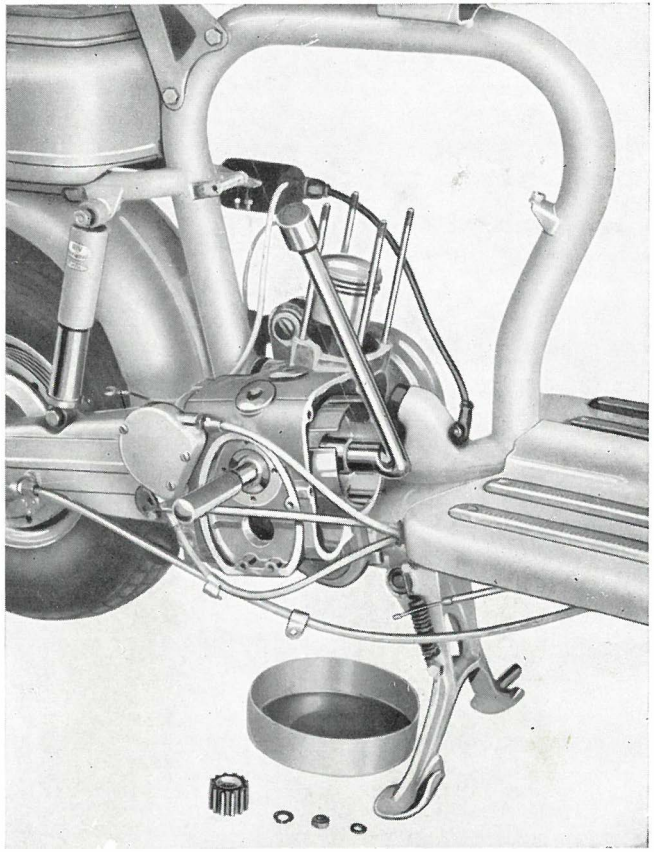


Fig. 33 - Clutch bell nut removal.

Apply the wrench 37101 on the clutch drum notches (fig. 32) and loosen the lock nut.

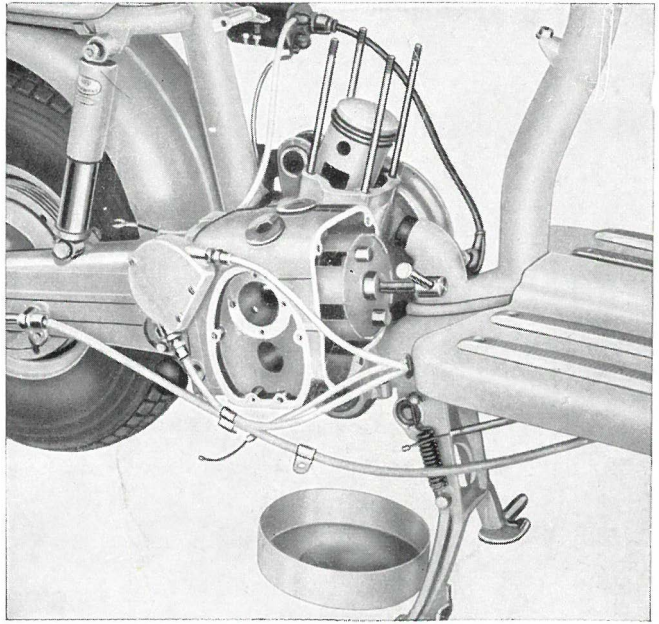


Fig. 34 - Removing clutch bell.

Slide the clutch drum off; if necessary, help removal by forcing the screwdriver between the clutch slotted drum and the bell.

Straighten the safety ring tabs: apply the hub locking wrench 49256 inserting it from the k.s. bevel gear hole; unscrew the bell locking nut (fig. 33).
Apply the bell puller by engaging its six teeth in the grooves of the disc retaining ring; then operate the puller screw, sliding the bell off from the clutch control gear (see fig. 34).

Loosen the three screws holding the bearing flange in place and take bearing and flange out.

To dismantle the bearing apply the puller 43170, as illustrated, and force its end until the bearing is entirely off. Pinion and sleeve will be simultaneously freed.

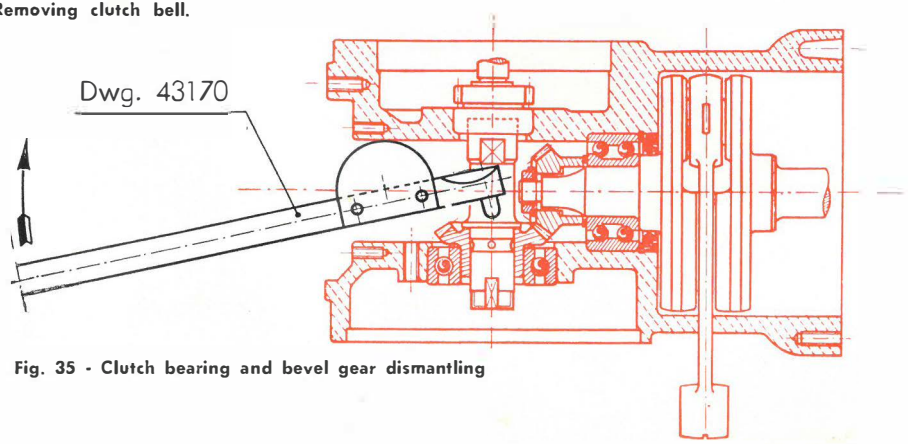


Fig. 35 - Clutch bearing and bevel gear dismantling

REMOVAL OF THE GEAR CHANGE SELECTOR CASING

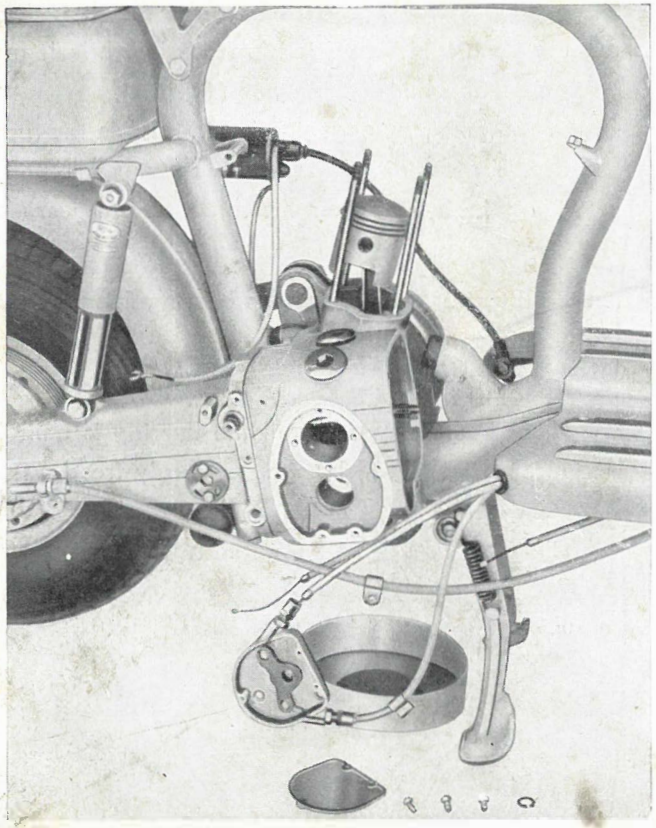


Fig. 36 - Removal of the gear change selector casing.

Remove the casing cover by loosening the three bolts.
Loosen the two cable adjusters; remove the Seeger ring, and slide off the lever from the pin (fig. 36).
Detach the casing from the crankcase by slackening the three screws.

WHEEL AND REAR MUDGUARD REMOVAL

To remove the rear wheel, unscrew the three cap nuts fixing the rims to the hub. Disassemble rims and take out the tyres; tighten the nuts previously loosened; apply washers.

To do the same operation on Model « LD » first remove the left-hand side covering.

To overhaul or repair the brakes remove the wheel hub as well, so that adjustment of the brake shoes may be easily performed. The hub is locked to the wheel axle by means of a special lock nut; unscrew it by using the wrench 35603, or the normal multi-ended wrench. Then apply the puller 37061 and pull the hub out of the shaft.

Remove the key located on the wheel axle to avoid dropping or losing it.

To remove the transmission and rear suspension assembly it is not necessary to take the hub out (disconnect it only in the case of complete dismantling of the group), but the mudguard must be removed; to this end unscrew the bolts fixing it to the frame and crankcase.

The rear mudguard is provided with clamps to fix the tail light cable.

Do not tear this cable while removing the mudguard, as it is long enough to allow placing the mudguard on the board, assuming you do not prefer disconnecting it from the motor scooter.

In this latter case detach the cable from the tail lamp socket and slide it from the clamp off.

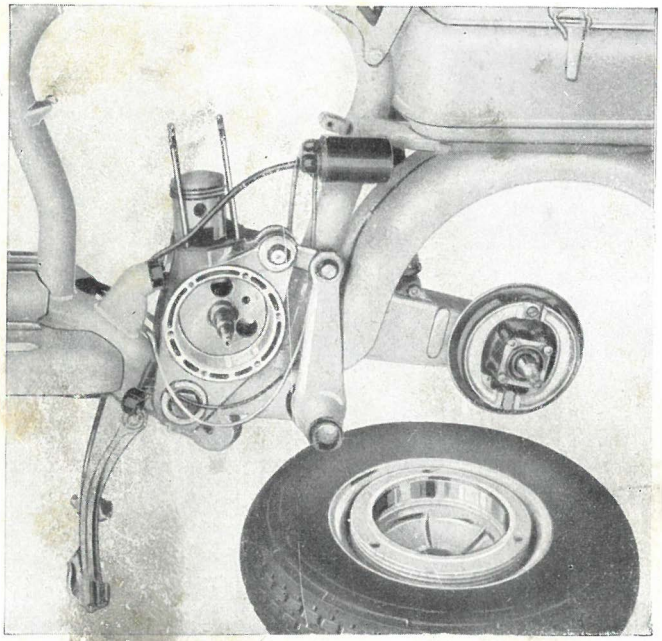


Fig. 37 - Removing rear wheel tyre and hub.

REMOVAL OF THE FRONT WHEEL AND TYRES

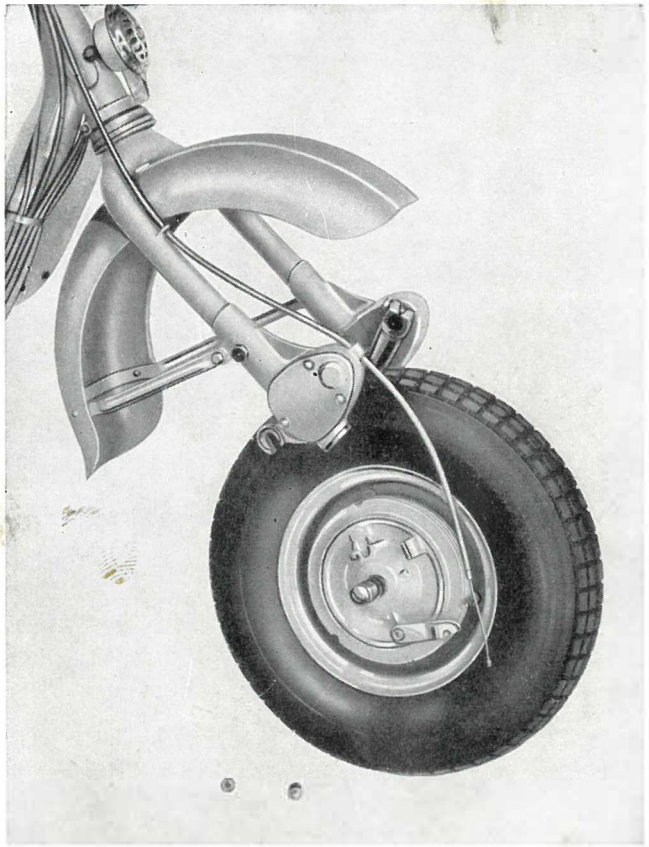


Fig. 38 - Front wheel removal.

To remove the front wheel on both models, first disconnect the brake cable, then unscrew the side nuts fixing the wheel to the trailing links and slide off the washer located under the trailing link fixing nuts (fig. 38). To remove the tyres from the front and rear wheel rims on both models, first deflate the tubes, then unscrew all six nuts (three normal and three cap nuts).

REMOVAL OF THE TRANSMISSION REAR SUSPENSION ASSEMBLY OPERATING FROM THE CRANKCASE SIDE

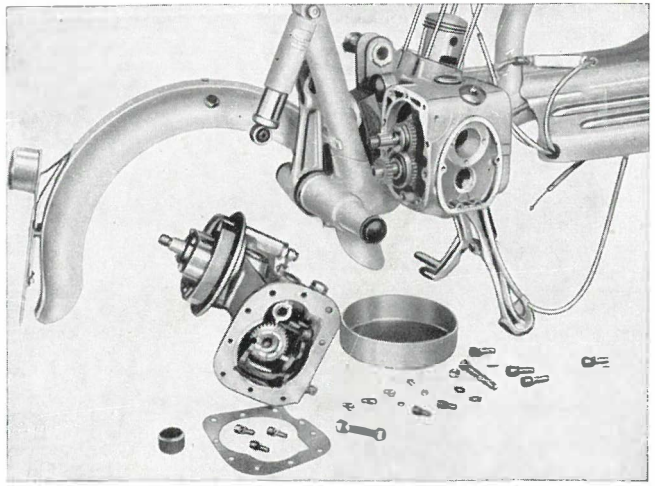


Fig. 39 - How to dismantle the tubular damper.

After dismantling the gear change selector casing, the rear wheel and the mudguard, slacken the terminal nut of the rear brake control cable and slide the latter from the adjustable attachment off.

Free the damper from the bolt fixing it to the transmission case. If its replacing is not necessary, it is advisable to hold the damper assembled with the frame. Remove the rubber pad and set the crankcase swinging at its maximum degree. Place a piece of wood between engine and frame in the manner shown in fig. 39 in order to hold the group lifted as otherwise it would rest on the torsion bar housing and prevent easy slackening of the transmission case fixing screws.

Place a bowl under the crankcase connecting line to recollect oil.

Now we can start dismantling the transmission group: first remove the bolt aligning the crankcase and the transmission case. This bolt is locked by a nut located at the transmission case side; slide it off together with the washers, and gently strike with the mallet freeing the pin. Loosen the remaining nine exagonal screws and detach the transmission group from the cranckase. Rotate the group and pull it out.

After dismantling, drive the main and secondary shafts out from the crankcase and remove the gears keyed to them. If necessary, slide the second gear connecting ring on the countershaft off, taking the Seeger ring out first (see fig. 39).

To free the gear shifting fork it is necessary to slide the shaft off locked by the Seeger ring inside the crankcase. Next drive out the **neutral gear on the main shaft and the transmission shaft;** take care the needles inserted between the gear and the bushing do not get lost.

DISMANTLING OF THE REAR BEVEL GEARS

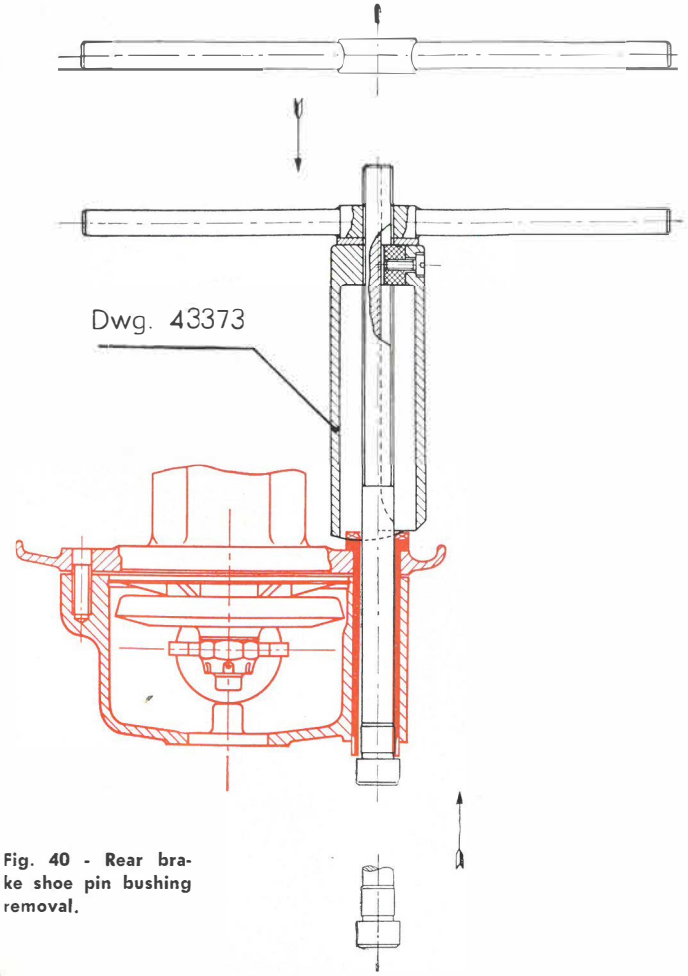


Fig. 40 - Rear brake shoe pin bushing removal.

After disconnecting the transmission case and rear wheel hub from the crankcase dismantle the entire group as follows:

Slide the Seeger ring from the **rear brake shoe pin off;** operating with a screwdriver, detach the shoes from the pin. Drive the Seeger ring from the shoe control cam pivot out, dismantle the control lever and the greaser and extract the pivot by striking with a suitable punch. Remove the washer locking the cam bushing nut and unscrew the latter.

Insert into the bushing hole the threaded puller pin 43373 (See fig. 40) and apply the puller from the opposite side in such a manner that the key corresponds with the groove. Screw the lever on the threaded end and extract the bushing.

Loosen the brake shoe pin and the nut locking the rear wheel supporting flange; take the washer out and disconnect the flange from the crankcase. Attention must be paid to avoid breakage of the gaskets.

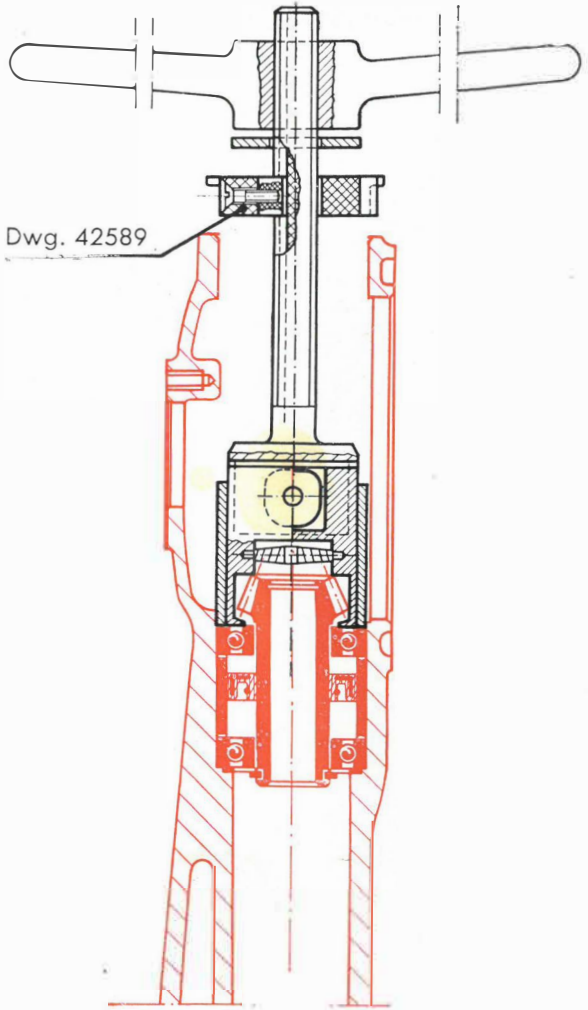


Fig. 41 - Detailed drawing showing how extracting the bevel pinion group.

Wheel, axle, bearings, rear bevel gear, etc.; are fitted on the rear wheel supporting flange. To disconnect these parts follow this sequence:

Unscrew the four nuts fixing the bearing cover and detach flange and packings — take the cotter pin out from the castle nut locking the bevel gear — loosen the nut which holds the axle in place either by means of the wrench 43370 or by fitting the wheel hub momentarily.

Strike with punch the axle end to free the bearings. During this operation we recommend to place between the punch and the part a soft material spacer (aluminium or lead) to avoid damaging the axle end and thread.

Loosen the four screws fixing the rear cover of the transmission case and three screws fixing the speedometer drive cover; take out the retaining ring placed under the former together with the washer and extract the bevel pinion bearing retaining plate from the transmission case support.

Apply the bevel pinion puller 42589 and extract beside the pinion, the bearings, gaskets, etc. following this sequence:

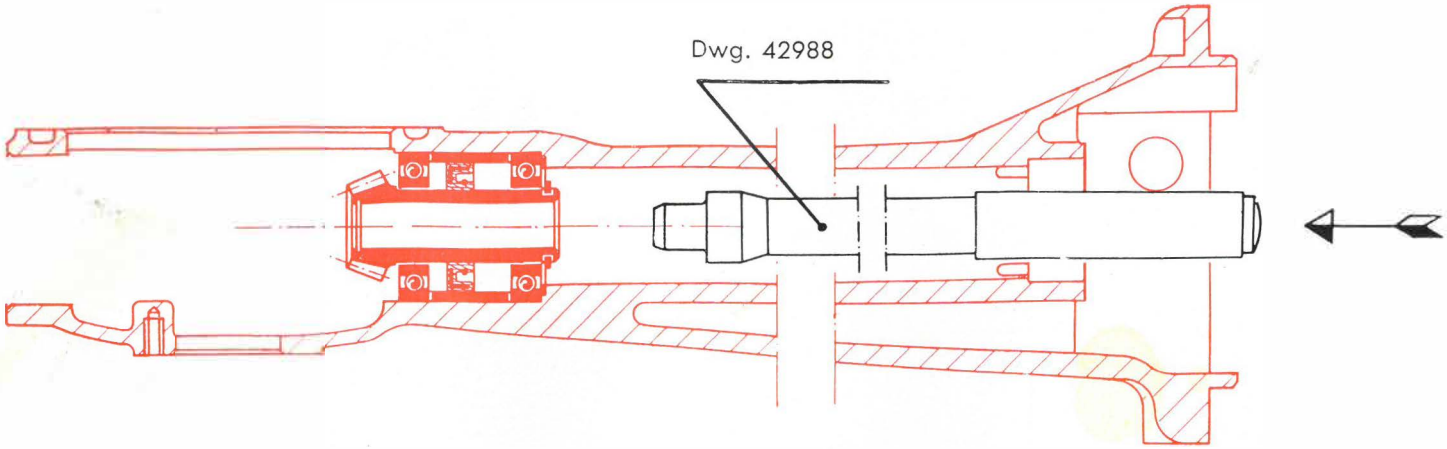


Fig. 42 - Bevel pinion removal.

Insert the tool from the transmission case rear hole; engage the tool clamps between pinion and bearing (see fig. 41).

To perform this operation, shift the support partially so that the clamps open under the inner spring action and grip the part; then lower the support again.

Fit the washer at the transmission case end and operate the handle to remove the group from its seat. Drive the spacers out and dismantle the pinion assembly.
This operation is easily performed; in effect when the Seeger ring and washers have been taken out, it is sufficient to strike the pinion end with the punch (42988) after getting the bearing resting on a proper tool.

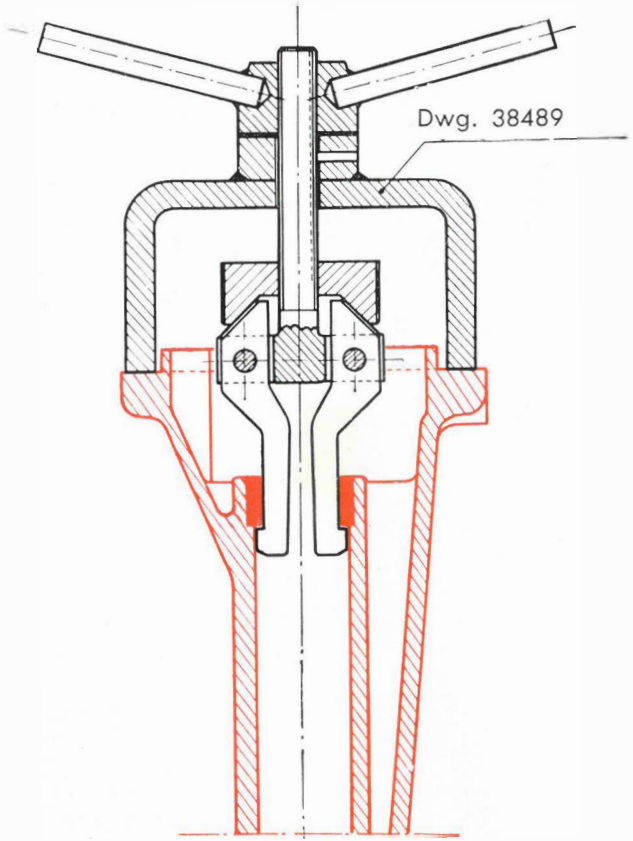


Fig. 43 - Removal of needle bushing from the transmission case.

The punch 42988 can be used also for extracting the pinion instead of the puller 42589 (fig. 42).

Extract the needle carrying bushing on the main shaft, operating from the transmission case, engine side (fig. 43).

Take care, before starting this operation, that the tool is correctly supported on the crankcase and the clamps fully enlarged.

PISTON AND CRANKSHAFT REMOVAL

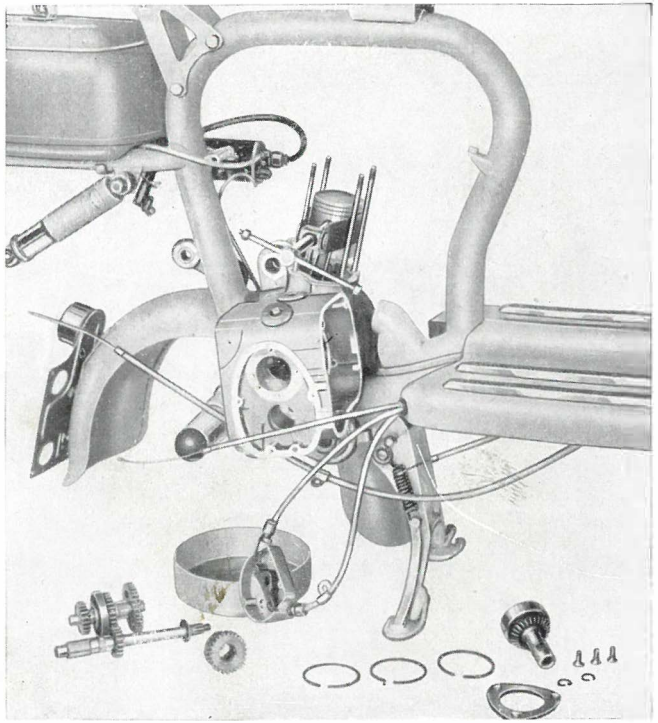


Fig. 44 - Piston removal.

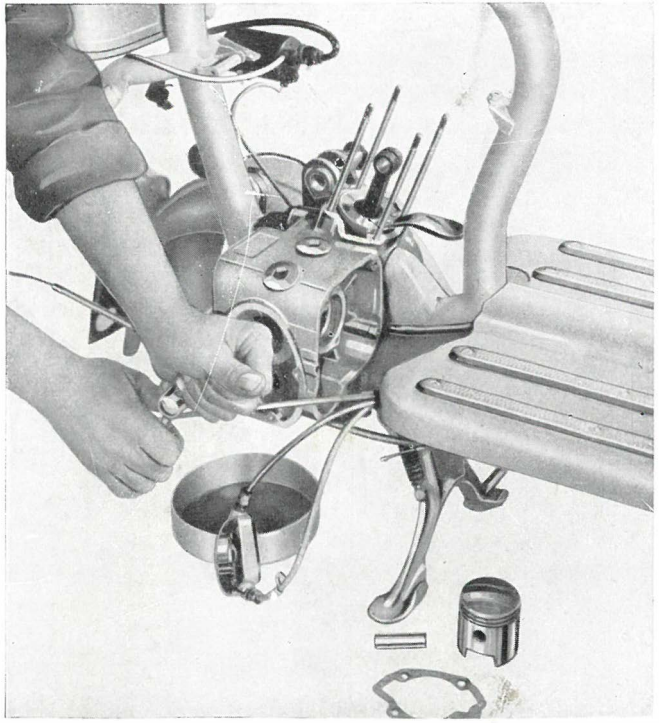


Fig. 45 - How to remove the lock nut of the bevel pinion.

To remove the piston, operate as follows: first free the gudgeon pin from the Seeger ring and then using the tool 49199 pull the pin out.

Straighten the tabs of the washer placed under the bevel pinion lock nut.

To dismantle the cranskshaft, turn it until the connecting

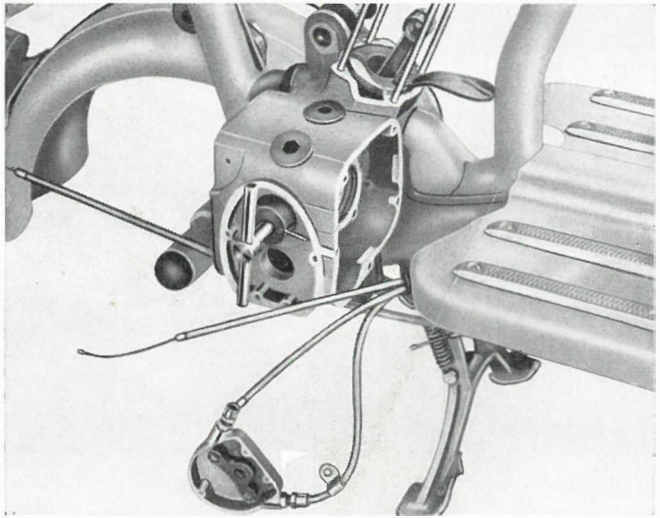


Fig. 46 - Extracting the bevel pinion.

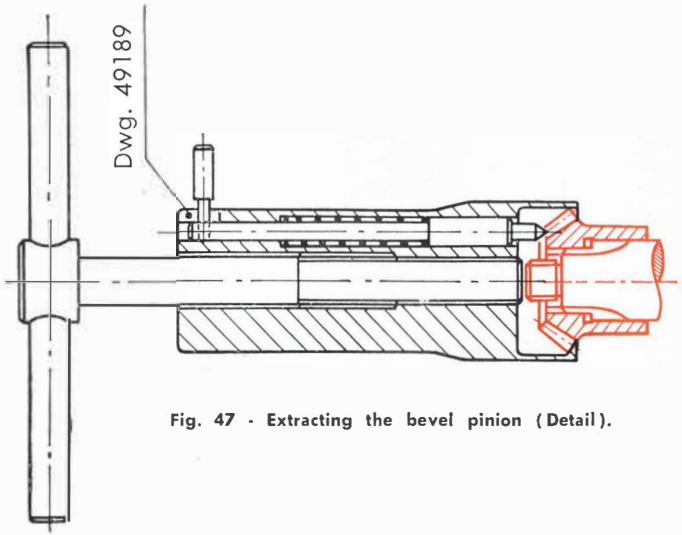


Fig. 47 - Extracting the bevel pinion (Detail).

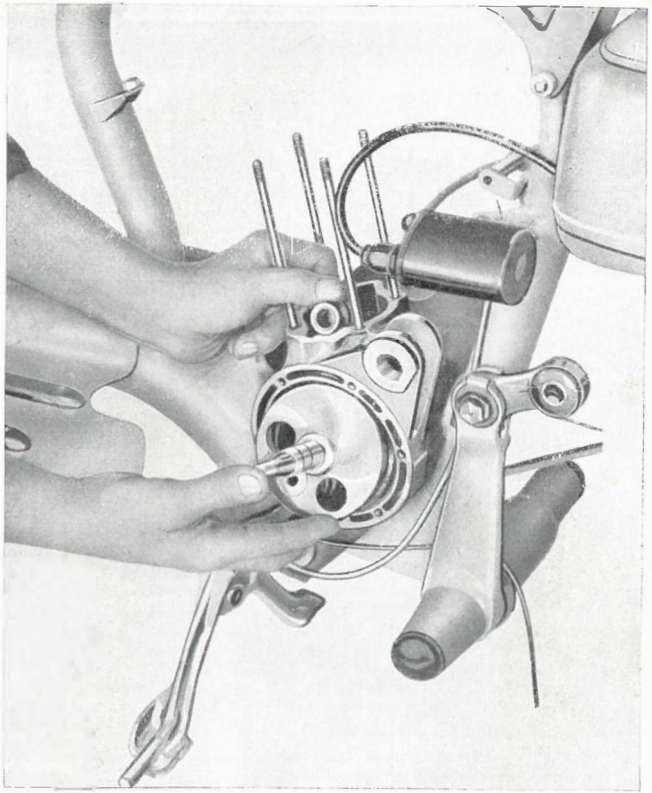


Fig. 48 - How to pull out crankshaft and connecting rod from the crankcase.

rod has reached the T.D.C. Insert the tool 49221 in the crankcase hole, cylinder side, to prevent any rotation of the crankshaft; using the tubolar 17 mm (0",67) wrench

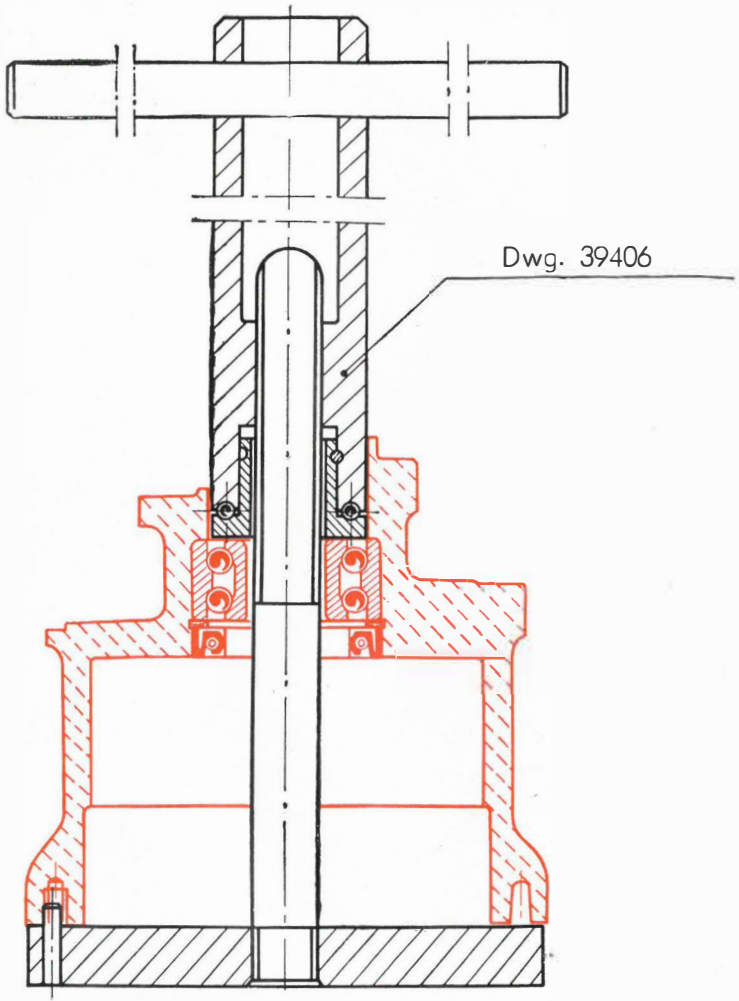


Fig. 49 - Detailed drawing showing the removal of the roller bearing.

unscrew the lock nut. Apply the puller Dwg. 49189; grip the bevel pinion and extract it by rotating the threaded pin (fig. 46).

Turn the crankshaft until the connecting rod has reached the L.D.C., pull the crankshaft (flywheel magneto side) and push the connecting rod in the spline, which has been foreseen to give the easiest removal, by canting the entire group (fig. 48).

To extract the bearing from the crankshaft apply the puller 39406 (fig. 49).

Insert the threaded pin, flywheel magneto side, in the way that the tool supporting plate perfectly rests on the outer crankcase surface; screw in the threaded sleeve and extract the bearing. To extract the bearing from the main shaft, strike with a punch 49200 inserted into the crankcase, clutch side; the punch is provided with an extension which must be driven into the port. Before striking on the punch, make sure it is exactly positioned in order to avoid breakage of the tool extension.

TORSION BAR AND HOUSING LEVER BUSHING REMOVAL

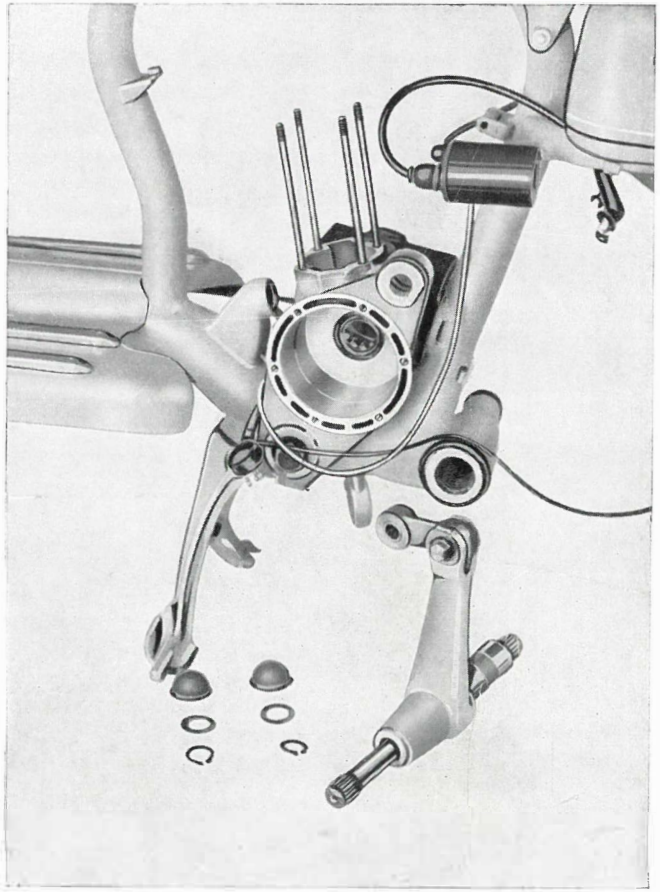


Fig. 50 - Showing how to dismantle the torsion bar.

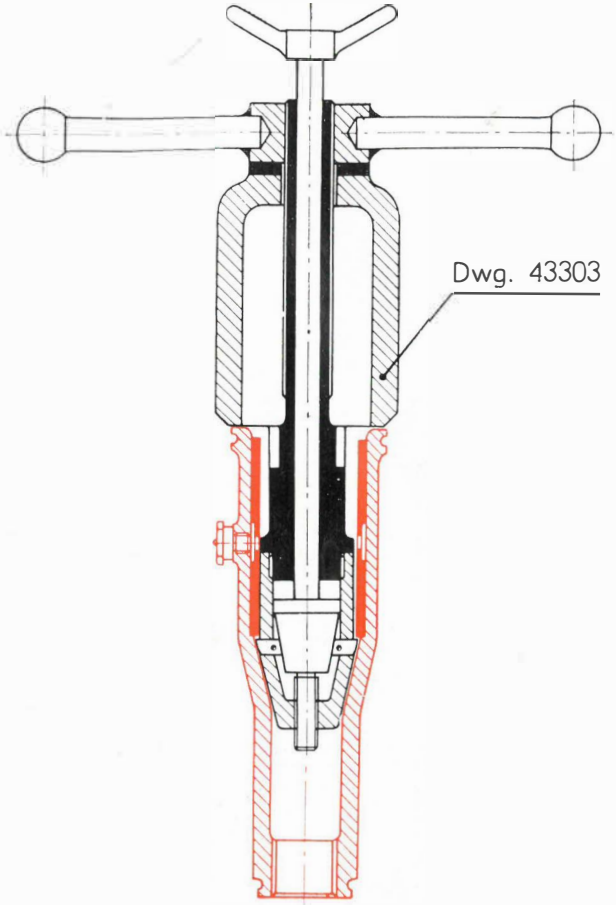


Fig. 51 - Detailed drawing showing how to extract the bushing of the torsion bar lever.

The particular position for dismantling the torsion bar is at the gearbox side. Slide the Seeger ring off placed at the inner end of the connecting pin between the crankcase extensions and the tie rod of the torsion bar lever (fig. 50). Press with a punch the pin in the way to make possible inserting the special bushing of the tool Dwg. 46604, and then strike with the same until the pin is disconnected. Extract the pin entirely; the bushing can be left into the tie rod to prevent the needles from dropping. Remove the rubber caps from the torsion bar housing ends; remove the Seeger rings and the washer located on the K.S. side, striking the torsion bar with a mallet until it is taken out. Insert, as shown in fig. 51, the tool 43303 driving it into the housing through the larger hole (flywheel magneto side).

By actuating the puller wheel engage the grips in the bushing inner edge, in such a manner to ensure a supporting surface as larger as possible.

Push the puller bell against the torsion bar housing and actuate the levers to release the bushing from its seat.

DISCONNECTING CRANKCASE FROM FRAME

To disconnect the crankcase from the frame operate as follows: free the pin from the protection rubber caps; loosen the lock nuts locking it (27 mm = 1",06 wrench) and extract it using a proper punch.

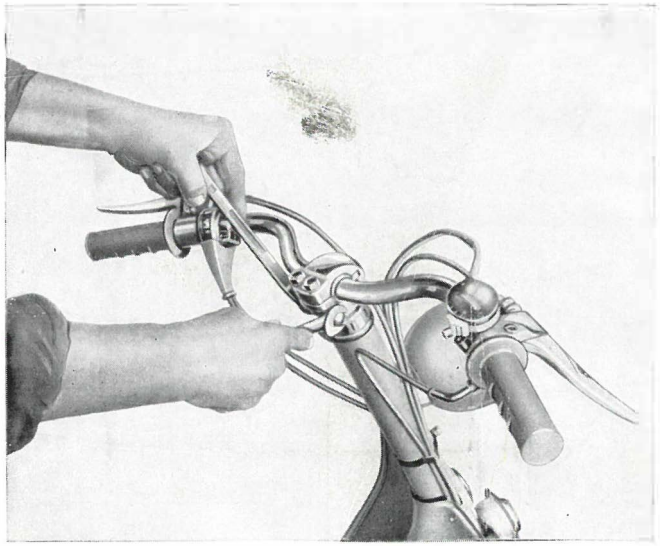


Fig. 52 - Handlebar removal.

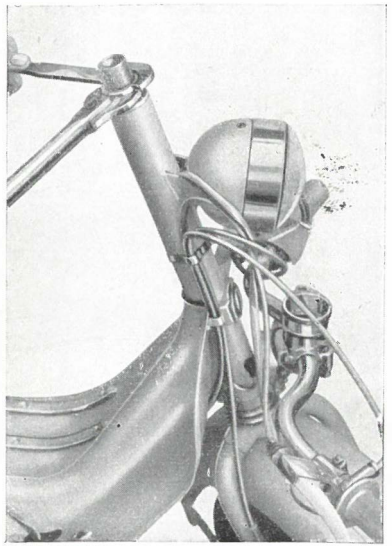


Fig. 53 - Removal of the steering upper bearing threaded ring.

Loosen the locking nut fixing the handlebar support; remove bolt, nut and washer (fig. 52). Slide the handlebar from the steering column and place it on the board.

Avoid bending the gearbox control cable and the other cables on the handlebar.

Apply the wrench 40482 to the steering adjusting ball cup, and the wrench 40490 to the adjusting threaded ring (fig. 51); actuate them in order to loosen ring and cup, picking up the upper bearing balls. To check wear of the steering bearing balls and cups slightly slide

Fig. 54 - Front fork dismantling.

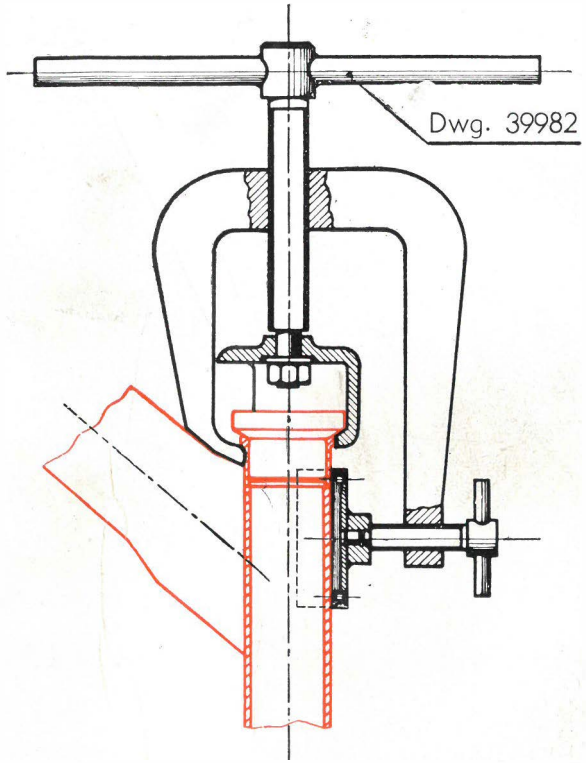


Fig. 55 - Detailed drawing showing how to extract the bearing upper cup using the tool 39982.

steering and front wheel group off. If repairs to column and fork are necessary, detach the control pin from the front brake shoe control lever, by loosening the locking pin and driving it out from the adjusting nut (fig. 54) and then from the holes drilled on the fork right arm.

Steering lower bearing upper cup

Apply the puller 39982 inserting it under the outer cup and operating the pressure screw, lock the clip against the steering. Rotate the puller lever until the cup is withdrawn (fig. 55).

Steering adjusting ball bearing seat

Drive the puller 40804 with handles at stop, into the cup hole and operate the lower handle levers to extract the cup by rotating the tool (fig. 56).

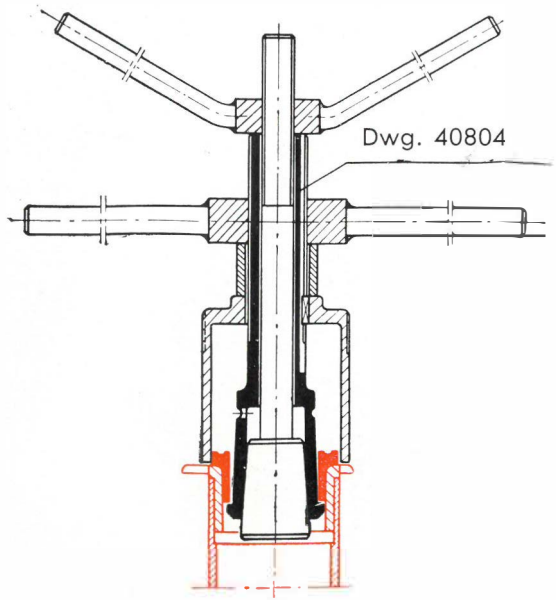


Fig. 56 - Detailed drawing showing the ball bearing seat puller.

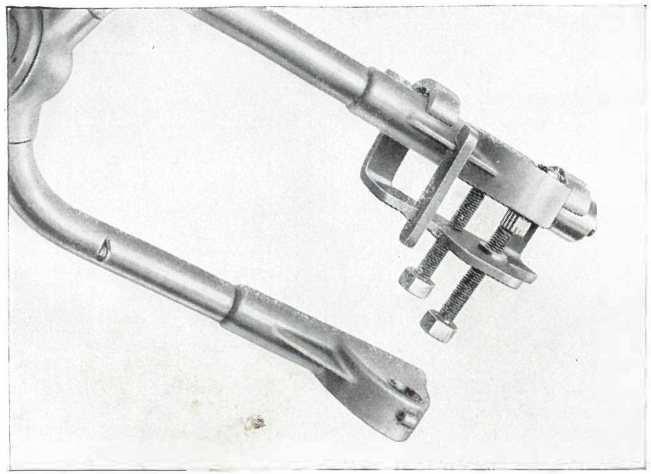


Fig. 57 - Extracting the inner lever from the fork.

To dismantle the front springing assembly, which is fully enclosed within the fork and sealed cases, operate as follows:

Detach the brake cable, as previously indicated, and remove the front wheel: loosen the three screws fixing the case covers and the nuts holding the trailing links and slide them off, using a screwdriver.

Extract the inner levers and the case covers at the fork arm ends; take the push blocks and springs out.

If it is not possible to extract them by hand, owing to seizing of the inner lever pins in the bronze bushing, we recommend the use of the tool shown in the fig. 55; operate as follows: screw a threaded pin into the bottom plate plug hole; apply the tool and drive the clip in the housing ribs and tool edge: operate the lower screw adjusting the tool position with respect to the housing and then operate the upper screw extracting the pin from the bronze bushing (fig. 57).

Replacement of the bronze bushings is performed following usual shop practice. Bear in mind that calibrating of the bushings must be made after forcing them into the housing.

WEAR LIMITS

After dismantling the various engine components, before reinstalling them, inspect accurately every part.

As previously recommended, clean all parts thoroughly with paraffin or petrol, in order to better detect defects or deterioration.

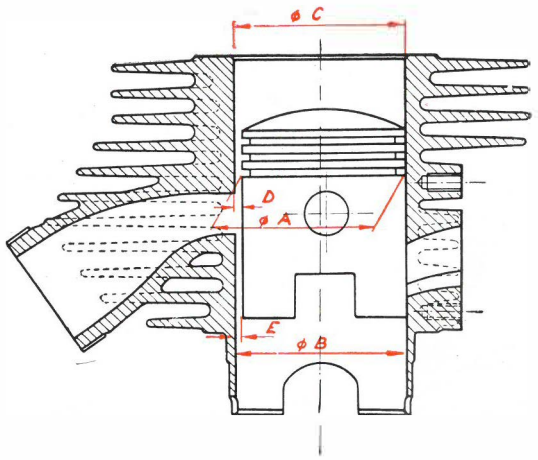
Beside size inspection, in accordance with the data listed below, check engine elements for wear and deterioration. Thus it will be easy to determine defects caused either by poor lubrication and maintenance or improper use of the machine and normal deterioration.

We have reported in the following charts the data regarding the different limits of the main engine elements. The values indicated are the maximum permissible limits.

Therefore it is strongly recommended never to go beyond these values. The parts showing an excessive play amount must be replaced.

The « Wear Limits » listed below cover the main parts; for the less important ones follow normal shop practice.

INSTALLATION ALLOWANCE AND WEAR LIMITS FOR CYLINDER AND PISTON



A = Outer piston diameter under the ring grooves

B = Outer botton piston diameter

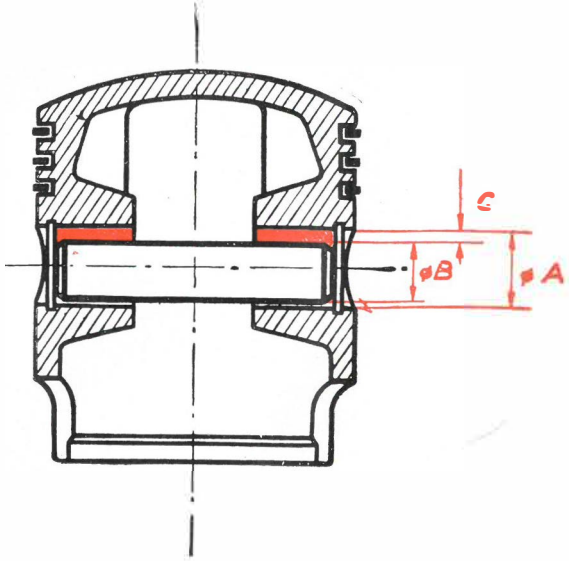
C = Cylinder bore diameter

D = Installation clearance according to ∅ A

E = Installation clearance according to ∅ B

Operation	Cylinder size ∅ C 11 M. 201 in.	Piston			Installation allowance		Wear limits in.
		Position	Dimensions Dwg.	Dimensions Cast in.	Position	Dimensions in.	
Normal installation	+ 0.000748 —0 2.2441	∅ A	11 M. 1026	+0 —0.000393 2.2393	D	max. 0.005866 min. 0.004724	0.0098
		∅ B		+0 —0.000393 2.2409	E	max. 0.004685 min. 0.003149	
1° Cylinder bore oversizing	Grind to + 0.000748 —0 2.2520	∅ A	11 M. 1231	+0 —0.000393 2.2472	D	max. 0.005866 min. 0.004724	
		∅ B		+0 —0.000393 2.2481	E	max. 0.004685 min. 0.003149	
2° Cylinder bore oversizing	Grind to + 0.000748 —0 2.2600	∅ A	11 M. 1236	+0 —0.000393 2.2550	D	max. 0.005866 min. 0.004724	
		∅ B		+0 —0.000393 2.2563	E	max. 0.004685 min. 0.003149	
3° Cilinder bore oversizing	Grind to + 0.000748 —0 2.2677	∅ A	11 M. 1241	+0 —0.000393 2.2630	D	max. 0.005866 min. 0.004724	
		∅ B		+0 —0.000393 2.2641	E	max. 0.004685 min. 0.003149	

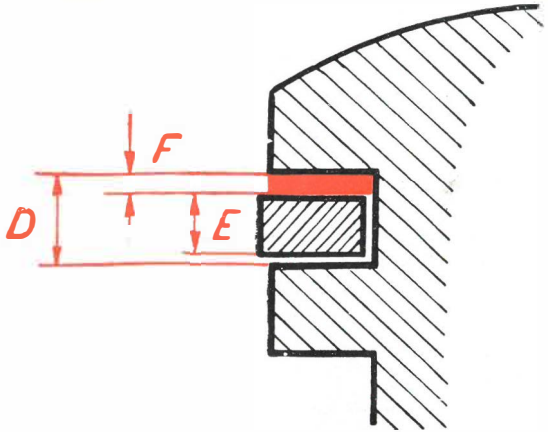
INSTALLATION INTERFERENCE AND WEAR LIMITS BETWEEN PISTON AND GUDGEON PIN



Operation	Piston Ø A in.	Gudgeon Pin		Interference and Clearance C in.	Wear limit in.
		Dwg.	Ø B in.		
Normal Installation	+0.000236 —0.000472 0.551181	11 M. 323	+0 —0.000433 0.551181		
First Pin oversizing	+0.000236 —0.000472 0.555118	11 M. 332	+0 —0.000433 0.555118	—0.000472	—0.001181
Second Pin oversizing	+0.000236 —0.000472 0.559055	11 M. 333	+0 —0.000433 0.559055	+0.000669	

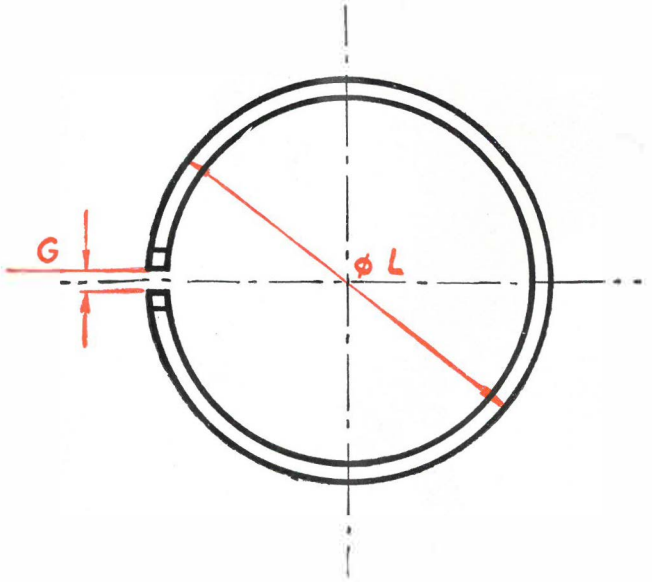
PISTON RING AXIAL INSTALLATION ALLOWANCE AND WEAR LIMITS

Piston D in.	Piston Ring 11 M. 324 E in.	Axial Allowance F in.	Wear Limit in.
I° = 0.080709 II° = 0.080393 III° = 0.080118 } +0.000551 —0	+0 —0.000984 0.078748	I° = 0.003504-0.001968 II° = 0.003110-0.001653 III° = 0.002913-0.001378	0.003346

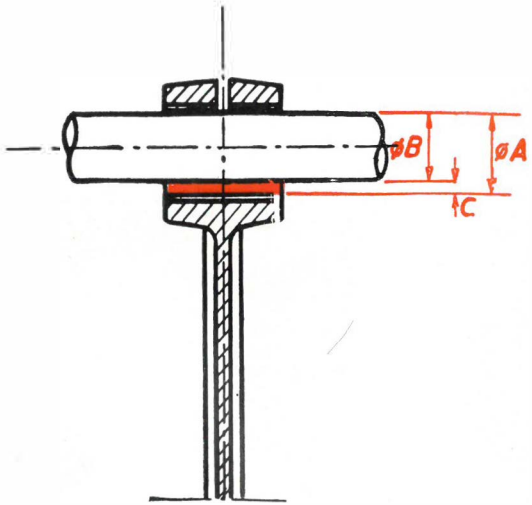


INSTALLATION ALLOWANCE AND WEAR LIMITS FOR RING END GAP AND RING DIAMETER

Part N.	Outer ring diameter L	Gap of the ends with ring in working position G	Wear limit in.
11 M. 324	2.2441 +0.000748 —0	0.013779 +0.005905 —0	0.059057
11 M. 334	2.2520 +0.000748 —0		
11 M. 335	2.2600 +0.000748 —0		
11 M. 336	2.2677 +0.000748 —0		



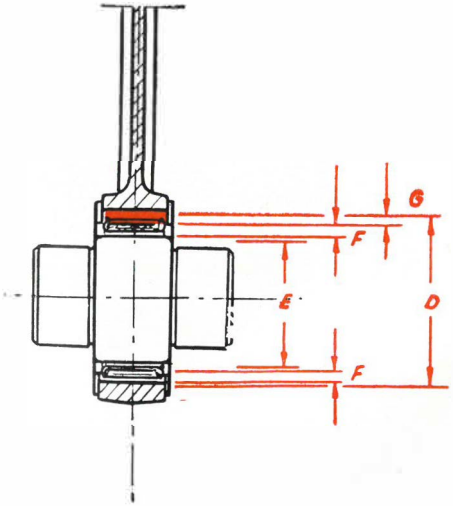
INSTALLATION ALLOWANCE AND WEAR LIMITS BETWEEN GUDGEON PIN AND CONNECTING ROD LITTLE END EYE



Operation	Little end bushing 11 M. 1041 ∅ A in.	Piston pin ∅ B		Allowance C in.	Wear limit in.
		Dwg.	Dimension in.		
Normal installation	+0.000629 +0.001063 0.551181	11 M. 323	+0 —0.000433 0.551181	0.001496	0.002362
First oversizing	+0.000629 +0.001063 0.555118	11 M. 332	+0 —0.000433 0.555118	0.000629	
Second oversizing	+0.000629 +0.001063 0.559055	11 M. 333	+0 —0.000433 0.559055		

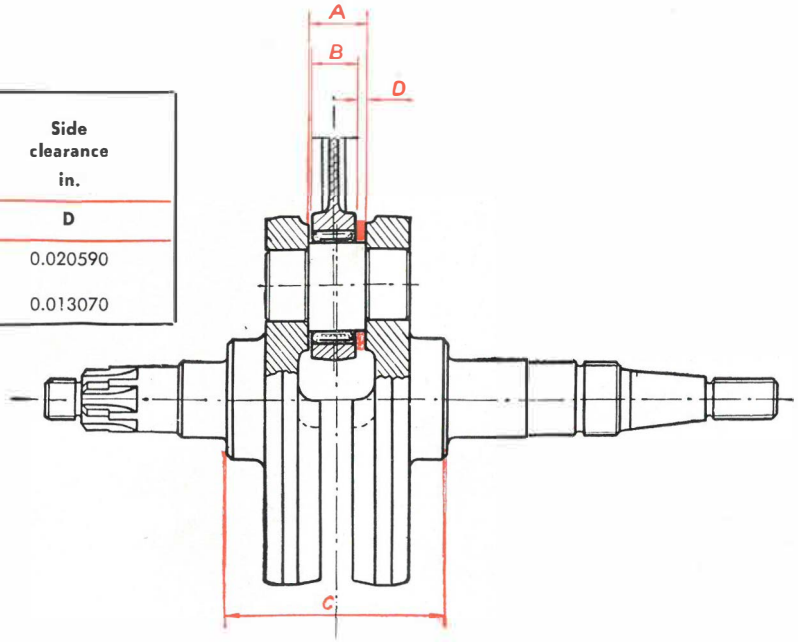
INSTALLATION ALLOWANCE AND WEAR LIMITS BETWEEN CONNECTING ROD BIG END AND CRANKSHAFT THROW

Connecting rod big end 11 M. 1041 D in.	Crankshaft throw 11 M. 304 E in.	Needles 2 M. 303 F in.	Allowance G in.	Wear limit in.
+0.000512 —0 ∅ 1.1378"	—0.000787 —0.001299 ∅ 0.901574	+0 —0.000196 ∅ 0.118079	0.000787 0.002205	0.003150



INSTALLATION ALLOWANCE AND WEAR LIMITS BETWEEN CRANKSHAFT AND CONNECTING ROD BIG END

Crankshaft throw width	Connecting rod big end 11 M. 1041 in.	Crankarm width in.	Side clearance in.
A	B	C	D
+0.005822 —0 0.551181	+0.001260 —0.002952 0.539370	+0 —0.004409 2.204724	0.020590 0.013070



REINSTALLATION

Preliminary instructions

Before reinstalling, wash every part thoroughly. **Lubricate all engine and suspension elements with oil or grease.** Replace lockwashers and cotter pins which have been damaged during removal.

Inspect every part carefully. Compare the size of the most important parts with the tabulated « Wear Limits ». Check wear conditions of bearings, gaskets and seals, and replace if necessary.

The following procedure covers only installations requiring particular care or special tools; for minor installing operations proceed according to the usual repair shop practice.

Under certain running conditions, a slapping of the piston may be heard when the engine is cold. This noise does not affect engine performance. Should slapping occur when the engine is hot, it can be eliminated by increasing the carburettor jet up to 0,05 mm (0.00197").

When replacing the piston rings, take care that the ends do not press against the piston slot pins; furthermore it is necessary to adjust the ring ends in order to obtain the correct play when the piston is fitted into the cylinder.

TO REPLACE BALL BEARINGS IN THE CRANKCASE

Make sure that the seats in the crankcase are perfectly clean and not sized or badly marked by loose outer bearing rings. **Press the bearings evenly in their seats and check for exact alignment.** Keep the bearings carefully free from dust or from any foreign matter. After assembling make sure the inner ring runs freely.

GASKET INSTALLATION

When installing the rubber gaskets on the crankshaft, make sure that they are correctly positioned, i.e. the edges of both must be turned towards the connecting rod, otherwise the gaskets are not tight.
Care should be taken not to damage the gasket edges when fitting, as if the gaskets are not tight enough oil leakage may occur especially from flywheel magneto side with consequent wetting of the breaker points and bad performance of the spark plug.

SILENTBLOCK INSTALLATION ON THE CRANKCASE

Carry out the installation of the silentblocks on the crankcase with considerable care. The seats on the crankcase should be examined to make sure they are free from marks and seizure.

Press the silentblocks into the crankcase in such a manner that their final position results as shown in the fig. 58.

For installing the silentblocks we recommend the use of a bench press; do not forget to place a proper washer between the press and the silentblock in order to get the compression force applied on the outer ring only, thus preventing any distorsion of the silentblock and incorrect positioning.

If no suitable press is available use a threaded tie rod. Whenever possible slightly warm the crankcase to facilitate the installation.

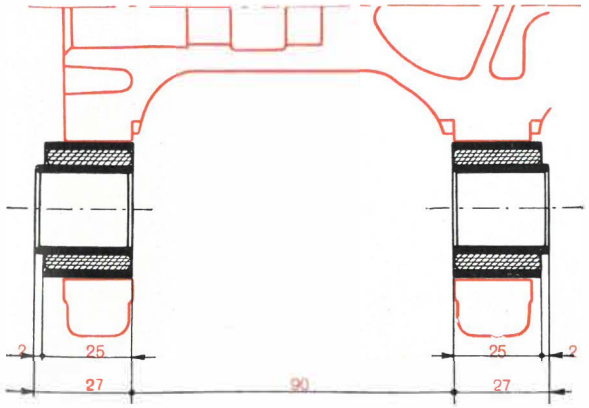


Fig. 58 - Showing the installation of the silentblocks.

REINSTALLATION OF THE CRANKCASE ON THE FRAME

To facilitate installation of the bearings, bronze bushings and gaskets it is advisable to operate the crankcase detached from the frame.

The procedure is as follows:

Insert the torsion bar lever bushing in the housing, so that one of the holes drilled on the bushing aligns with the greaser hole.

Connect the crankcase to the frame, driving the pivot, abundantly coated with grease, into the crankcase hole (flywheel side); ascertain whether the bevel bushings align correctly and lock by placing under the nut the safety washer (gearbox side).

Make sure the crankcase can freely swing on the pivot, without play; complete locking the nut, clamping the pivot (flywheel side) with a proper wrench.

This operation must be performed accurately using standardized wrenches.

REINSTALLATION OF THE CRANKSHAFT AND CLUTCH BEVEL GEARS ADJUSTING

Drive the crankshaft into the crankcase on which bearings and gaskets have been already mounted. Then reverse the sequence of operations described in the chapter « Dismantling ».

Position the crankshaft and the connecting rod. Insert in the crankshaft (flywheel magneto side) **the washer** for the two-row ball bearing. It must be remembered that the chamfered edge on the inside diameter must face the collar on the crankshaft.

Install the flywheel magneto flange and make sure that the two-row ball bearing and the gaskets are in good condition. Insert the spacer, the rubber packing and the washer, first preventing the crankshaft from rotating. To this end insert the tool 49221 into the crankcase (See fig. 45).

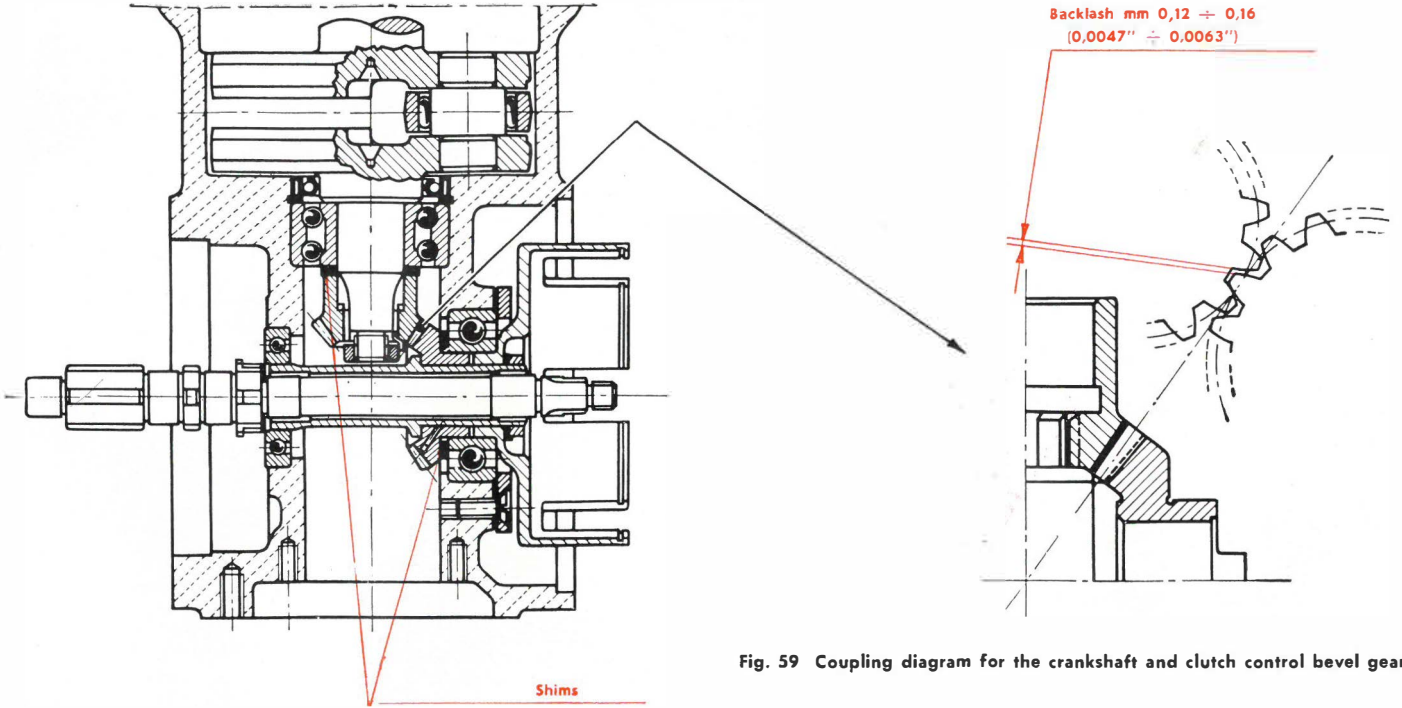


Fig. 59 Coupling diagram for the crankshaft and clutch control bevel gears.

The next step is **to check the crankshaft for eccentricity.** For this purpose a clock indicator is required; fix it to the crankcase; rotate the crankshaft and read the clearance on the indicator. It should not be more than 5/100 mm (0,00197").

If a suitable clock indicator is not available use a scriber. Black the tapered portion of the crankshaft and bring the point near until a slight contact is reached; rotate the crankshaft; if a thin continuous line appears, everything is in order.

Should the eccentricity of the crankshaft be unsatisfactory first check the ground surface of the nut and next the bearings.

Having the crankshaft perfectly positioned, **install the pinion** and the spacer using the punch 49045; drive the washer in the crankshaft and tighten the nut by means either of the wrench 49225 or the 26 mm (1,02") exagon tubular wrench.

Make sure that the crankshaft does not move in any direction as if there is play the bevel gear adjustment may result incorrect with consequent misalignment of the connecting rod within the cylinder.

When it is found that there is play have the group dismantled and carefully reassembled.

Quite possibly the cause may be the bearing shifted during mounting. In this case place a proper spacer between the Seeger ring and the bearing.

When mounting is correct bend the washer tabs on the bevel gear locking nut.

Check the coupling between the main shaft and bevel gear and bell hub bushings, and replace them if badly worn or seized.

Insert the main shaft from crankcase side and the hub with the clutch bevel gear already mounted from clutch side; add a proper spacer and then **drive and position the ball bearing** using the punch 38935. **Inspect if bevel gears mesh exactly;** look for eccentricity and noiseness. **Install the retaining flange of the bearing** and secure it to the crankcase with the three screws.

Locate the clutch bell on the bevel gear exactly: the hub slots have to face the dogs of the clutch bevel gear.

Check the play on the bevel gear diametral pitch; if it is not correct replace the shims with others having a suitable size; tighten the three flange fixing screws and calk them.

Adjustment of the engine bevel gears is very important to obtain a noiseless engine running. Bear in mind that it is not always possible to have a correct adjustment operating the shims of a gear alone; it is then necessary to change the position of both gears until the cone distances are perfectly aligned (See fig. 59) and the play between the teeth is 0.12-0.16 mm (0,0047"-0,0063").

If replacement of one bevel gear is necessary, replace the entire group to ensure silence and good performance.

REINSTALLATION OF THE PISTON

Before reinstalling the piston, check the play between the piston pin and the eye of the connecting rod little end, and the interference between gudgeon pin and piston.
Refit the gudgeon pin using the tool 49199 and then reverse the operation described in the chapter regarding « Dismantling ». Fit the two circlips last; ascertain they are properly located in the piston grooves.

REINSTALLATION OF CLUTCH SLOTTED DRUM

Lock the clutch bell accurately. After tightening the nut, bend the safety washer tabs on the nut faces. **Recheck the bevel gear play and be sure the gears** operate smoothly.

Place the slotted drum Seeger ring into the groove at main shaft end. Insert the slotted drum on the main shaft coupling and slightly tap with a leather mallet; **make sure it is exactly positioned.** Apply the clamping wrench 37101 engaging its two levers in the clutch bell notches; replace the safety washer and the slotted drum lock nut and tighten it with the wrench 37337 as far as it will go.

REINSTALLATION OF THE FLYWHEEL MAGNETO

Replace and fix the stator on the flange by means of three screws (the flange has been previously assembled to the crankshaft).

When working, be careful since the coil windings must be neither damaged nor scratched.

The rotor has to be keyed on the tapered portion of the crankshaft on which the key has already been fitted.

In order to lock this group by means of washer and nut it is necessary to prevent the crankshaft from rotating. For this, use the tool 49210.

Ascertain if the rotor does not wobble. Allowance of 0,1 mm (0,0039") on the larger diameter.
Check wobbling using a comparator or a scriber point.
Should the flywheel rotation exceed this limit proceed as follows: remove the flywheel and check crankshaft taper for deformation or dents; **make sure the flywheel taper is perfectly clean and that no deformation or burrs in the key slot are present;** install the tapered flywheel end into the spindle, checking by rotating the flywheel whether it still wobbles. If such should be the case, the flywheel surface has probably been deformed. Flywheel replacement is therefore necessary.

CYLINDER AND CYLINDER HEAD REPLACEMENT

After reinstallation of the flywheel magneto, turn the main shaft until piston is at the top of its stroke.
Insert the gasket on the fixing studs using care not to damage it. If the piston is not provided with rings, install them. Turn the crankshaft further until piston is a the bottom and install the cylinder.
To make sure the piston rings are correctly fitted, turn the engine; if no installation defects or performance troubles are found, fit the cylinder head to the cylinder and screw in the four crankcase stud bolts.

IMPORTANT

Since there is no gasket between the cylinder head and cylinder, make sure the cylinder head contacting surface shows no lines or dents preventing tightness.

Before reassembling, check for completeness of the contact using a proper surface plate. Cylinder head is fixed to the cylinder by four stud bolts. Take great care when tightening the nuts not to cause thread straining. Use wrenches not exceeding 15 cm (5.906"). To obtain perfect tightness, lock only when engine is hot.

Inspect the bolts during the first 2000 km (1250 miles) to make sure the head is adhering perfectly to the cylinder, and eliminate loosening.

Spark plug threaded seat is placed in the light-alloy cylinder head top. Fit the spark plug by hand to avoid incorrect location and thread damage.

REAR BEVEL GEAR REINSTALLATION

First prepare the various groups forming the rear transmission, i.e. transmission case, wheel supporting flange, rear bevel pinion.

Install in the transmission case the needle carrying bushing for the neutral gear on the main shaft and the bronze bushing into the secondary shaft; use the punches 49127 and 43282.

Ascertain the mounting of the needle carrying bushing is exactly performed; its seat must be thoroughly clean without seizure or marks from previous service. Install the brake return pivot, last.

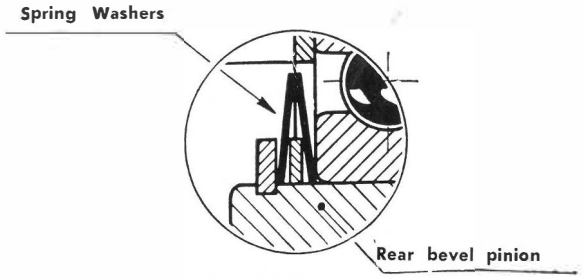


Fig. 60 - Installing spring washers.

The bevel pinion group must be prepared as follows:

Insert the retaining gasket into the sleeve so that its edge faces the gearbox. To this purpose use punch 43349. Make sure the pinion is provided with the proper aluminium bottom cover; if it does not lock perfectly, replace with another locking it to ensure lubricant tightness. Drive the pinion in the bearing and the latter in the sleeve; care must be taken to avoid damaging the washer inner edge; then locate the other bearing; strike with a proper punch and check that the parts are correctly mount-

ed; insert the spacers and springs washers and finally a plain washer.

Positioning of these washers is very important (See fig. 60); ascertain whether their alignment and clamping with a Seeger ring are perfectly performed.

Mount in the rear wheel supporting flange the first bearing (rear wheel side), place the rubber ring and then install the bearing locking flange fixing it with four nuts and plain split washers.

Replace the rear wheel transmission axle and then mount the sleeve and the second bearing; engage the bevel gear crown with the axle splines and lock it by means of a plain washer, castle nut and cotter pin.

To lock the axle during tightening of the castle nut, insert into the groove, placed on the axle tapered portion, the half-circular key connecting the wheel; fit the stop wrench 43370.

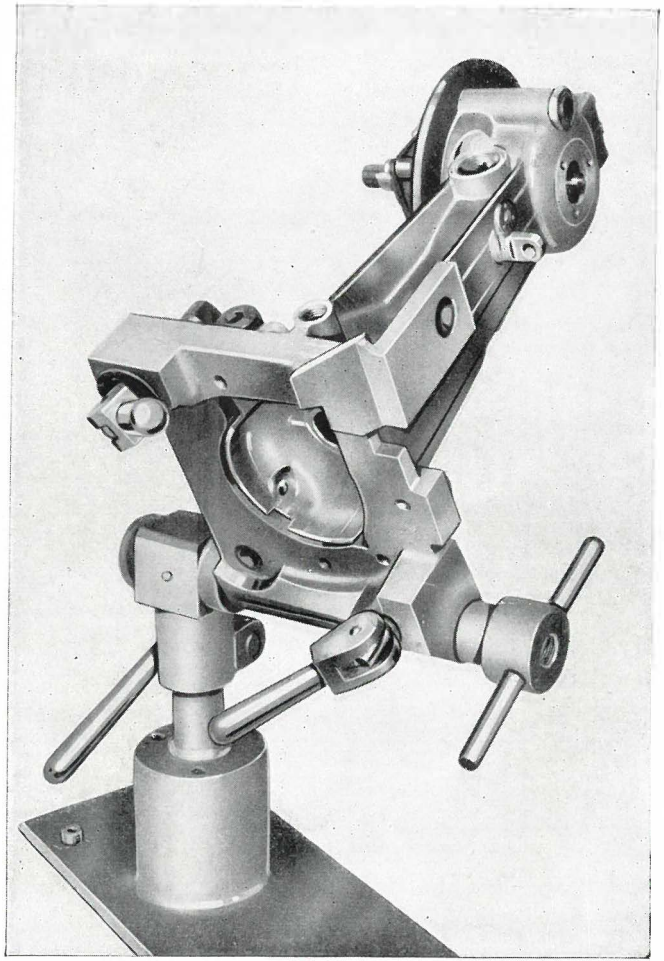


Fig. 61 - Installing device for transmission case assembly.

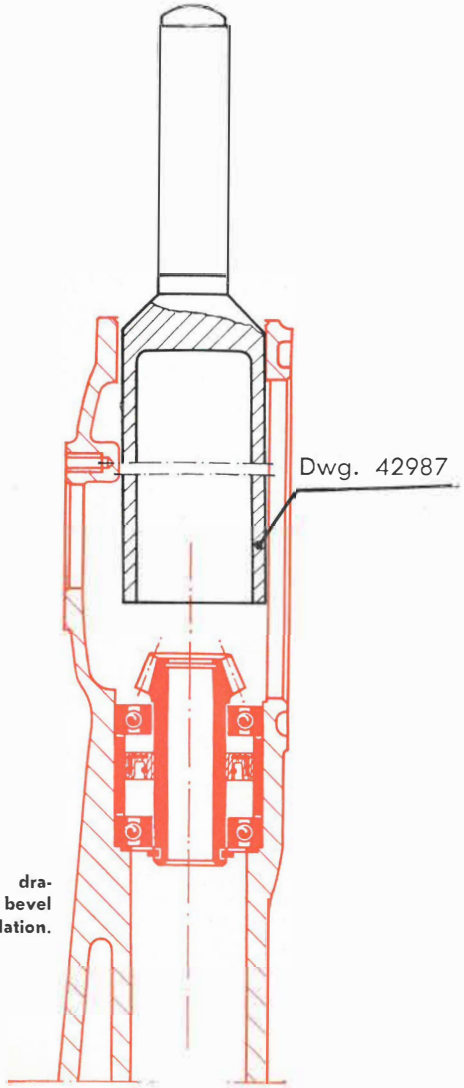


Fig. 62 - Detailed drawing showing the bevel pinion group reinstallation.

If such wrench is not there, insert the axle with the key into the rear wheel hub momentarily. At last drive the gasket into the flange and fix it with a Seeger ring; during the reinstallation remove the key to avoid damaging of the gasket edge and causing leakage of lubrificant.

Clamp the transmission case on the proper fitting device 42507 (see fig. 61).

Fit the device so that transmission case end is up and insert in the pinion seat a suitable spacer. The spacer thickness has been selected at our works; it may be utilized again only if the bearing pair or the bevel gear couple do not need replacing.

Locate the spacers under the bevel pinion, strike the latter to obtain a perfect installation using a proper punch 42987 (see fig. 62). Coat with Ermetic the mating surfaces of the transmission case and install the gaskets and the rear wheel supporting flange.

During this operation check if the bevel pinion and the crown teeth mesh exactly; tap with a leather mallet the flange periphery fixing it to the transmission case by means of suitable nuts. Insert the half-round key into the proper groove on the rear wheel axle with wrench 43370, rotate the axle to check the exact alignment of the bevel gear pair. Correct adjustment requires complete mating of the cone distances. Blacklash between 0.12-0.16 mm (0,0047'' 0,0063'') should ensure a noiseless performance.

If it is necessary to replace the gear pair (it is not possible to replace a gear alone) or other parts (bearing, sleeve, etc.) operate in the following manner: after placing the spacer in the trasmission case seat, check the bevel gear adjustment using a special testing group consisting of the bevel pinion, two bearings, 42291, and one sleeve 43281 and then insert the washer and the rear wheel supporting flange. See fig. 63. After checking, dismantle the rear wheel flange group and drive the bevel pinion retaining plate into the splined hole at transmission case end.

Replace the shims, if necessary, and locate the flange (after coating the mating surface with Ermetic); lock it with the four nuts and the split washers.

Insert the brake cam bushing (threaded hole toward the crankcase); place the spacer and the bushing locking nut fixing it with safety washer.

Apply the brake shoes locking them by means of a Seeger ring. Insert the cam pin into the bush; install the control lever and the Seeger ring. Finally screw in the greaser. At the transmission case end hole fit the retaining disc and the spring washers.

These latter should be so positioned when they are fitted that their inside diameters match, while the outside diameters are divergent.

Coat with Ermetic the contacting surfaces of the trans-

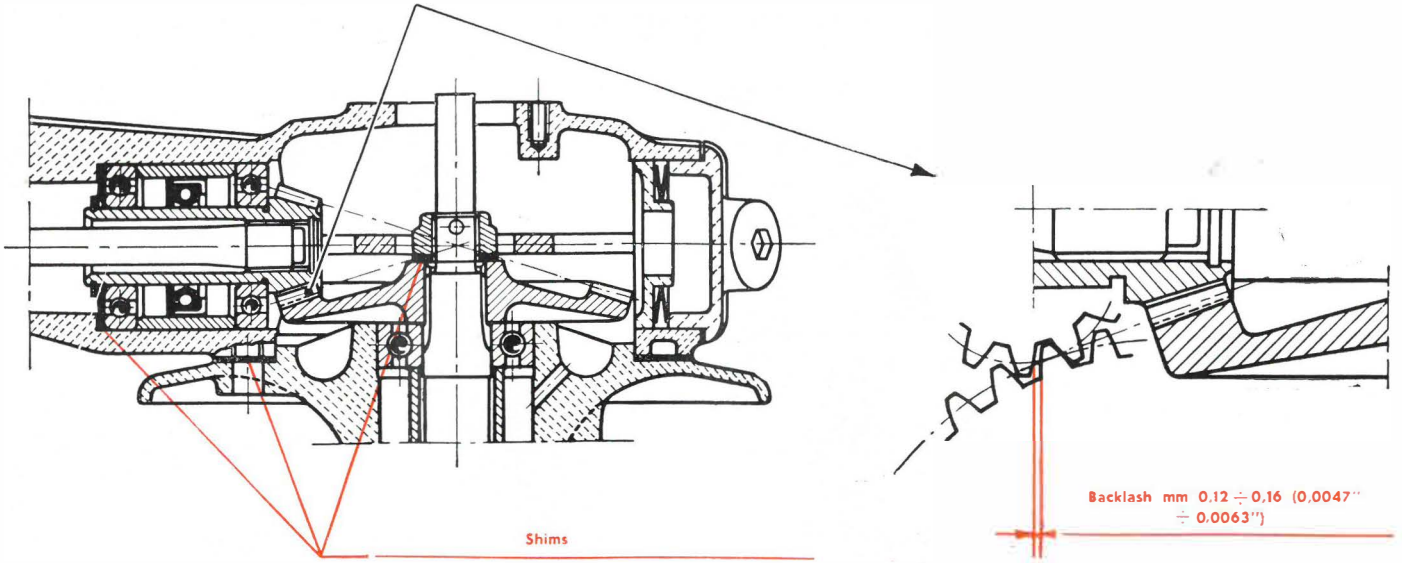


Fig. 63 - Rear transmission bevel gear coupling diagram.

mission case cover and the speedometer fitting cover; place the gaskets and fix the covers with the proper screws.

Pour through the filler 100 gr (¼ lbs) MOBILUBE GX 140 oil (See diagram page 11) and then fit plug and packing.

GEARBOX REINSTALLATION AND CONNECTION OF TRANSMISSION GROUP TO CRANKCASE

After installing the rear bevel and gearbox gears into the transmission case, connect the latter to the crankcase, operating as follows:

Drive the second gear into the main shaft splined coupling (jaws must face the transmission case).

Locate the connecting ring on the countershaft second gear and fix it with a proper retaining Seeger ring.

Drive the second gear on the countershaft (connecting ring toward transmission case) and then add the neutral gear and the shim; place another washer behind the gear keyed on the countershaft.

Coat with grease the group and the bushing placed on the secondary shaft seat (transmission case) and then drive into the bushing the shaft and the gears already mounted; care must be taken to align the second gear on the main shaft with the connecting ring situated on the second gear on the countershaft. Prepare the neutral gear on secondary shaft; place and hold in with grease the 24 needle rollers. Engage the torsion bar with the rear bevel pinion on the transmission-rear suspension assembly. Engage also the neutral gear on the primary shaft, previously prepared; coat with Ermetic the mating surface between crankcase and crankshaft; locate the gasket and connect the two cases.

Fit the selector lever on the transmission case and the adjustable pin with the packing.

To obtain a proper positioning of the selector the eccentric portion of the pin must be downwards. Lock the flange with two nuts and locate the split pin inside the eccentric pin. Mount the gear shifting fork with its shaft, fixing it by means of a Seeger ring. Add the retaining spring for the roller lever and adjust the shifting fork in the manner that the two guiding arms insert perfectly into the cavity of the second gear on the main shaft. To make it easier gently strike with the mallet rotating the splined drum simultaneously. Next place the alignment pin in seat under

the crankcase driving it from the latter and locking it with nut and washer from the transmission case side.

After this operation check gearbox performance by rotating the clutch splined drum and shifting the gears by means of the lever 43382.

If the gears do not perfectly engage operate the eccentric pin of the selector lever. To this end some holes have been machined on the flange. Slacken the hexagon head screws and tighten them, after positioning the lever.

During this operation care must be taken not to damage the thread by forcing the screws too tight.

Assuming the gears mesh perfectly, tighten the remaining screws with relative plain and split washers.

Finally bolt the tubular damper to the transmission case.

REAR SUSPENSION REINSTALLATION

To ensure correct installation of the rear suspension and efficient performance follow our instructions carefully.

Check accurately if the various parts do not show any damage or traces of wear which may cause trouble in service.

Make sure the torsion bar housing bushing is not seized or ovalized and always check, while replacing, if the torsion bar lever adapts itself into the bushing exactly. Check shackle hole surface for wear marks; pins and needles serving as connection of the shackle with crankcase and lever must be accurately tried, before mounting, as the least play in these bearings may damage the assembly. Ascertain the connection pins do not turn in their seats on the crankcase and torsion bar lever arm.

Install the shackle on such lever: to this end insert the properly greased needle bearing cage into the shackle holes.

Insert the connecting pin into the lever and shackle holes (the greaser fitting must be on the bar outer side).

Place the Seeger ring into the connecting pin. At the opposite side locate safety washer and Seeger ring.

Drive the rubber cap into housing (push it to the final position after lever reinstallation) and place the shim between housing and return lever. Then insert the lever (already provided with shackle and provisionally carrying the torsion bar) into the housing; make sure it is driven in as far as it should go. The torsion bar is provided with splined ends; the one having 21 splines engages with the lever while the other with 22 splines engages with the fixed part of the frame.

Insert the shackle betwen crankcase expansions. Position of the two holes is so that the center line of the first one aligns with the front end of the second hole, namely displacement must be of ½ hole.

Such displacement provides for preloading of the torsion bar. In case, before dismantling, a deformation of the torsion bar is noticed, it is advisable to increase the hole displacement in order to increase the preloading. Slightly

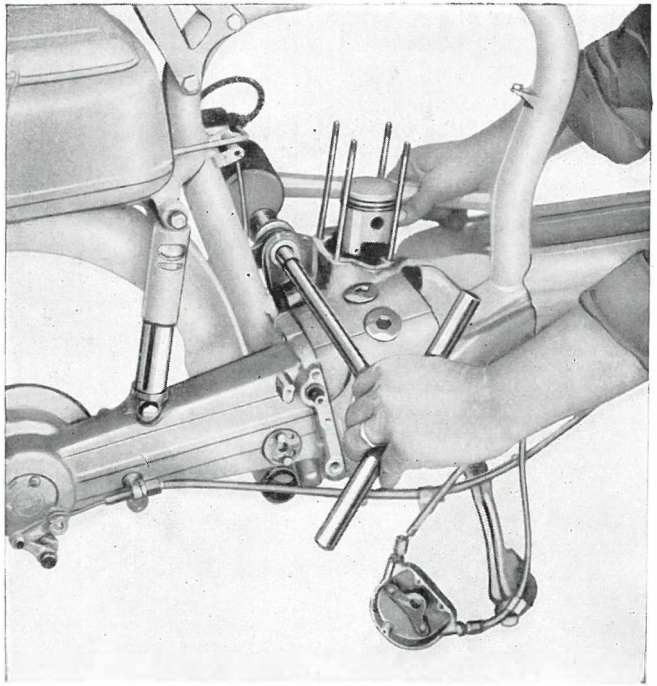


Fig. 64 - Torsion bar preloading.

strike with an aluminium hammer the torsion bar ends to mesh the latter with the housing inner teeth. If their alignment does not correspond with that of the bar splines slightly shift the lever arm.

Installing and bolting of the bar must not cause friction or distortion; when the best position is selected, the bar must slide easily into the couplings.

Use the device for torsion bar preloading 46604, as shown in fig. 64.

Operate its screw with the proper wrench until the shackle hole aligns with the crankcase extension hole. Then, using a proper punch, insert the shackle connecting pin; slightly strike the punch, pick up the spacer expelled by the pin and fix the safety ring and Seeger ring.

Locate the shim at the bar ends, fixing it by means of Seeger rings and place the rubber cap at the housing ends.

Install the greaser into the pin holes and grease by means of pressure gun the crankcase pivot, shackle and housing, provided with fittings.

Reinstall mudguard, fixing it with suitable screws and if the tail lamp has been disconnected, connect it again; locate the rear wheel with the hub and lock it with its nut.

Inside the front fork tubes there are the groups forming the front suspension; to reinstall them follow this sequence:

Clean the inside of the fork tubes and the boxes placed at

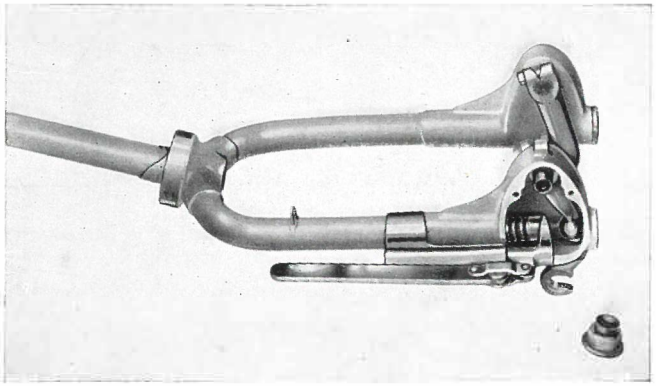


Fig. 65 - Preloading of front suspension springs.

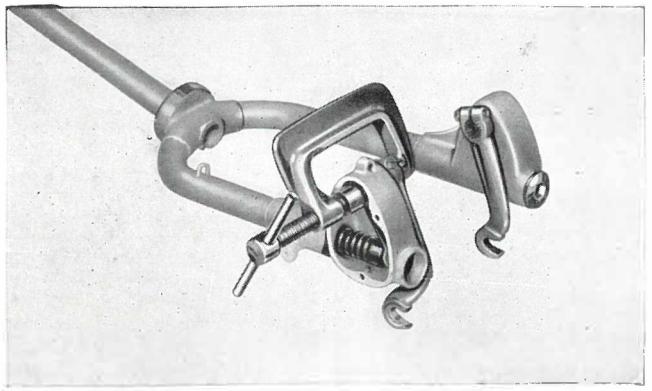


Fig. 66 - Reinstallation of the trailing links.

their ends thoroughly; clean springs and other parts of the suspension group. Install the fork into a bench vise in the way that the steering column is placed horizontally. Check the coupling of the bronze bushings situated inside the boxes and the inner lever pins. Replace the bushings if necessary. Perform the same operation for the bushings placed in the covers, coupling them with the opposite lever ends. Coat abundantly the springs with grease, before inserting them into the fork tubes; use the grease, recommended by Lubrication Diagram (page 17).

Such springs have been designed with variable pitch in order to gradually absorb the road shocks; therefore it

is necessary to mount them with the smaller pitch upwards.

Install the preloading device 42621 as shown in fig. 65 and compress the push block and the springs.

Insert the inner lever into the box in the manner that the lever pin splined end is placed in the fork inner slide.

The lever must turn into the bushing without any play and the roller at its end must rest against the push block.

Take out the preloading device and place the rubber packing in the inner lever pin; locate the device in the bushing seat and then insert the shim. On the pin splines bolt the wheel carrying rocker arm; check the exact position aligning the lever screw hole with the corresponding pin groove. Lock by tightening the screw interplacing the split washer.

To get over possible difficulty when installing the rocker arm, use a proper clamp (See fig. 66). Never try to press the lever with the aid of a punch which should damage the bronze bushing.

Insert the rubber block into the plug seat, locate the packing and screw the plug on the fork. Fill the box with the same grease used for the springs and, after placing the gaskets, tighten the three screws holding the covers in place.

Achieve the same operations for the other fork arm.

STEERING AND HANDLEBAR REINSTALLATION

Insert the lower bearing upper cup and the upper bearing ball seat at the column ends and by means of the proper tool push in the cups.

Coat with grease the lower cup; insert 23 balls and drive in the front fork from the lower side.

Place 36 balls, which should be held in with grease, into the upper bearing seat; tighten the two threaded rings and adjust the two bearings; steering must operate easily though mounted without play. Install the handlebar and connect front brake cable to the shoe control lever.

REINSTALLATION AND ADJUSTMENT OF GEARBOX

Be sure the gear indicator on the left handgrip operates correctly and smoothly, the control cables slide regularly in their covering and the handgrip play amount being not excessive.

Drive the felt packing, aligning ring for the gear selecting casing and Seeger ring in the gear shifter control shaft, projecting outside the crankcase.

Set the gearbox in neutral, operating the control shaft; use the tool 43382; turn the rear wheel alternately to make gear engagement easier and ascertain that the gears slide perfectly and quietly.

In the case of unusual noise, operate the eccentric pin of the selector lever, as indicated in the chapter « Dismantling ».

After correct engaging set the indicator in neutral position. Install the gear selecting casing; insert the lever in the splined end of the control shaft and fix the casing to the transmission case by means of three screws and plain and split washers.

Next check if the gear indicator is still in neutral; if any displacement is noticed try adjusting the cables; to do this actuate the adjuster placed near the gear selecting casing. If the gear indicator is not yet at the right position remove the casing and reinstall after shifting the lever into another position ensuring a correct performance of the selector through cable adjusting. Put in and throw out all gears to make sure they work correctly.

Pour grease in the casing and fix the cover by means of three screws.

IMPORTANT

If the gearbox operation is too hard and this defect does not depend on the control on the handeblar, make sure the cable slides freely in the outer cable and does not afor any deformation, burrs, or wear which may cause difficult performance; ascertain the outer cable is not bent too sharply.

The casing and the lever must be mounted parallel, so that the latter does not rub against the casing.

Adjust the spring of the roller lever for positioning the selector in the way that the drive does not become too hard.

CLUTCH REINSTALLATION

When clutch assembling, check whether steel discs show traces of overheating or rubbing. This should indicate clutch slipping and in such a case discs must be replaced. Insert both the driven and driving discs into the clutch bell alternately. Eventually, replace spring as well.

Assemble the various parts separately; first the springs holding disc with cups and its springs. Install the ball bearing cup into the disc center hole and clamp it with Seeger ring.

Put some grease in the cup and insert ten 5/32" balls; locate the washer and the Seeger ring; place in the clutch control tie rod. These two groups connected with the control disc must be inserted within the clutch bell. Fit the special disc puller (see fig. 31 « Dismantling ») and press the discs; insert the tie rod into the tool hole and screw a nut on the threaded end. Operate the nut until the tool is compressed against the spring bearing disc and the springs therein contained are entirely compressed; then force the disc retaining ring into the bell groove. Make sure the installation is correct and remove the tool. Reinstall the clutch control inner and outer levers into the cover. Coat the case slightly with « Ermetic »; place the gasket on the case; install the case cover and be careful that the square side of the pin, projecting from the spring bearing cup, is turned upwards and enters exactly into the control lever already completed with the other parts of the clutch cover.

Fasten the clutch cover to the crankcase by means of the corresponding five screws and washers.

Drive the ball headed bushing into the tie rod (keep the head towards the tie rod end) and tighten with nut and counternut; engage the control cable with the outer lever; operate nut and counternut adjusting carefully the clutch drive.

Allow an axial clearance of the tie rod into the cover hole up to 0.0197" (0,5 mm). Place at last the plug.

KICK STARTER REINSTALLATION

Commence reinstalling the bevel pinion by inserting the pinion into the aluminium support centre hole; fix it with plain washer and Seeger ring.

Drive in the gaskets and packing rubber ring; place a stopping ring at the shaft end, washer and spring; insert the group in the bevel pinion hole, in the way that the spring is seated into the pinion cavity (teeth side).

Reverse the group, engage the starter clutch pinion and fasten it with washer and stopping ring to be forced into the pin cavity.

Insert the entire group in the crankcase; ascertain the gear teeth mesh with the bevel pinion exactly and then lock accurately.

Reinstall the K.S. pedal into the cover; load the spring by three turns of the proper wrench; apply the pin to the spring dog, locate the crankcase cover inserting the gasket coated with Ermetic, and tighten with the five hexagonal screws securely.

IGNITION TIMING

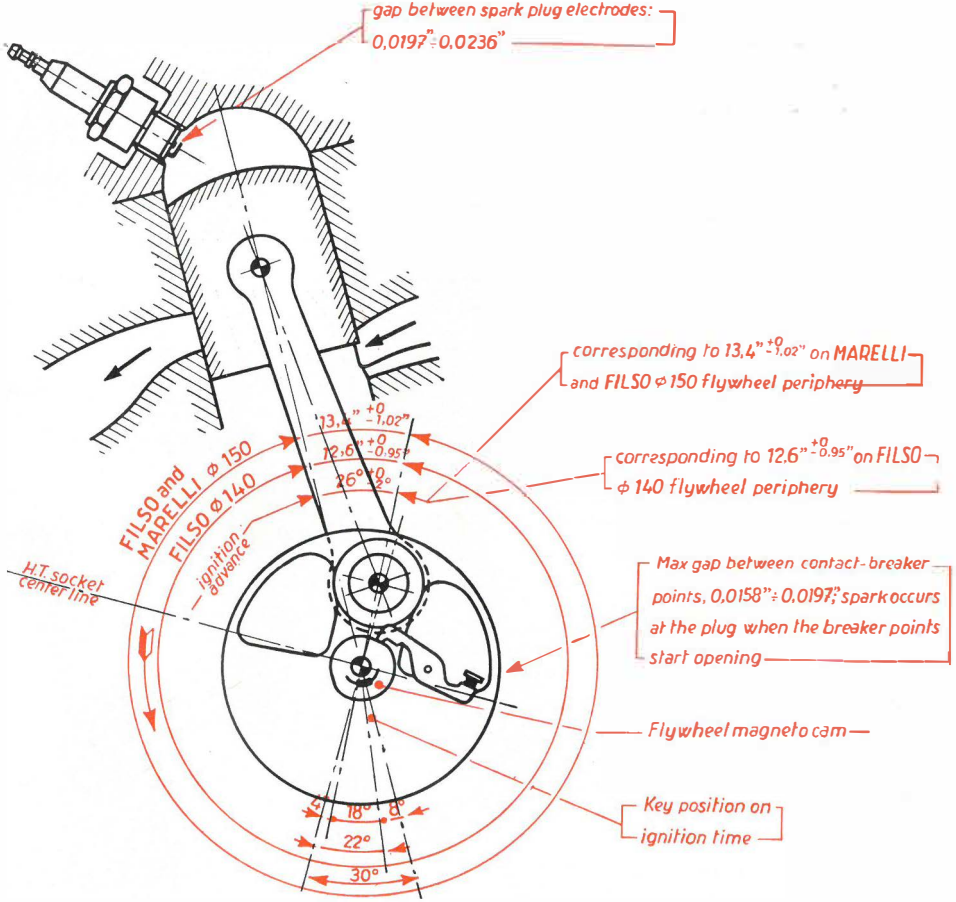


Fig. 67 - Ignition diagram.

Timing adjustment is very important. Incorrect adjustment affects engine performance; therefore beside the description of the operation to be performed we have reported timing adjustment diagram for the two flywheel makes (Marelli and Filso) fitted on our motor scooters.

Inspect the contact-breaker points: Make sure the contact surface is smooth and clean. If the points are pitted you can truing them with a special contact-point file.

Check and adjust the contact-breaker points.

Rotate the flywheel magneto by hand until the points are separated to their maximum, then slide alternately two spacers of 0,35÷0,45 mm (0,0138"÷0,0177") between them. If the gap is not correct, adjust the screws placed on the rotor plate.

Re-check and tighten the screws having a a 0,45 mm (0,0177") blade between the points to make sure that positioning has been achieved to the maximum prescribed.

Timing adjustment

Remove the spark plug; screw in the threaded hole of the cylinder head the tool 48059 (See fig. 67) complete with a dial gauge. Rotate the flywheel clockwise slowly

by hand until T.D.C. is reached. The T.D.C. corresponds to the top of the pointer stroke, before reversing the direction.

Rotate the dial until the zero point corresponds to the pointer position.

Next connect the cable of the circuit tester to the earthing socket (I. t.) on the crankcase (corresponding either to the black wire from the flywheel or to the green one to the switch).

Connect the second cable to one cylinder head fin. Shift the circuit tester switch to the position « On ». Rotate the flywheel clockwise until the pilot bulb is off. The pointer stroke (from zero point) must be between 3,6 and 4,4 with a corresponding advance angle of 24° and 26° respectively.

In the case that the readings are different, timing must be corrected as follows: slacken the screws fixing the stator plate; care must be taken no to damage the flywheel connections with the screwdriver. If the reading is less than 3,6 mm rotate the stator plate clockwise. If the reading is higher than 4,4 mm turn the stator plate counterclockwise. If difficulty is experienced in rotating the stator plate by the aid of the screwdriver, it is advisable, to remove the rotor first. After reinstalling re-check timing.

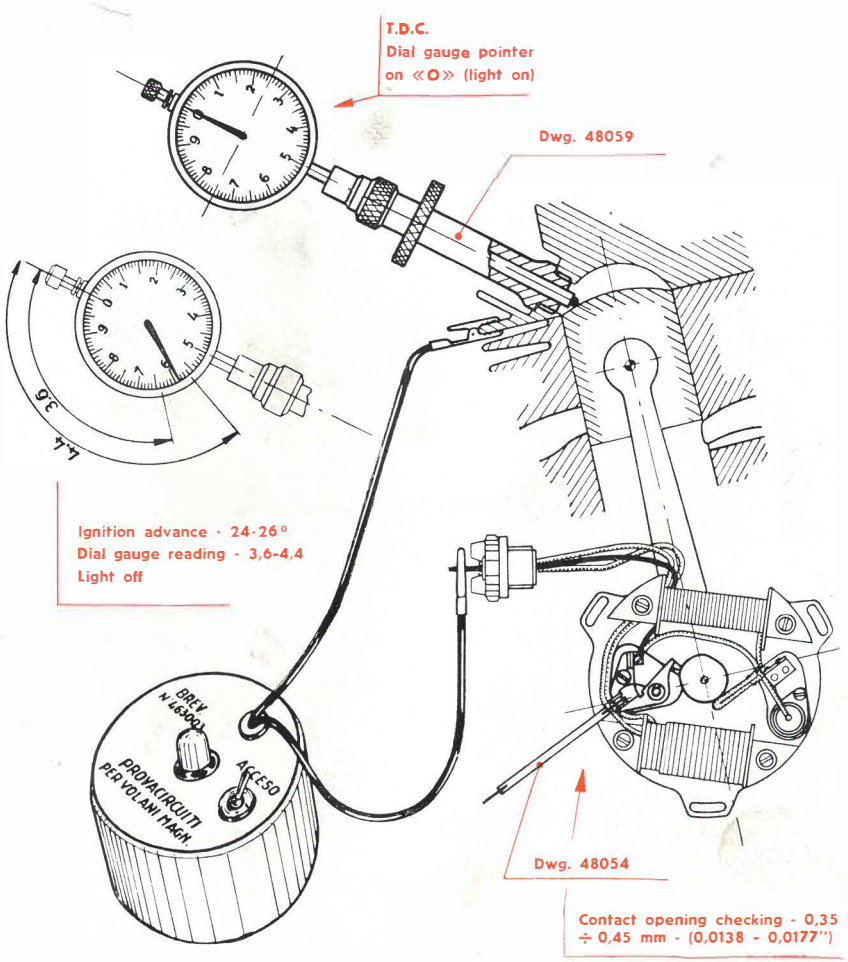


Fig. 68 - Flywheel magneto timing operations.

GEAR AND THROTTLE CONTROL ON THE HANDLEBAR

Wear increases the amount of play between the guiding slide of the gear and throttle twistgrip and the corresponding grooves of the sleeves with a consequent increase in axial twistgrip play. Eliminate this trouble by inserting shims between the twistgrip end and the sleeves.

In refitting install the slides exactly in the same position as before, to avoid a new settlement which might cause further wear.

To check controls, take the gear-cable from the outer cable out and before reinserting fill the outer cable with thick grease using a grease gun.

TROUBLES AND REPAIRS

If engine does not develop normal power, check as follows for possible causes of trouble:

a) Carburation

Petrol flow through flexible tube is not constant
Carburettor valve does not open completely
Main jet hole partly clogged
Float chamber bottom dirty
Idling regulating screw not properly adjusted

b) Ignition

Incorrect timing
Improper heat range of the spark plug: electrodes dirty
Gap clearance wrong (correct: 0.0197")
Poor insulation of H. T. coil
Cable or wire earthed
Breaker point arcing

c) Cylinder and Silencer

Scavenging and exhaust port partly clogged by carbon deposit
Silencer dirty

Miscellaneous

Make sure that crankshaft gaskets are efficient
Oil and petrol properly mixed according to our instructions
Piston ring perfectly tight

FLYWHEEL MAGNETO

If there is an indication that the magneto is causing trouble it is recommended before attempting to repair it, to check other elements such as the spark plug, carburettor, and connections; make sure the magneto timing is correct.

INCORRECT IGNITION

CAUSE	REMEDY
Magneto breaker points dirty	Clean
Breaker points out of adjustment	Adjust according to given data
Breaker points imperfectly matching	Adjust so that point surfaces match exactly
Poor breaker contact pressure	Adjust or replace spring; check pressure referring to tabulated data
Breaker arm does not turn freely on its pin	Lubricate breaker arm pin
Poor connections (terminal, cables)	Inspect connections and tighten screws
Defective condenser	Replace condenser
Magneto stator defective	Replace stator

INCORRECT IGNITION AT LOW SPEED

CAUSE	REMEDY
Breaker points dirty	Clean
Breaker points out of adjustment	Adjust
Breaker points imperfectly matching	Adjust so that point surfaces match exactly
Defective condenser	Replace condenser
Magneto stator defective	Replace stator

INCORRECT IGNITION AT HIGH SPEED

CAUSE	REMEDY
Magneto contact points out of adjustment	Adjust in accordance with tabulated data
Poor contact pressure	Adjust or replace spring; check pressure referring to tabulated data
Contact points imperfectly matching	Adjust so that point surfaces match exactly
Breaker arm does not turn freely on its pin	Lubricate pin
Poor connections (terminal, cables, etc.)	Inspect connections; tighten screws
Defective condenser	Replace
Magneto stator defective	Replace stator

ENGINE MISFIRES

CAUSE	REMEDY
Magneto contact points closed	Check breaker contacts
Breaker arm locked on its pin	Check and lubricate
Defective condenser	Replace condenser
Magneto stator discharged or shortcircuited	Replace stator
Disconnected cables	Inspect cables, terminals, clamping screws, etc.

LIGHT GENERATOR DOES NOT DEVELOP FULL POWER

CAUSE	REMEDY
Light generator stator short-circuited or grounded	Replace stator
Poor connections	Inspect connections, terminals, clamping screws, etc.

LIGHT GENERATOR DOES NOT OPERATE

CAUSE	REMEDY
Generator stator disconnected, short-circuited or grounded	Replace stator

SPARK PLUG

Test spark plug for proper heat range; remove it and inspect condition. Symptoms noticed on the engine when using inadequate spark plug, and effects on the plug.

Plug is too hot

Engine missing, specially at high r.p.m., knocks, preignition and consequent lack of power.

Plug test:

— Burning traces on the shell and insulator
— Electrodes badly corroded
— Insulator ends white with dark-brown deposits.

The same troubles can occur because spark plug has become loose in its seat, incorrect spark timing, mixture too lean and inner plug gasket burned.

Plug is too cold

Engine does not fire as electrodes are short-circuited.

Plug test:

Oil sediment and carbon on insulator end, shell and electrodes.

Oil and carbon filling the plug recess.

Another cause of trouble: mixture too rich.

Using proper spark plug the engine performance will be correct at any speed range, its temperature normal and starting easy.

Remember general rule:

For engines developing a great deal of heat, use a hard plug, for low-compression engines use a soft one.

SPARK PLUG INSTALLING

Before installing the spark plug on the engine, especially if already used, make sure the insulator is in good conditions. Check insulator and electrodes for dirt or carbon, and adjust clearance properly. Improperly adjusted gap may cause trouble in the ignition system; either no spark or a weak spark occur if gap is too large, whilst the contrary may cause short circuit.

Reset gap properly, bending or straightening the outer electrode. Set medium plug points to between 0,4÷0,5 mm. (0,0157"÷0,0197"), soft plugs to between 0,5÷0,7 mm. (0,0197"÷0,0275") and hard plugs to 0,3 mm (0,0118") only, because of the high tension in the cylinder.

When reassembling the spark plug to the cylinder, do not forget to fit the copper gasket between them, and make sure the plug is drawn up tight. Loose spark plug may cause poor compression of the engine, defective heat conduction, with consequent burning of the gasket, and in addition a deterioration of the general performance conditions.

Do not install spark plugs with longer threaded stem than that prescribed, fitting another gasket to compense the longer stem. In such a case the plug should be considered as a soft one, because of bad heat conduction.

All spark plugs require to be checked periodicaly, removing carbon deposits on the insulator, shell and electrodes by means of very fine emery cloth, and resetting the gap between the electrodes, as these may become worn. In this way the plug will always operate properly.

The spark plug adapted to our motor vehicles is of medium heat range; thread M 14 1,25 length 12 mm (0,47"); gap to between 0,5÷0,6 mm. (0,0197"÷0,0236").

HARD STARTING

Hard starting may depend on carburettor troubles, beside faulty ignition system, as previously described.

CAUSE	REMEDY
Mixture does not reach carburettor correctly	Inspect filter and if clogged clean with a brush or blow out all dirt with air.
Atomizer hole partly clogged	Clean hole by blowing with air
Float is leaking and does not maintain proper level	Replace float
Float needle does not move freely	Clean float needle hole
Mixture too rich	Drain mixture and refill with 94% petrol and 6% oil

CLUTCH

The troubles which occur in the transmission system most frequently depend on badly adjusted or defective clutch. Adjust the clutch by unscrewing the ring of the clutch cable adjuster on the handlebar and loosening nut and counternut at the opposite cable end in the crankcase.
Here are reported clutch troubles, their most likely causes and the remedies to be adopted.

CLUTCH SLIPPING

CAUSE	REMEDY
Clutch control cable too long with respect to the outer cable and consequently discs are not in contact.	Regulate cable length simultaneously operating nut and counternut of the control pin using two 0,315" wrenches
Clutch discs excessively worn	Replace discs
Weak springs	Replace springs

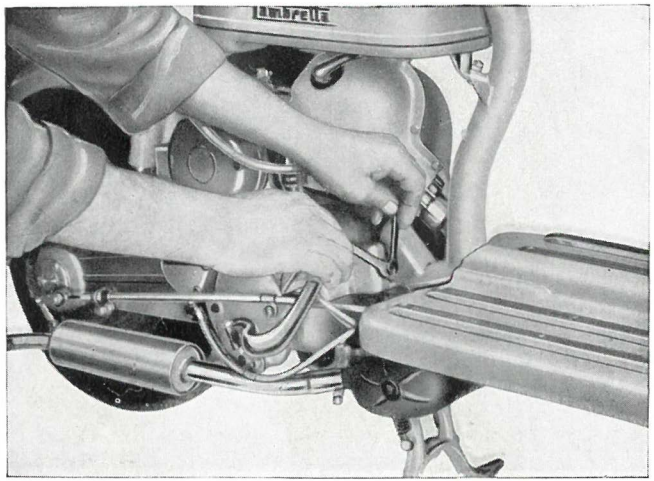


Fig. 69 - Clutch adjusting.

CLUTCH DOES NOT RELEASE COMPLETELY

CAUSE	REMEDY
Clutch control cable too long with respect to the outer cable.	Regulate cable length, operating nut and counternut by means of two 0.315" wrenches

BEVEL GEARS

UNUSUAL ENGINE NOISES AT HIGH SPEED

CAUSE	REMEDY
Excessive play between bevel pinion and crown wheel of the two bevel couples.	Check clearance on both bevel rear transmission gear couples; first inspect the bevel gears.

To adjust the rear bevel gears, first dismantle the wheel pin supporting flange, replace the shims situated between the latter and the transmission case.

We recommend this operation sequence:

— dismantle the rear wheel with the drum, remove brake shoes and their pin and also the lock nut of the brake shoe cam bush; slightly strike this bushing to reduce the pressure on the flange.

— loosen the four nuts locking the rear wheel supporting flange.

— operate by means of wrench 43370 after inserting the key on the pin (See description page 74); check after loosening of the nuts whether the defect persists or not.

— after locating the trouble, dismantle the flange and replace the shims placed under the bevel pinion group. Extract this group from the transmission case (See description page 48) using the puller 42589. Replace the shim situated between pinion group and transmission case seat, increasing or reducing thickness of the shim, according to the necessity of approaching or withdrawing the pinion to or from the crown. Reinstall, following the sequence indicated in « Reinstallation » and check if couplings are correct. See fig. 63. If the trouble does not depend on the rear bevel gears, inspect and adjust the front couple, dismantling the transmission-suspension group from the crankcase, and removing K.S. casing and clutch discs, as previously described, (See « Dismantling »). Remove the clutch bell, and check front bevel gear for proper play (fig. 59), after removing clutch completely, and replace the spacer with a new one.

INSTRUCTIONS FOR REPAIR SHOPS
MODIFICATIONS

INNOCENTI

MODIFICATION No. 1) - KICK STARTER GROUP

In a series of 3000 machines the k. s. group has been improved as follows :

The bevel pinion (1), into which the pin is forced (2), rotates on a ball bearing pair (3) ; a spacer (4) of proper thickness interposed between them carries some holes in order to facilitate adequate lubrication ; oil tightness is ensured by a packing.

The entire group is pressure fitted into the crankcase ; positioning is provided by a Seeger ring (5) placed in the spline, which has been machined at the crankcase mouth. The outside plate (6) locked by means of two fixing screws, prevents any axial movement of the group. The k. s. gear (7) rotates on the central pin (2) and its engagement with the bevel pinion (1) provided with special dogs, is ensured by a spring, properly calibrated, which is located on the pin end.

It will be noticed that on the cover of the k. s. group there is now a curved surface portion. As a matter of fact the cover has been modified according to the different position of the pin, in order to permit the rotation of the pin forced into the pinion.

As in early production, connections between the crankcase and the k. s. group consist of two calibrated screws, determining the position of the latter, and three exagonal screws and split washers.

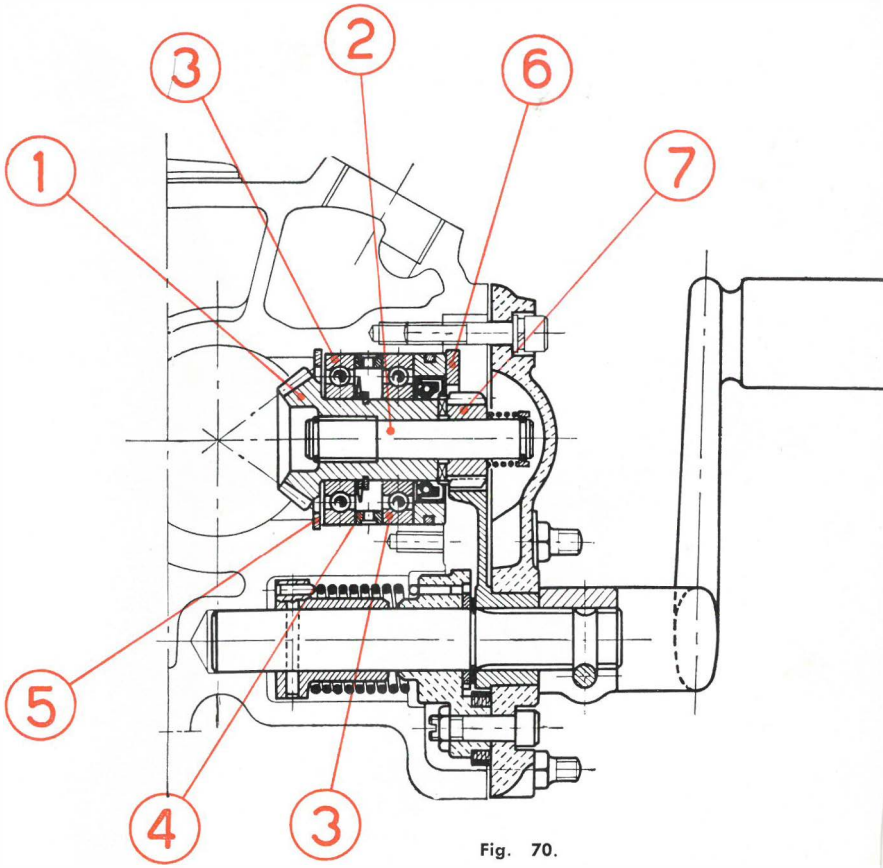


Fig. 70.

It will be realized that the solution adopted for the machines of later production is again that involving the supporting sleeve and bronze bushing. However the position of the central pin has been retained to permit fitting the spring, which provides for constant engagement between the k. s. gear and the bevel pinion (See fig. 71). The cover carries the same curved surface portion like the design of Modification 1).

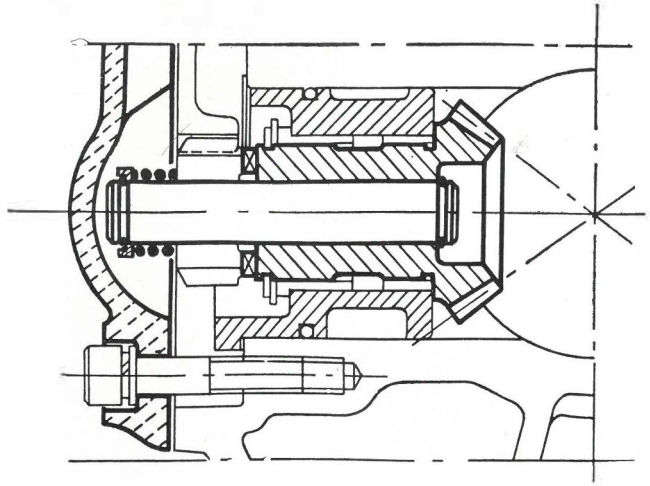


Fig. 71

Bear in mind that owing to the oversized diameter of the crankcase mouth as far as the scheme to fig. 70 is concerned there is no interchangeability with the sleeve and bronze bushing.

MODIFICATION No. 2) - PERIODICAL LUBRICATION OF THE CRANKSHAFT BEARING, FLYWHEEL MAGNETO SIDE

As indicated in the Lubrication Diagram, after each 7000 km (4300 miles), re-establish the prescribed quantity of grease in the seat of the ball bearing, flywheel magneto side.

We recommend to follow this procedure:

— Run the engine to warm it up

— Remove the hexagonal cap of the vent located near the greaser and with engine running inject grease at intervals until it will come out from the vent hole. Use a common pressure gun.

— Screw the vent cap in and inject further about 2-3 g grease.

MODIFICATION No. 3) - REMOVAL OF THE NUT LOCKING THE CRANKSHAFT

To remove the crankshaft locking nut preventing in the meantime its rotation, use the tool to 49221, illustrated in fig. 45 and fig. 46, instead of using the locking tool to 49628, as previously suggested.

Insert the tool in the crankcase, cylinder side; it will lock the crankshaft, allowing to extract the nut with the aid of a 27 mm wrench.

MODIFICATION No. 4) - STARTING GROUP

After the alterations, notified in Modification 1), the starting group has been further improved, as illustrated in fig. 72. The last solution will remarkably improve the operation of the starting device, preventing the edge contact of the gears at the beginning of mesh through a new element, which allows engagement of the first tooth of quadrant (12) with the starter pinion (3) when the latter is in neutral on the pin (2).

All components are now incorporated in the cover (15), thus making inspection easier.

OPERATION

As the starting pedal is actuated, the quadrant (12) starts rotating; but before engaging the pinion (3) the tab of the plate (11), connected to the quadrant, presses against the cup (4) and overcoming the pressure of the spring (8) pushes the cup (4) with the pinion (3) alongside the pin (2), causing disengagement of pinions (1) and (3).

The quadrant (12) continues in revolving and engages the starting pinion (3). Should the teeth be out of engaging position, the quadrant will position the pinion easily, being the latter in neutral.

The tab of the plate (11) which revolves with the quadrant (12) after overtaking the cup (4) releases the spring (8) and pushes the pinion (3) against the bevel pinion (1)

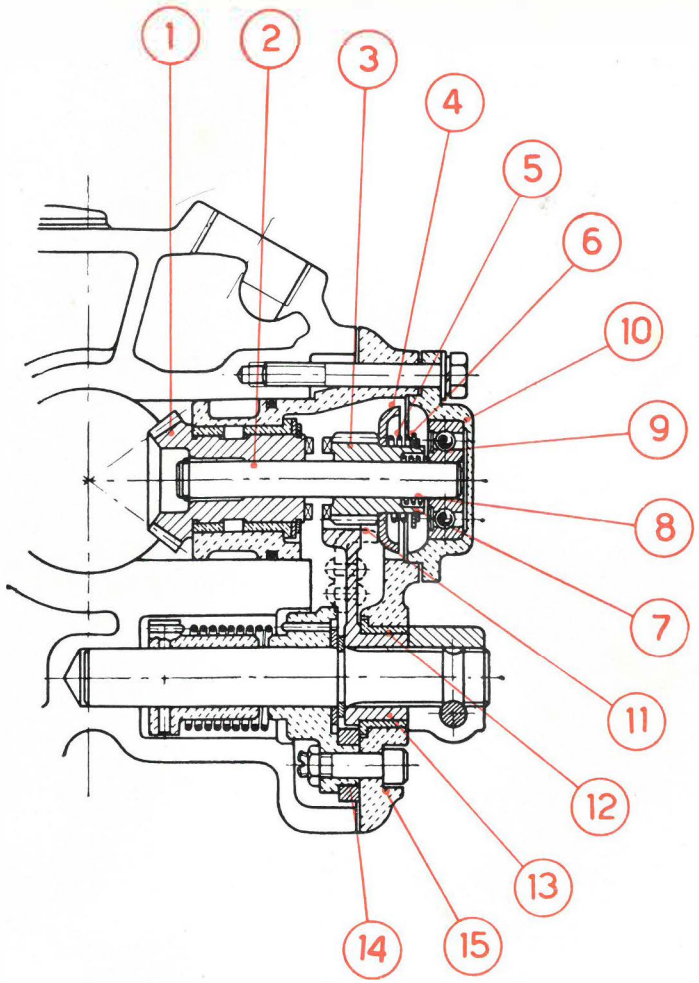


Fig. 72 - Showing how the starting group operates.

causing them to mesh. Then the revolving motion is transmitted to the crankshaft.

After releasing the starter pedal, a torsion spring brings both pedal and quadrant back to the start position.

Moving in the reverse direction, the tab (11) passes under the cup (4) and disengages the starting pinion momentarily from the bevel pinion (1), but engagement between the two gears will be re-established at once and they will further revolve as one, supported on bronze bush internally and on bearing (9) externally.

Should a backlash occurs, a rough return of the starting pedal will follow, and the tab (11) pressing against the cup (4) instead of displacing the starter pinion (3), overcomes the pressure of the spring (5) and passes over shifting the cup only.

In such a manner the reversal motion of the quadrant is ensured. After the tab has passed over, the cup returns to start position.

DISMANTLING

Supposing that repairs or replacements have to be effected, it is advisable to remove the entire starting group, taking it from the crankcase out by slackening the four exagon screws and the calibrated screw.

To dismantle the cap

Slacken the remaining two screws fixing the cap (10) to the cover (15); next apply the puller 51239 (look at fig. 73) so that the three gripping sectors rest on the cover (15); rotate the cap with the aid of a screwdriver in such a manner that it will be gripped by the tool sectors; this done, operate the nut and pull the cap out.

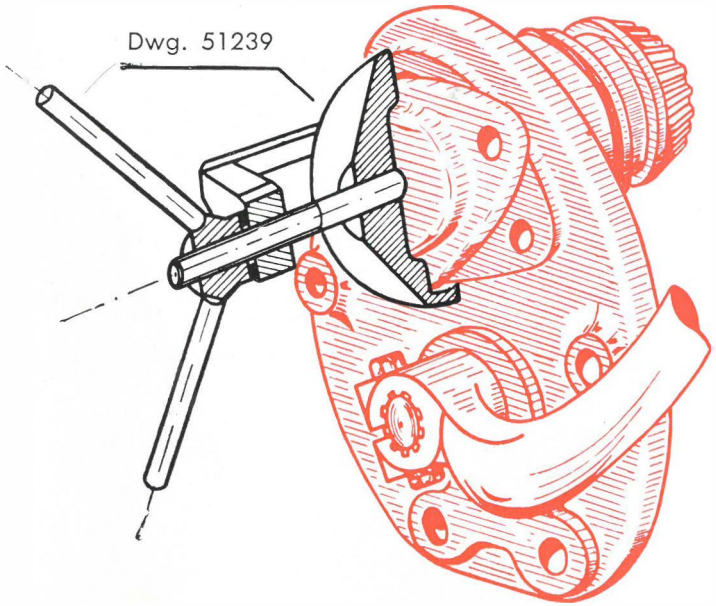


Fig. 73 - How to use the tool 51239

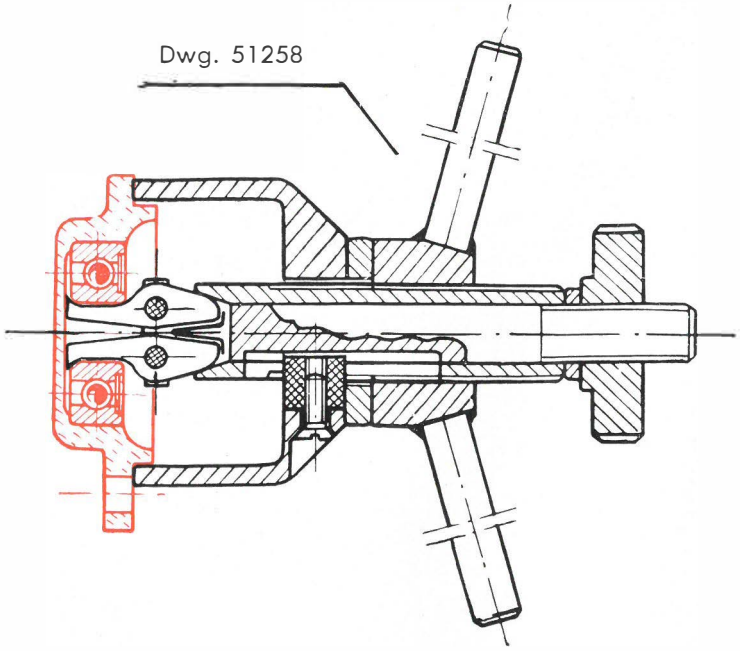


Fig. 74 - How to use the tool 51258

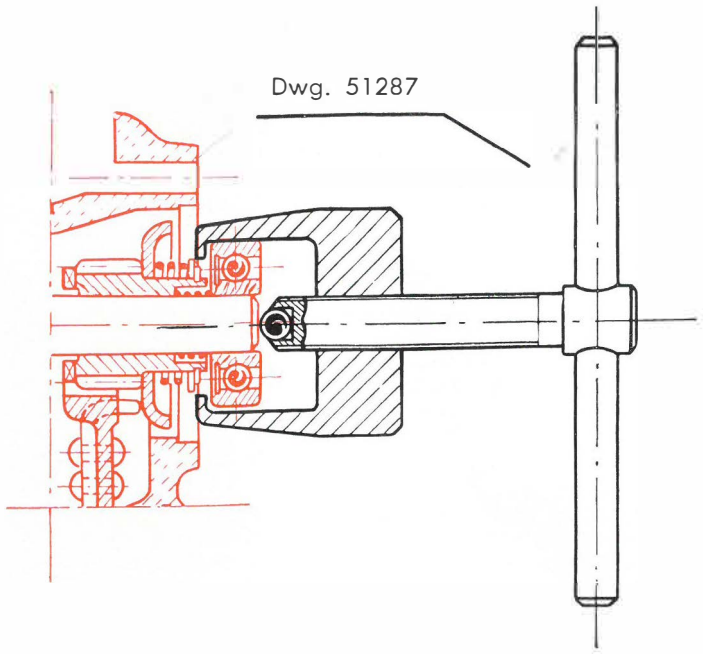


Fig. 75 - How to use the tool 51287

Bearing removal

To extract the bearing from the cap, apply the tool 51528 (See fig. 74); should not this tool be available, follow this procedure: warm up the two parts in oil; gently tap the cap edge to facilitate the bearing to be freed.
In the case that the pin is forced into the bearing and assuming the latter should be extracted, apply the puller 51287 (see fig. 75) so that the stirrup grips the outer ring of the bearing; operate the tie rod and free the bearing.
To dismantle the remaining parts, reverse the sequence indicated in « Dismantling ».

REASSEMBLING

Install the bevel pinion (1), with the shaft (2) forced into it, in the cover (15), where the bronze bushes have already been fitted, (Look at fig. 72); next position the pinion with the aid of washers and Seeger rings.

Replace the starter pinion (3) already provided with cup (4), spring (5) and its supporting ring (6), Seeger ring (7). Now install the control spring (8) for pinion engagement, the cap (10) carrying the bearing (9) and fit it to the cover (15) by means of two locking screws.

The remaining parts (see fig. 72) are similar to those of the previous starting group; only the quadrant rotating on bronze bushing carries the plate (11).

The rubber ring, serving as a stop for the starter quadrant, has now been replaced with a steel ring of the same size. The entire group mounted on the cover is attached to the cranckcase by means of a calibrated screw, which positions the cover itself, and four exagon screws, one of them passing through the cap; split washers will help to lock the group. **Bear in mind that the adjustment of the bevel pinion is effected by interposing some packings between crankcase and starter cover.**

MODIFICATION No. 5) - FLYWHEEL MAGNETO WITH AUTOMATIC ADVANCE MECHANISM

Because of the desirability of having an easier starting, the Lambretta 150 cc, LD and D models, have been equipped with improved flywheel magneto. The new unit carries an automatic advance mechanism, the characteristics of which are different for the two makes (MARELLI and FILSO); therefore parts are not interchangeable, although operation is quite similar.

MARELLI FLYWHEEL MAGNETO, MVB 4 C

The new model merely differs from the early design (illustration appears in chapter **« Flywheel Magneto »** page 34 of this Manual) in that it is provided with automatic mechanism consisting of following elements:

— (1) **Expansion weights and arm**
— (2) **Return lever**
— (3) **Cam**
— (4) **Stop pin**
— (5) **Flywheel central hub**

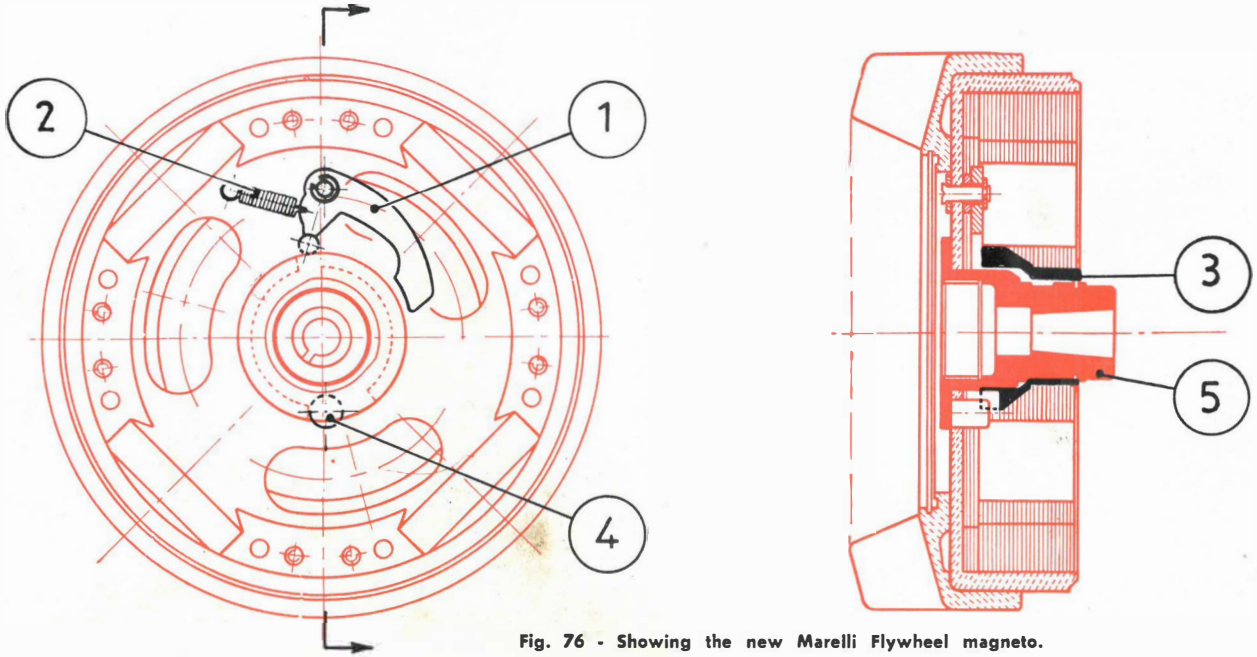


Fig. 76 - Showing the new Marelli Flywheel magneto.

Operation

The automatic mechanism permits to advance the timing $6^0 \div 8^0$ when starting the engine and to increase it up to $24^0 \div 26^0$ when the engine is running faster.
Timing variation begins at 1200 r.p.m. increasing progressively to a maximum of 1600 r.p.m.
When the engine is at standstill (or at low revolution rate), the expansion weight (1), urged by spring (2), with the aid of its arm keeps the cam (3) in the position shown in fig. 76.
After having reached 1200 r.p.m., the expansion weight (1) starts moving outwards, due to the centrifugal force, and overcoming the resistance of spring (2) causes the cam (3) to rotate; rotation will be limited by the stopping pin (4) on which rests the left side of the cavity of cam (3).
The variation of the cam angle is 18°.

FILSO FLYWHEEL MAGNETO, F. 0188 C

Operation of FILSO flywheel magneto, Mod. F.0188 (See fig. 77) is similar to that of MARELLI make.
The components of the automatic advance mechanism are as follows:

— (1) **Expansion weights**
— (2) **Return lever**
— (3) **Cam**
— (4) **Stopping ring**
— (5) **Flywheel hub**

Note in the fig. 76-77 the differences between MARELLI and FILSO makes. The expansion weights (1) are mounted on the outer side of the rotor. The maximum opening of the weights is determined by the stopping ring (4), made of plastic material, fitted to the rotor.

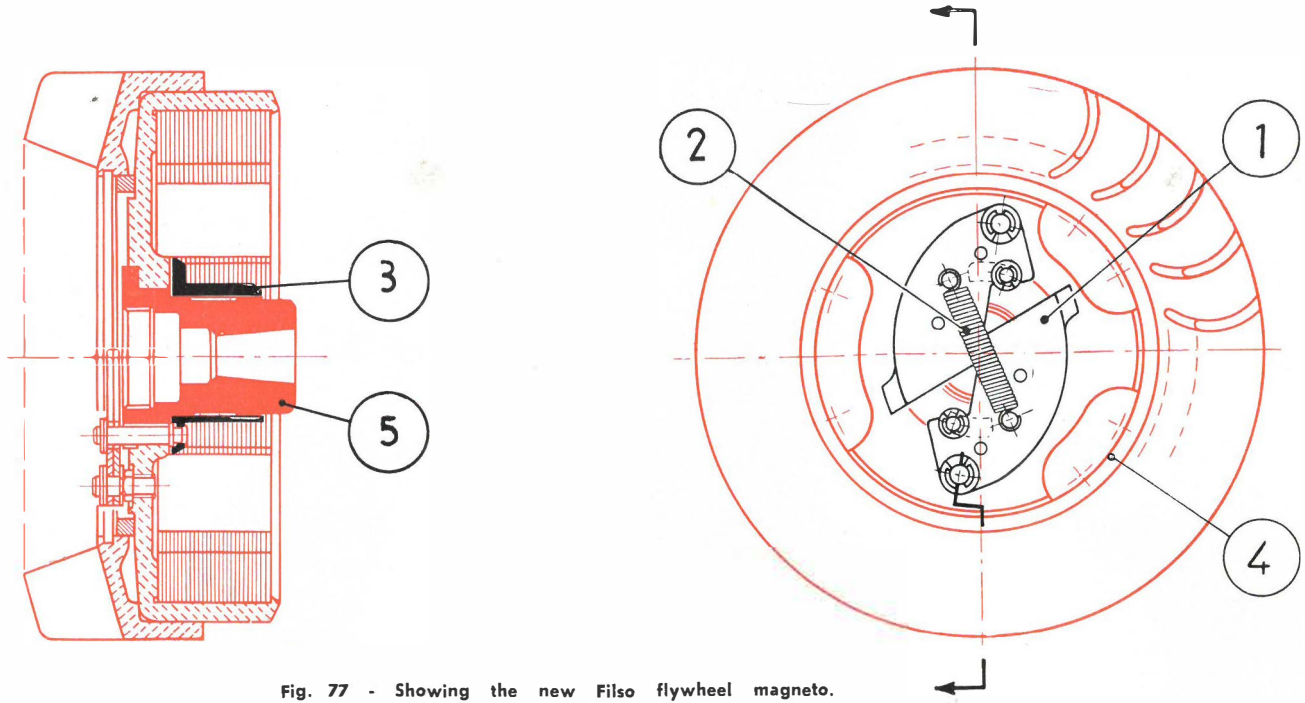


Fig. 77 - Showing the new Filso flywheel magneto.

DISMANTLING AND REINSTALLATION OF FLYWHEEL MAGNETO WITH AUTOMATIC ADVANCE MECHANISM

The operations required for dismantling or reassembling purpose are similar to those concerning the old flywheel magneto and they have already been described on page 44 and 82 respectively.

TIMING

While the timing of the flywheel magneto previously mounted has been discussed and illustrated on page 98-99 of this Manual, the same general principle underlies the timing of the new flywheel magneto type (MARELLI MVB 4 C and FILSO F 0188 C). **Variations consist solely in performing all operations keeping the expansion weights fully open** (See fig. 78-79).

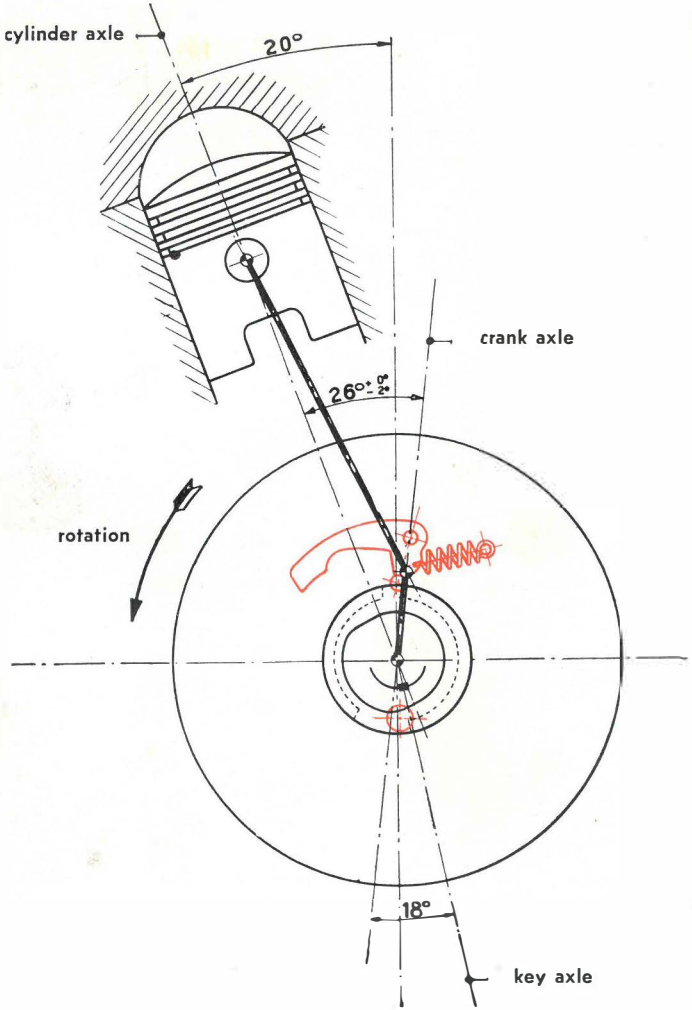


Fig. 78 - Timing of the **MARELLI** flywheel magneto.

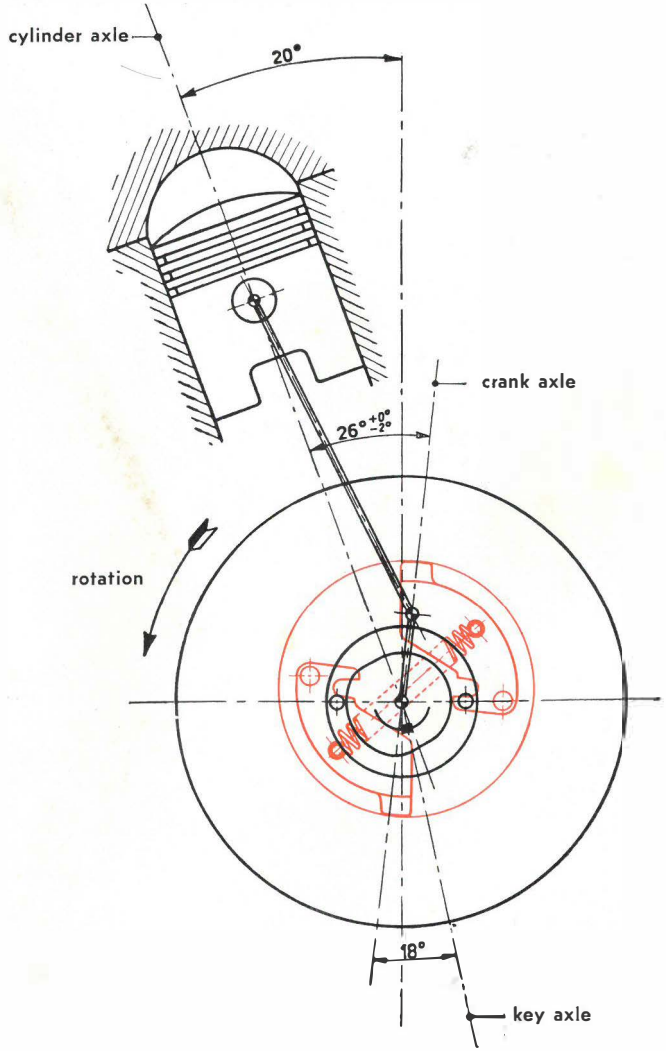


Fig. 79 - Timing of the **FILSO** flywheel magneto.

MODIFICATION No. 6) - LAMBRETTA 150 cc. WITH PARKING LIGHTS

The new electrical equipment mounted on the Lambretta 150 cc. includes a cell battery, which permits to utilize lights for parking purpose. Arrangement throughout the machine is shown in a schematic manner in fig. 80.

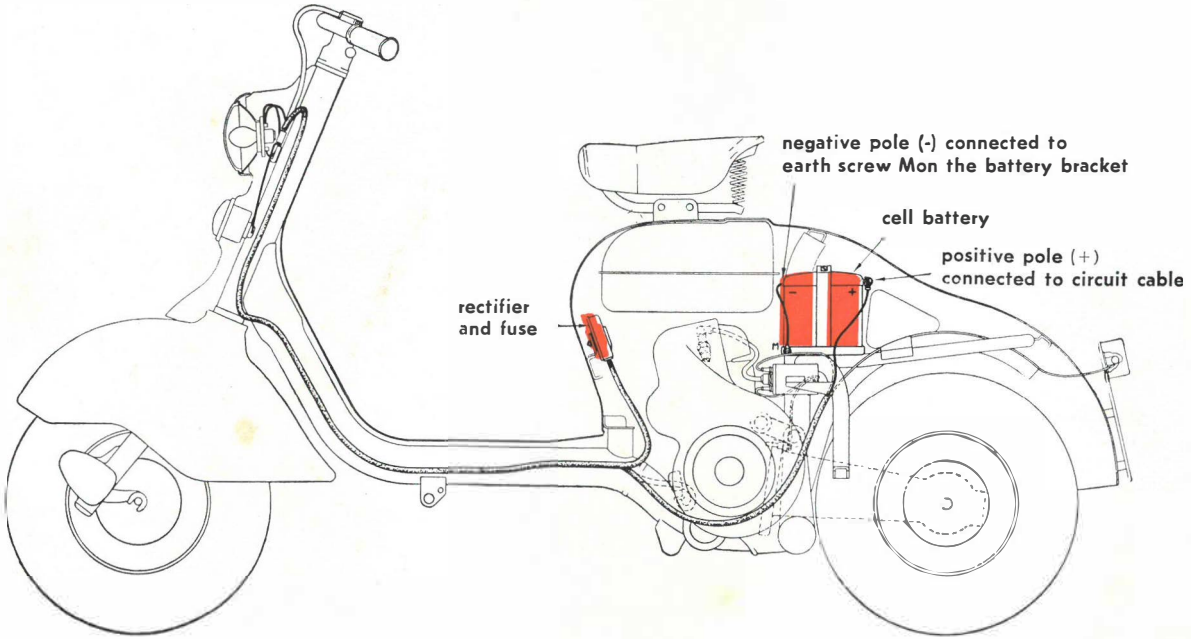


Fig. 80 - A schematic drawing showing the 150 cc. Lambretta

NOTE - The arrangement concerning the Model « D » is sligtly different, but wiring connections are quite similar.

The electrical equipment is supplied by means of a flywheel magneto, which induces low tension current to the twin-filament bulb (6V-25/25W), incorporated in the headlamp, and 6V-1,5W bulb in tail light; it provides further for battery charging through a rectifier. The 6V-4Ah battery delivers direct current to the 6V-5W bulb in head lamp, (acting as pilot and parking light), and 6V-1,5W bulb, (acting as tail and parking light).

The lighting control consists (as in the old equipment) of a switch, located on the r. h. handlebar; the switch lever serves as well to earth the engine (Position « M » on the switch). The switch is coupled with the horn button, still operated by alternating current. If a speedometer of illuminated type is fitted, the socket should be linked to the terminal plate in the head lamp (See Wiring Diagram). For the lighting circuit use only the following devices and bulbs:

— Flywheel magneto	27W-6V	
	Marelli Make	Drwng 12 M 1231
	Filso Make	Drwng 12 M 1241
— Head lamp	Twin-filament bulb 6V-25/25W	
	Pilot and parking bulb 6V-5W	
— Tail light	6V-1,5W bulb	
— Speedometer	6V-1,5W bulb	
— Battery	6V-4Ah	

Either dry batteries (Pat. Varley-Safa) or lead-acid batteries can be mounted on the machines.

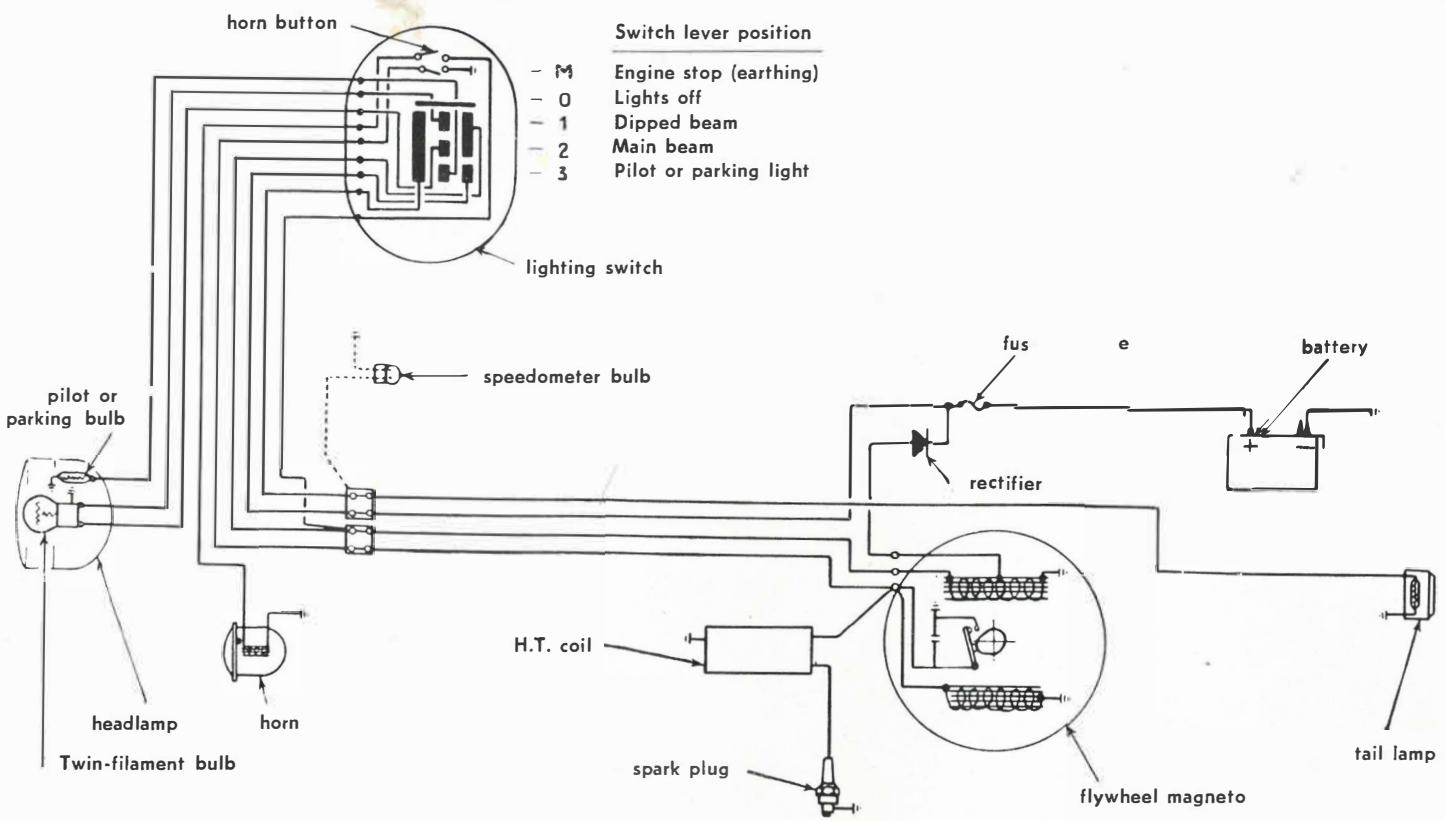


Fig. 81 - Wiring of the Electrical Set.

TEST EQUIPMENT

— Hand-operated tachometer
— Voltmeter for direct current 0 ÷ 10V
— Ammeter for direct current 0 ÷ 3A
— Milliammeter for direct current 0 ÷ 10mA
— Hydrometer

BATTERY MAINTENANCE

Dry Battery

1) Check the battery every now and then avoiding it becomes discharged, otherwise it will likely deteriorate.

2) Add distilled water monthly (in hot weather at least once a fortnight), until liquid level reaches the top of the plates and remains constant.
In the event that too much water has been added, let the cell at rest for a quarter of an hour, and then draw up the excess liquid with the aid of a rubber bulb.
It is advisable to add distilled water after a ride rather than before.

3) Make sure that terminals between battery and circuit wires are perfecty tightened and coated with grease, to avoid corrosion.

4) If the machine is to be left standing for a long time it is desirable to dismantle the battery and store it where there is no danger of the water freezing; further the battery should be given a refreshing charge at a local Service Station once every month to keep it efficient.

5) When mounting the battery on the machine care must be taken that connections are exactly performed (See fig. 80) that is: positive pole (+) to circuit wire and negative pole (—) to earth screw on the battery bracket.
As the battery is being positioned, bear in mind that the manufacturer's mark must be on the external side of the machine. (Fig. 83).

6) The battery must be charged with direct current only, at a rate equal to 1/10 of its capacity (0,4 Ampère).
Check the voltage of each cell with the aid of a voltmeter; when cell voltage reading is 2,6 V, charging should be further continued during 3 hours.
When charging is completed, add distilled water and let the battery at rest for 15 min, eliminating the excess liquid by drawing it up with the aid of a rubber bulb.

Lead-acid Battery

1) Refer to dry battery
2) Once a month, and in any case after 1500 km (900 miles) the level of the acid in each cell should be checked. Dot not allow the surface of the electrolyte to get below the level specified by the manufacturer, namely 5-10 mm (0.197 - 0394") above the tops of the plates. To make up the eventual deficiency add **distilled water.**
3) Refer to dry battery
4) Refer to dry battery
5) Refer to dry battery
6) Refer to dry battery
7) Check the density of the acid using a hydrometer.
   If the battery is fully charged the density of the liquid should be 1.26 (30 Bé). A hydrometer reading of 1.21 indicates that the battery must be charged immediately to avoid deterioration.
   If the specific gravity (density) reading is less than 1.21 that means the deterioration process is being in course. In such a case it is advisable to have the battery sent to the nearest battery manufacturer's Service Station.
   When charging has been completed, shacke the battery vigorously to facilitate escaping of the gas from the battery cells and finally get the level to the prescribed height.
   For the first battery charging, follow the maker's instructions attached to the battery itself.
   In the case the battery operates in very high temperatures, specific gravity reading should be 1.21 (25 Bé) at 15 °C.

TEST OF BATTERY CHARGING CIRCUIT

Check battery charging circuit **when engine is running** by inserting an ammeter between the positive terminal of the battery and the circuit cable terminal, as shown in fig. 83 (battery positive to ammeter negative - ammeter positive to circuit cable):
The test should be effected at following engine rev. rate, measured with a tachometer fitted by hand to the flywheel locking nut (Look at fig. 82).

— 5000 rev. approxim. 0.9 Ampère
— 3000 rev. approxim. 0.4 Ampère

Take the readings with lighting switch lever in the position « O » (lights off).
If the readings do not reach the above values, the causes of the deficiency may be as follows:
— Failure of rectifier (electrical leakage): replace

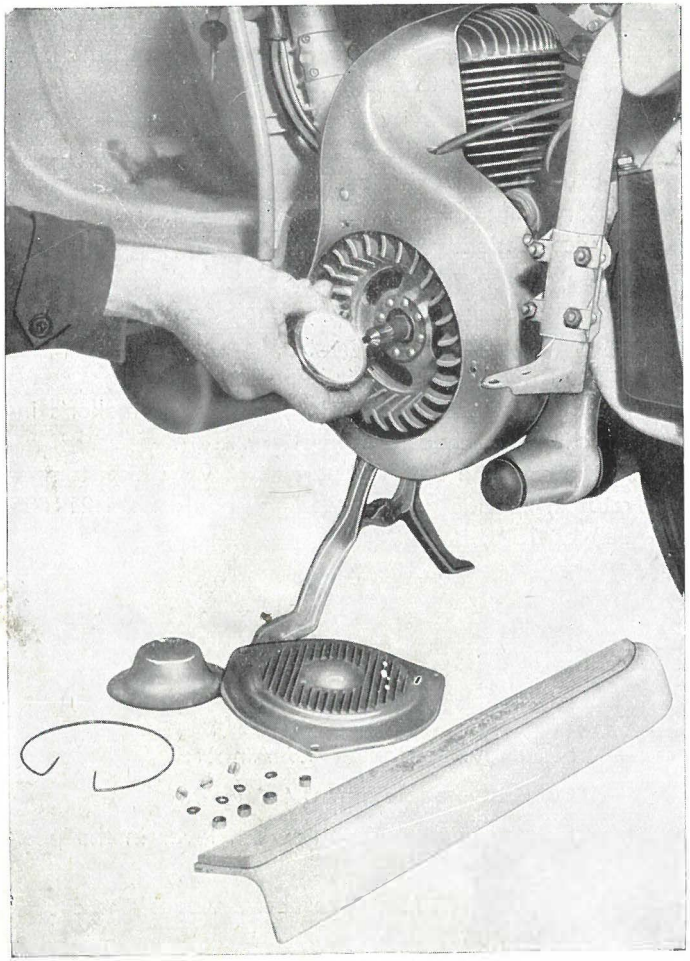


Fig. 82 - Fitting tachometer.

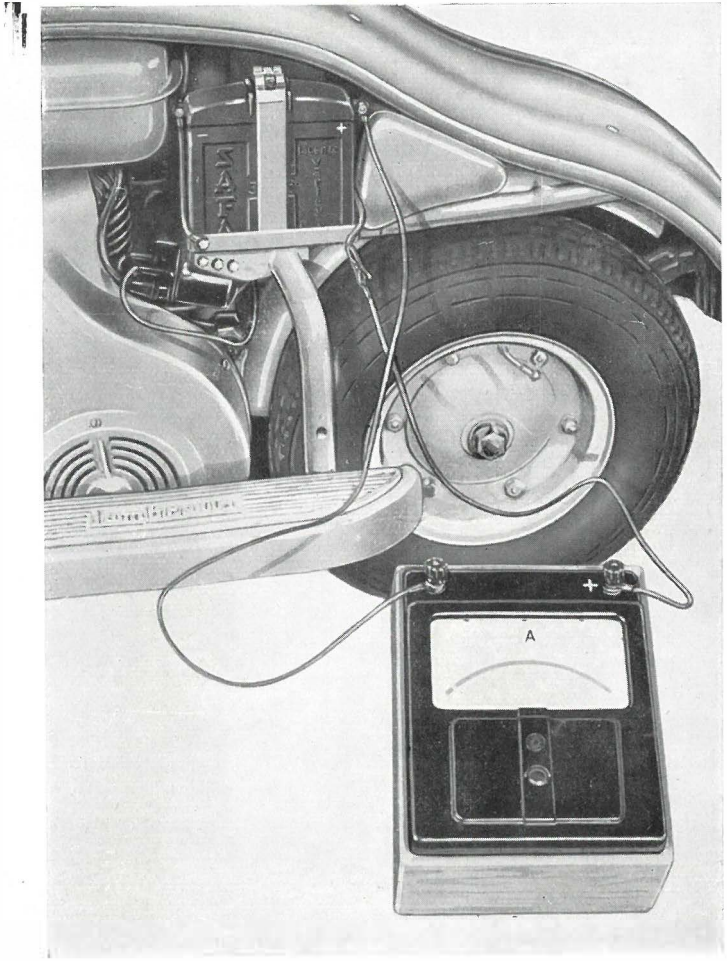


Fig. 83 - How the ammeter is used.

— Burnt fuse (parking lights fail to operate): replace

— Failure of magneto owing to demagnetization (headlamp light weak): provide for re-magnetization or replacement.

ELECTRIC CIRCUIT TEST

By checking reverse current from battery to circuit, it is possible to detect electrical leakage. **Test the reverse current only with the engine at standstill.**

Insert a milliammeter between the positive pole of the battery and the circuit cable terminal, as shown in fig. 84. Reading should be no more than 3 mA (battery positive to milliammeter positive — milliammeter negative to circuit cable).

Reading should be effected with the lighting switch lever **in position 0** (lights off).

If the reading is more than 3 mA, it is evident that there is excessive electrical leakage, which may cause battery discharge. The source of leakage might be found:

— in the electrical circuit: wire insulating conditions as well as connections must be inspected to locate the portion of the circuit or the organ causing the failure

— in the rectifier, which may be faulty and need for replacement.

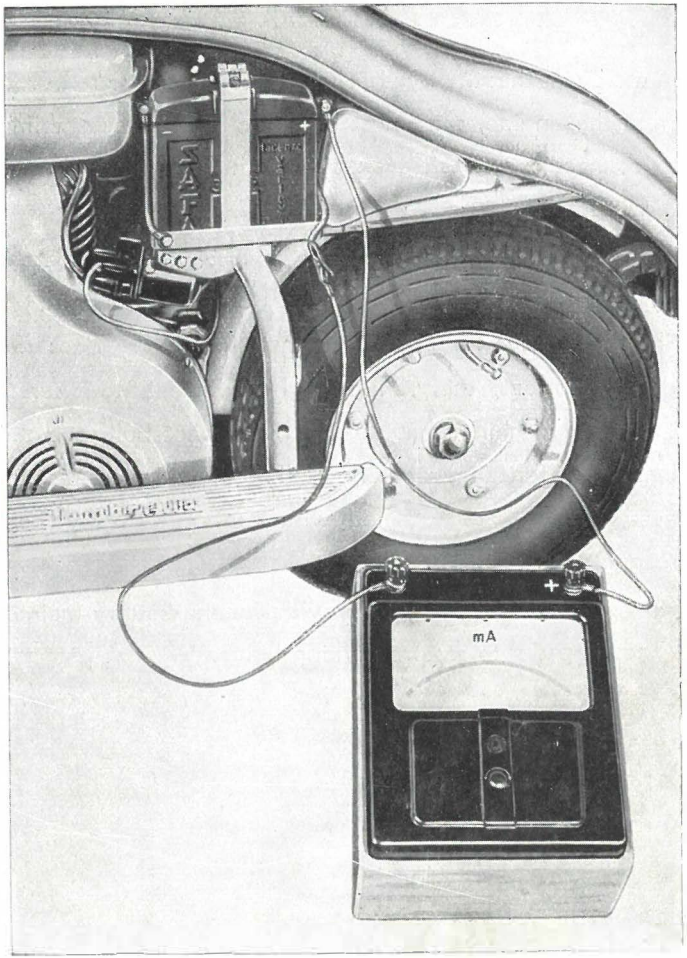


Fig. 84 - Testing the electrical circuit with the aid of a milliammeter

SUPPLEMENTARY NOTICE

In the event that the flywheel magneto should be removed from the engine, care must be taken when reassembling to connect circuit wires exactly to their terminals in the flywheel socket (Look at fig. 85).

If there is a faulty connection, the fact will be apparent by reason of a very low efficiency of the head light.

Should it occur for any cause that the battery does not deliver current, the parking lights will fail to operate when the machine is at standstill, but pilot bulb and tail lamp will function regularly, although with less brightness, as they are supplied with current from flywheel magneto.

However it is necessary to provide for the battery maintenance in order to restore parking lights.

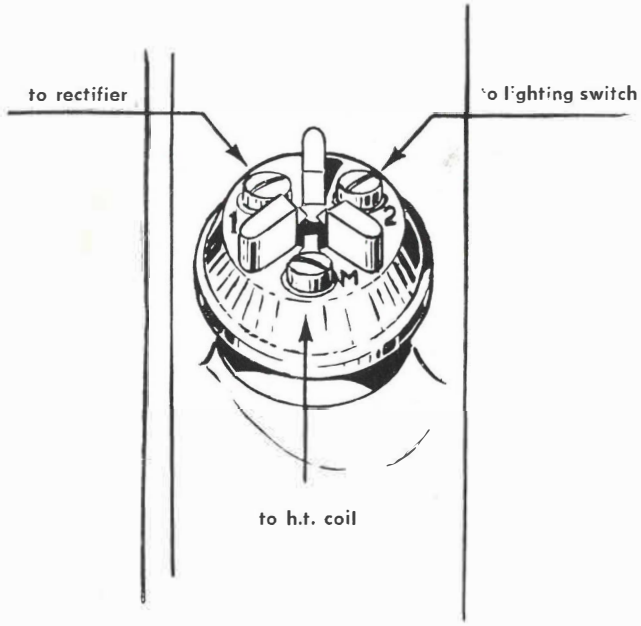
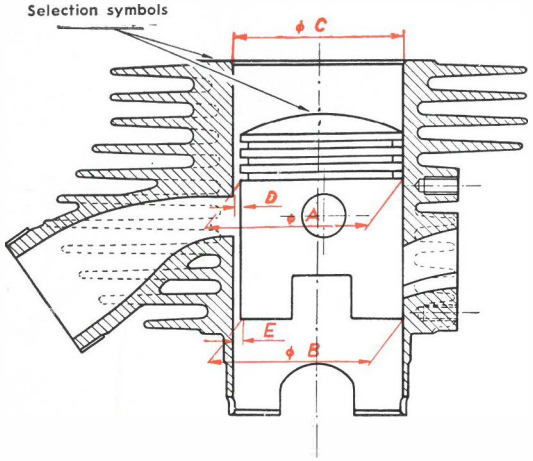


Fig. 85 - Showing the therminals on flywheel magneto socket.

WEAR LIMITS



A = Outer piston diameter under the ring grooves

B = Outer botton piston diameter

C = Cylinder bore diameter

D = Installation clearance according to ∅ A

E = Installation clearance according to ∅ B

INSTALLATION ALLOWANCE AND WEAR LIMITS FOR CYLINDER AND PISTON

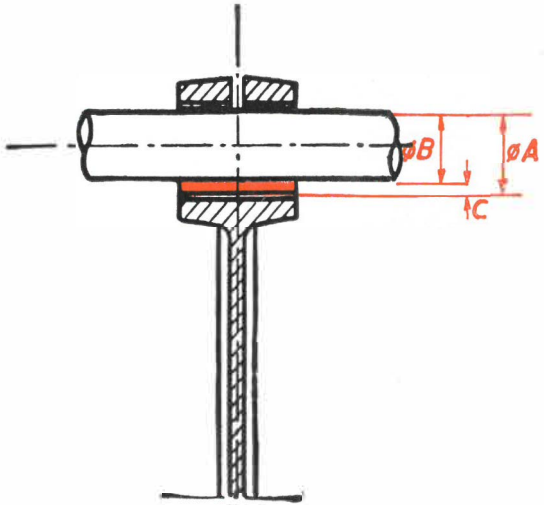
Operation	Selection	Cylinder size ∅ C 11 M. 201 in.	Piston			Installation allowance		Wear Limits in.
			Position	Dimensions Dwg.	Dimensions Cast in.	Position	Dimensions in.	
Normal installation.	1st class symbol —	2,244094	∅ A	11 M. 1021	2,239370	D	max. 0.004961	0,008661
					2,239606		min. 0.004488	
		2,244330	∅ B		2,241732	E	max. 0.002598	
					2,241968		min. 0.002125	
	2nd class symbol 0	2,244370	∅ A		2,239645	D	max. 0.004961	
					2,239881		min. 0.004488	
		2,244606	∅ B		2,242007	E	max. 0.002598	
					2,242244		min. 0.002125	
	3rd class symbol +	2,244646	∅ A		2,239921	D	max. 0.004961	
					2,240157		min. 0.004488	
		2,251882	∅ B		2,242283	E	max. 0.002598	
					2,242519		min. 0.002125	
1st Cylinder bore oversizing.	1st class symbol —	2,251968	∅ A	11 M. 1022	2,247244	D	max. 0.004961	0,008661
					2,247480		min. 0.004488	
		2,252200	∅ B		2,249606	E	max. 0.002598	
					2,249842		min. 0.002125	
	2nd class symbol 0	2,252204	∅ A		2,247520	D	max. 0.004961	
					2,247756		min. 0.004488	
		2.252480	∅ B		2,249882	E	max. 0.002598	
					2,250118		min. 0.002125	
	3rd class symbol +	2,252520	∅ A		2,247795	D	max. 0.004961	
					2,248031		min. 0.004488	
		2,252756	∅ B		2,250157	E	max. 0.002598	
					2,250393		min. 0.002125	

The selection symbols — 0 + are marked respectively:
cylinder: on the upper face
piston: on the top

INSTALLATION ALLOWANCE AND WEAR LIMITS FOR CYLINDER AND PISTON

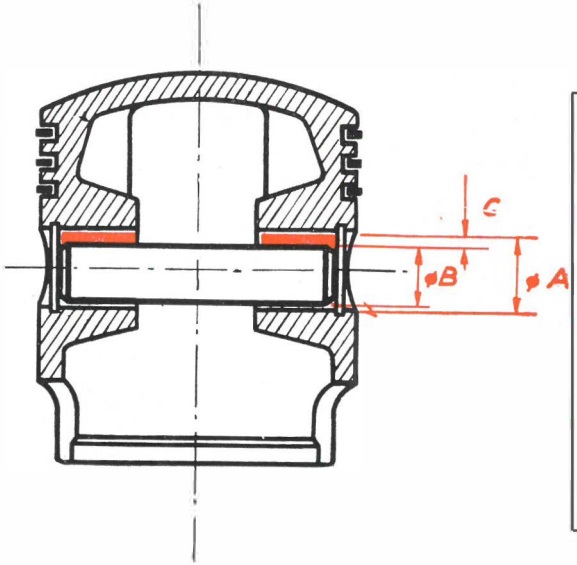
Operation	Selection	Cylinder size ∅ C II M. 201 in.	Piston			Installation allowance		Wear Limits in.
			Position	Dimensions Dwg.	Dimensions Cast in.	Position	Dimensions in.	
2nd Cylinder bore oversizing	1st class symbol —	2.259842	∅ A	11 M. 1023	2.255118	D	max 0.004961	0.008661
					2.255354		min. 0.004488	
		2.260078	∅ B		2.257480	E	max. 0.002598	
					2.257716		min. 0.002125	
	2nd class symbol 0	2.260118	∅ A		2.255393	D	max. 0.004961	
					2.255629		min. 0.004488	
		2.260354	∅ B		2.257755	E	max. 0.002598	
					2.257991		min. 0.002125	
	3rd class symbol +	2.260394	∅ A		2.255668	D	max. 0.004961	
					2.255904		min. 0.004488	
		2.260630	∅ B		2.258031	E	max. 0.002598	
					2.258267		min. 0,002125	
3rd Cylinder bore oversizing	1st class symbol —	2.267716	∅ A	11 M. 1024	2.262992	D	max. 0.004961	0.008661
					2.263228		min. 0.004488	
		2.267952	∅ B		2.265354	E	max. 0.002598	
					2.265590		min. 0.002125	
	2nd class symbol 0	2.267992	∅ A		2.263267	D	max. 0.004961	
					2.263503		min. 0.004488	
		2.268228	∅ B		2.265629	E	max. 0.002598	
					2.265865		min. 0.002125	
	3rd class symbol +	2.268268	∅ A		2.263543	D	max. 0.004961	
					2.263779		min. 0.004488	
		2.268504	∅ B		2.265905	E	max. 0.002598	
					2.265141		min. 0.002125	

INSTALLATION ALLOWANCE AND WEAR LIMITS BETWEEN GUDGEON PIN AND CONNECTING ROD LITTLE END EYE



Operation	Little end bushing II M. 345 ∅ A	Piston pin ∅ B		Allowance C in.	Wear limit in.
		Dwg.	Dimension in.		
Normal Installation	+ 0.000629 + 0.001063 0.629921	11 M. 346	+ 0 — 0.000433 0.629921	0.001496	0.002362
First oversizing	+ 0.000629 + 0.001063 0.629961	11 M. 347	+ 0 — 0.000433 0.629961	0.000629	
Second oversizing	+ 0.000629 + 0.001063 0.630001	11 M. 348	+ 0 — 0.000438 0.630001		

INSTALLATION INTERFERENCE AND WEAR LIMITS BETWEEN PISTON AND GUDGEON PIN



Operation	Piston in.	Gudgeon pin		Interference and Clearance C. in.	Wear Limit in.
		Dwg.	Ø B in.		
Normal installation	± 0.00118 0.629921	11 M. 346	+ 0 — 0.000433 0.629921	— 0.000118 + 0.00551	0.001181
First pin Oversizing	± 0.00118 0.629961	11 M. 347	+ 0 — 0.000433 0.629961		
Second Pin Oversizing	± 0.00118 0.630001	11 M. 348	+ 0 — 0.000433 0.630001		

WITH ELECTRIC STARTER

The electrical equipment has been designed so that the entire set will be fed with 12 V direct current. A flywheel magneto supplies the batteries through a rectifier.
A voltage regulator controls the current supplied by the rectifier ensuring correct charge to the batteries.
Components of the electrical set are listed in Table No. 1 together with part names and catalogue number; main construction and operation features are reported. The position of these elements on the machine is shown in the Scheme (fig. 86).
The wires can be easily identified by their different colours (See Electrical Diagram - fig. 87).

INSTRUCTIONS FOR INSTALLING THE ELECTRICAL SET

Flywheel magneto

Adjust timing in the same way as it is being performed in the Lambretta scooter without electric starter, that is the spark should occur at $25^0 \pm 1^0$ before top dead center, having the rotating weights fully open.

Holding the green wire (breaker plate) in the M position on the l.t. socket, connect the two remaining blue wires (coils) to the position 1 and 2 respectively.

Rectifier

The rectifier is mounted on a nickel plated sheet which is fitted to the saddle support with the aid of two locking bolts.
Care should be taken that such connections ensure electric continuity and permit earthing the rectifier.

Voltage regulator

It is rubber mounted on the frame. Do not allow the wires to be stretched too much as otherwise efficiency of the mounting gets lost.
The voltage regulator terminals are protected by the cap which should be removed as shown on fig. 88.
Never remove the top cap which protects the regulator coils.

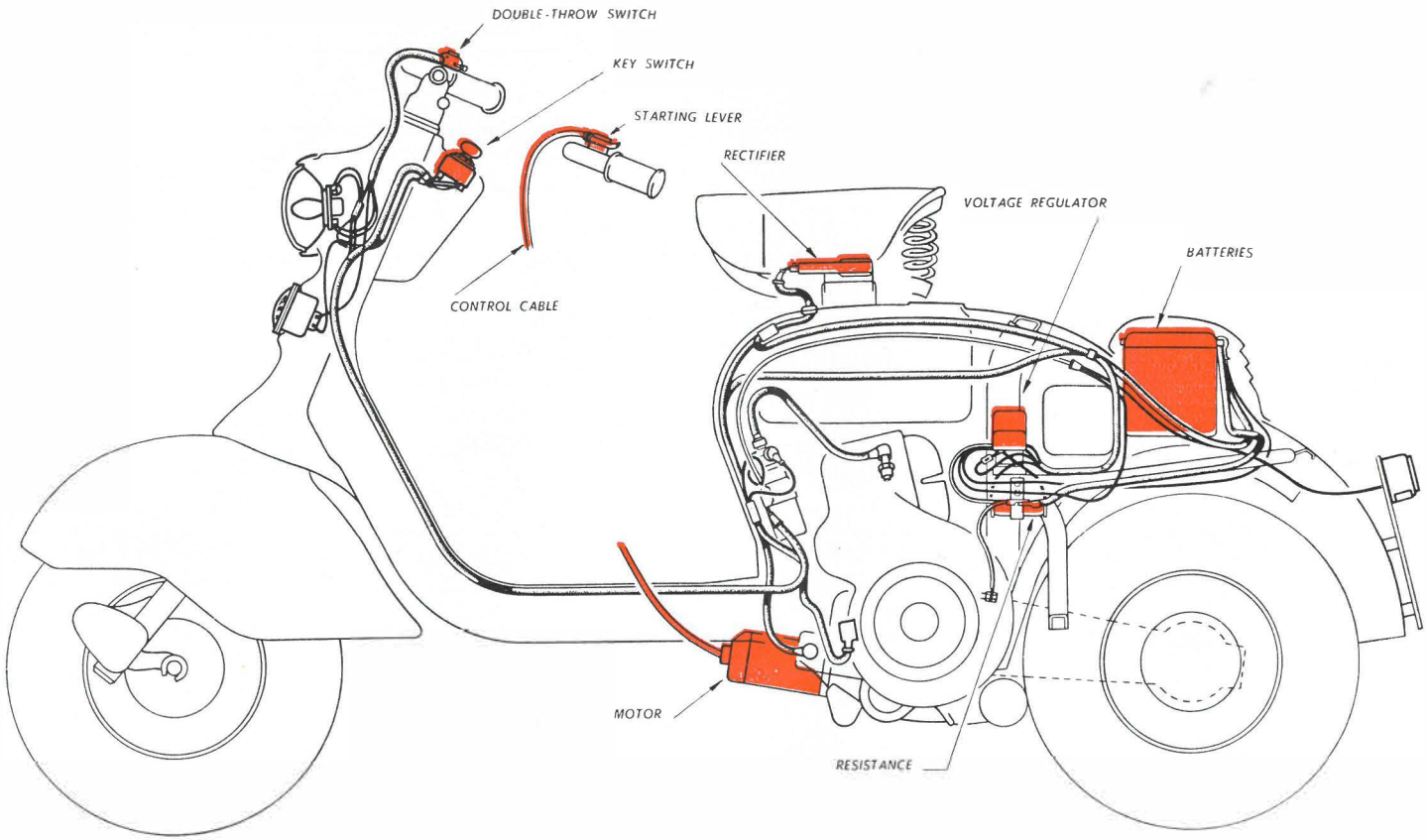


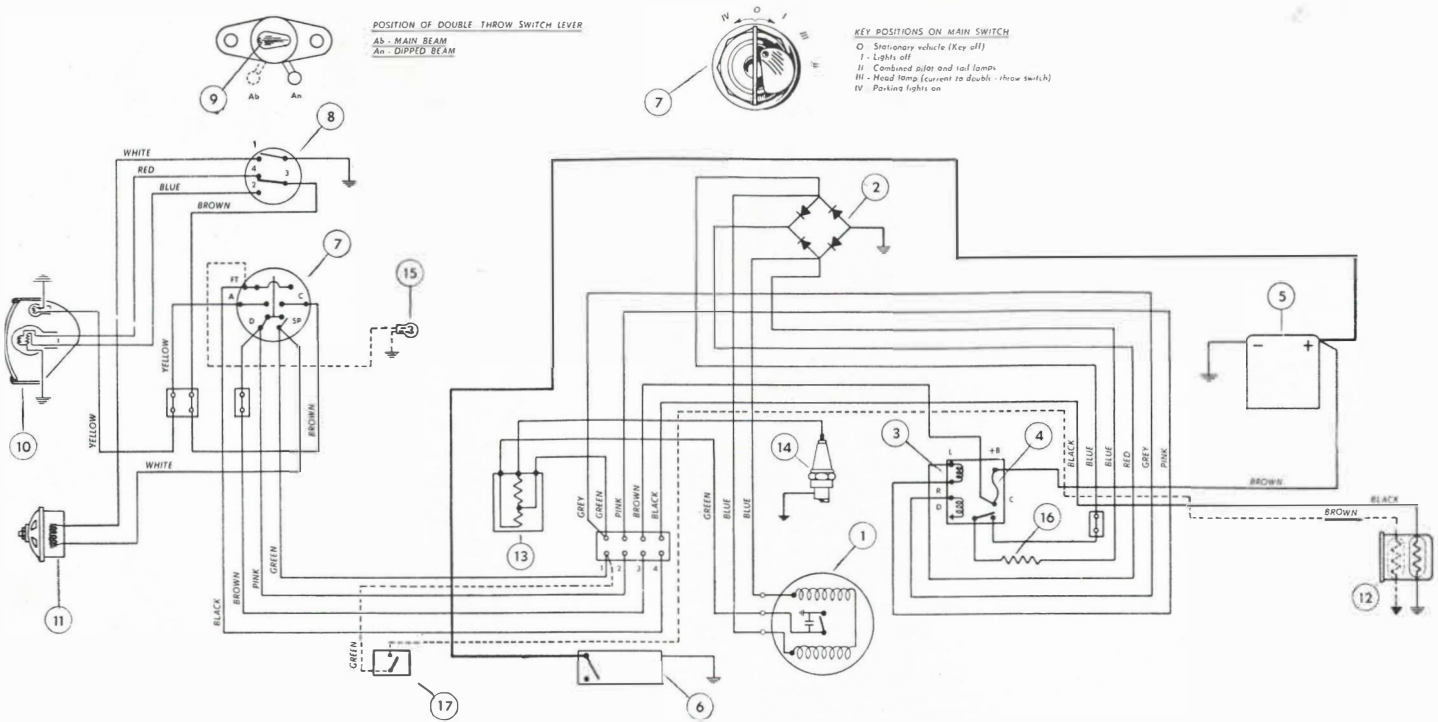
Fig 86

ELECTRICAL SET FEATURES

Table No. 1

PART NAME	CATALOGUE No.	FEATURES
Flywheel magneto	00811394	Of special type for 12 V electric starter. No. 2 l.t. coils, connected in series and insulated from earth; automatic advance with rotating weights; outer h.t. coil. Performance: 12,5 V at 3000 r.p.m. with 2,35 Ω load.
Rectifier	12011531	Of selenium cell type, full-wave, bridge connection. Max operating voltage = 20 V a.c. — 5 A max current. Output = 63 % approx. - Reverse current with 12 V d.c. voltage = ≤ 5 mA.
Voltage regulator	12011526	Provided with current coil and voltage coil; voltage coil input = 0,15 A; Rating voltage = 14,4 - 15,4 V max 11,5 - 13 V min The fuse is rated at 8 A.
Resistance	12011541	On ceramic rod, 3,5 Ω ± 10 %. Dissipated output = 80 W max.
Starter motor	00850523	Driving pinion controlled by flexible cable. Free wheel type joint. Input = 45 A max at 280 r.p.m. of the clutch bell. Supply = 11 V.
Outside h.t. coil	12011576	Of open magnetic circuit type, supplied with 12 V d.c. Average input when operating = 11 W. Input with stationary engine and close contact breaker points = 2,5 ÷ 3 A.

PART NAME	CATALOGUE No.	FEATURES
Bulbs :		
— Main-Dipped beam	12010152	12 V — 25/25 W bilux bulb; standard socket of bayonet type.
— Pilot light	12010153	12 V — 5 W bulb, tubular shape, 39 mm (1,53") length.
— Tail lamp	12010154	12 V — 3 W bulb, tubular shape, 39 mm (1,53") length.
— Speedometer light		12 V — 1,5 W bulb (suitable to speedometer socket).
— Stop light		12 V — 5 W bulb, tubular shape, 39 mm (1,53") lengh.
Main switch	12011566	The same reference number is engraved on both key and switch striking plate. Water-tight chamber.
Double-throw switch	12011621	Chromium plated box.
Horn	12011571	Energisized by 12 V d.c. Input = 2 A approx. 85 phons at 10 m distance
Battery	12011521	12 V - 13 Ah (two 6 V - 13 Ah batteries in series). Tilting angle. 90° - Plastic housing - Single battery size = 60 x 122 x 135.



1. Flywheel magneto - 2. Rectifier - 3. Voltage regulator - 4. Fuse - 5. Cell batteries - 6. Starter motor
7. Main switch - 8. Double-throw switch - 9. Horn button - 10. Head light - 11. Horn - 12. Tail lamp
13. H. T. coil - 14. Spark plug - 15. Speedometer bulb - 16. Resistance 3,5 Ω - 17. Stop switch.

Batteries

Before inserting the batteries into the cavity where they should be housed, assemble the group as illustrated in fig. 89.

Motor

Ascertain if the rubber protection for the cable attachment on the motor is suitably fitted.

See that the control lever in the handlebar has a small clearance beyond the stroke end stop (2-3 mm - 0,039-0,078'').

Adjust by means of the knurled nut on the outer cable and lock the counternut after adjustment.

Ignition coil

The coil maker states which terminal of the main circuit should be connected to the contact-breaker. In the case of the BOSCH coil TJ 12/3 type the terminal to be connected to the contact-breaker is No. 1.

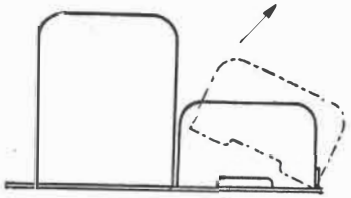


Fig. 88

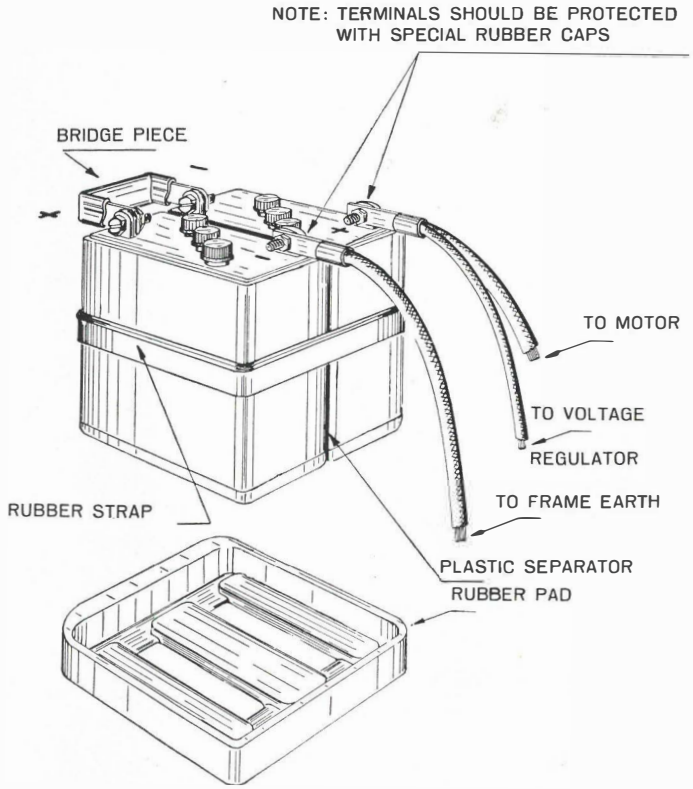


Fig. 89

If a combination-tester case is not available in your shop use following instruments:

No. 1 Voltmeter for direct current 0 ÷ 20 V

1 Ammeter for direct current 0 ÷ 10 A

1 Milliammeter for direct current 0 ÷ 10 mA

1 Megger or insulation tester - Testing voltage ≥ 90V

1 Rheostat 0-50 Ω ; ≥ 0,5 A current

1 Tachometer 0-5000 r.p.m.

1 Hydrometer

Table No. 2 includes the various operations to be carried out for testing the electrical circuit.

1) **Starting engine and reading r.p.m.** (fig. 90)

Observe reading of tachometer which should be fitted to the flywheel locking nut (fig. 90). Measurement is taken on the crankshaft directly. Use a tachometer provided with rubber protection to prevent damaging the nut. First turn the main switch key to O position (Stationary engine - see fig. 87); next actuate the starting device for 5"; this done, take the reading which should be over 380 r.p.h.

2) **Checking batteries**

a) Ascertain whether liquid level is 5-10 mm (0,19"-0,39") above the plate tops. Add distilled water, if necessary. If liquid is spilled when filling the cells, wipe dry to prevent corrosion. Check batteries monthly (more frequently at high temperatures), in any way every 900 miles (1500 km). In case the machine is to be left standing for a long time, remove batteries giving them a refreshing charge once every month. Store batteries in dry room where there is no danger of freezing.

b) Batteries should be charged with direct current at a rate of 1,3 A for a number of hours according to their charge conditions.
Before charging, ascertain if the liquid reaches the prescribed level. Check the voltage of each cell with the aid of a voltmeter. Batteries are fully efficient when voltage at the terminals averages 7,8/8,0 V. Check specific gravity of the acid using a hydrome-

MAINTENANCE OPERATIONS

Table No. 2

OP. No.	INSPECTION AND TEST	INSTRUMENTS	SCHEME	TESTING VALUES
1	Read rev. number at engine starting.	Tachometer	90	⩾ 380 r.p.m.
2	Inspect batteries.	Hydrometer		⩾ 1,26 gr/cm^3
3	Check battery charging current.	Ammeter and tachometer	91	⩾ 1 A
4	Check battery charge regulation.	Ammeter - Voltmeter - Rheostat	91	11,5 - 13,3 V 14,4 - 15,4 V
5	Check reverse current to rectifier.	Milliammeter	92	⩾ 5 mA
6	Insulation and continuity tests:			
	a) Starter motor circuit and partial battery charging circuit	Megger or Insulation tester	93	⩾ 5 MΩ or O.K.
	b) Tail lamp circuit and a.c. supply to rectifier	See above	94	⩾ 5 MΩ or O.K.
	c) High tension coil circuit horn, voltage coil supply, voltage regulator	See above	95	⩾ 5 MΩ or O.K.
	d) Circuit supplying current to headlamp bulbs	See above	96	⩾ 5 MΩ or O.K.

ter. Assuming the battery is fully charged, reading will be about 1,26 gr/cm^6 (30° Bè).

c) Do not allow excessive battery discharge to avoid corrosion. Batteries are discharged when density reading is 1,16 gr/cm^6 (equal to 20 Bè). But yet at 1,20 gr/cm^6 (24 Bè) they should be given a refreshing charge.

LOWER DENSITY INDICATES THAT BATTERIES ARE SULPHATED. IN SUCH A CASE IT IS ADVISABLE TO HAVE THE BATTERY RECHARGED BY A SERVICE STATION OF THE BATTERY MAKER.

Shake the battery after charging to facilitate escaping of the gas from the cells; next check the liquid level. For the first charging operation follow the battery maker's instructions attached to the battery.
Remember that in tropical climates specific gravity should be 1,21 gr/cm^6 (25 Bè) at 15°C for the first charge as well as for normal operation.

d) When mounting batteries in vehicle take care to connect leads correctly (See wiring diagram - fig. 89): insert positive pole (+) in the circuit and link negative pole (—) to earth in the frame. Faulty connections will short batteries resulting in burnt fuse. Make sure that battery terminals are properly tightened and coated with grease in order to prevent corrosion. Do not forget the connecting bridge.

3) **Testing battery charging current** (See fig. 91)

Remove the terminal protecting cover and the fuse. Insert the ammeter (0-10 A) connecting the terminal B of the voltage regulator to the ammeter (—) terminal and the terminal C to the ammeter (+) terminal. Check if terminals are tightened and contact neither other terminals nor the earth. Run the engine until the rate of 3000 r.p.m. is reached (check with tachometer); make sure that when lamps light charging current is not less than 1 A.

4) **Testing battery charge regulation** (See fig. 91)

After inserting the ammeter, as already described, disconnect the grey cable from the terminal (D) of the voltage regulator; link one of the rheostat terminals to the terminal C and the second rheostat terminal to the terminal D.
The terminal (+) of the voltmeter will be connected to the terminal D of the voltage regulator and the

terminal (—) to the earth on the frame. Next idle the engine for 5-10'', the holding the key in « 1 » position (lamps off) speed up until ammeter reading is 4 A. Move the rheostat slider slowly to either direction: you will notice that the ammeter indicates values of 4 A and 1÷1,5 A; this means that the voltage regulator performs correctly. Voltage values determining opening and closing of the voltage regulator are as follows:

a) change-over from 4 A to the minimum current rate 14,4÷15,4 V.

b) change-over from minimum current rate to 4 A; 11,5 ÷13,3 V.

This test requires a fully charged battery,

5) **Checking reverse current to rectifier**

In the case that this test will be performed after checking the battery charge regulation, first re-establish the connections; next disconnect positive cable from the battery (See fig. 92) and turn the key to the position O (engine at standstill - lamps off). Connect the terminal (+) of the milliammeter to

Fig. 90 - Fitting the tachometer.

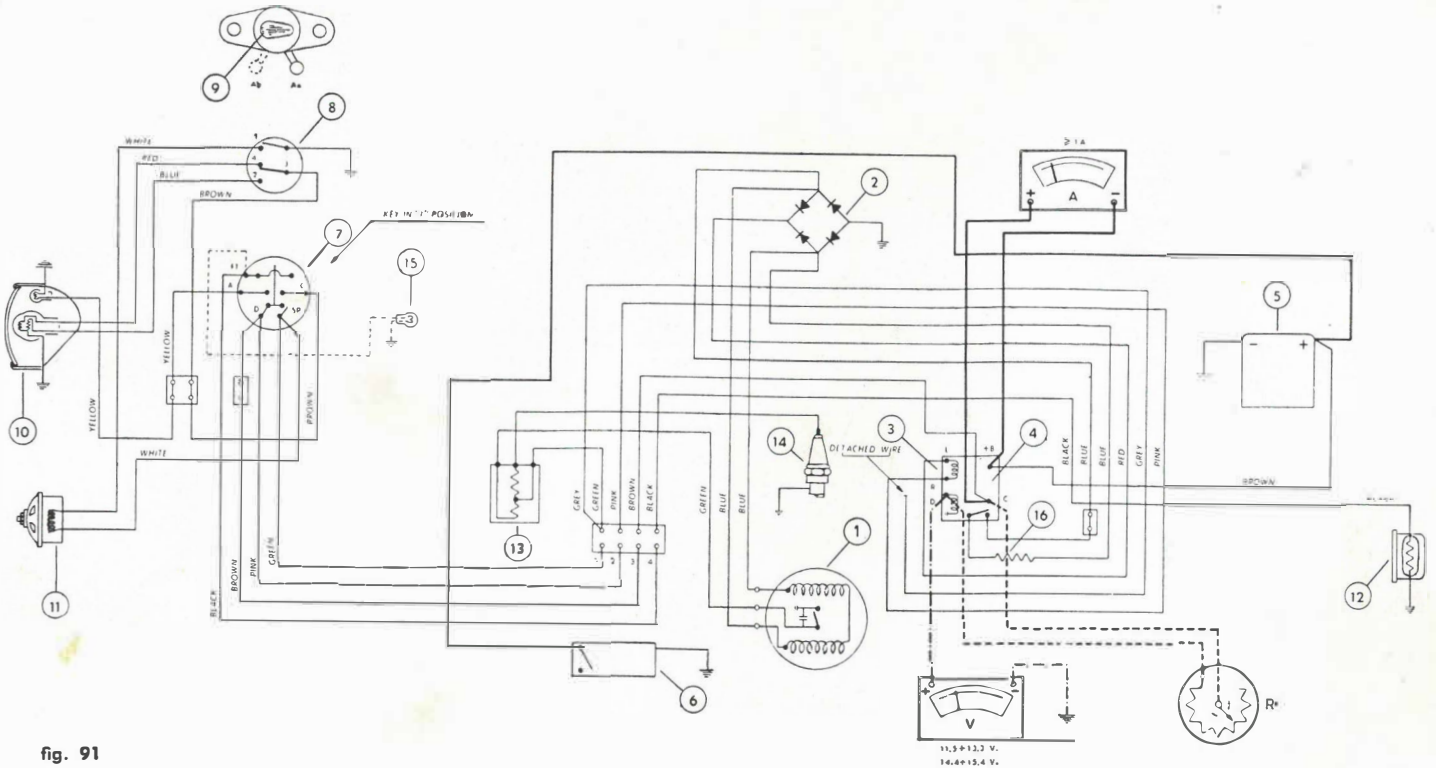


fig. 91

the terminal (+) of the battery and the termina! (—) of the instrument to the cable already disconnected from the battery. Reading should indicate a max value of 5 mA.

6) **Insulation and continuity tests**

a) Motor circuit and battery charging circuit partially (See fig. 93). With key in « O » position disconnect

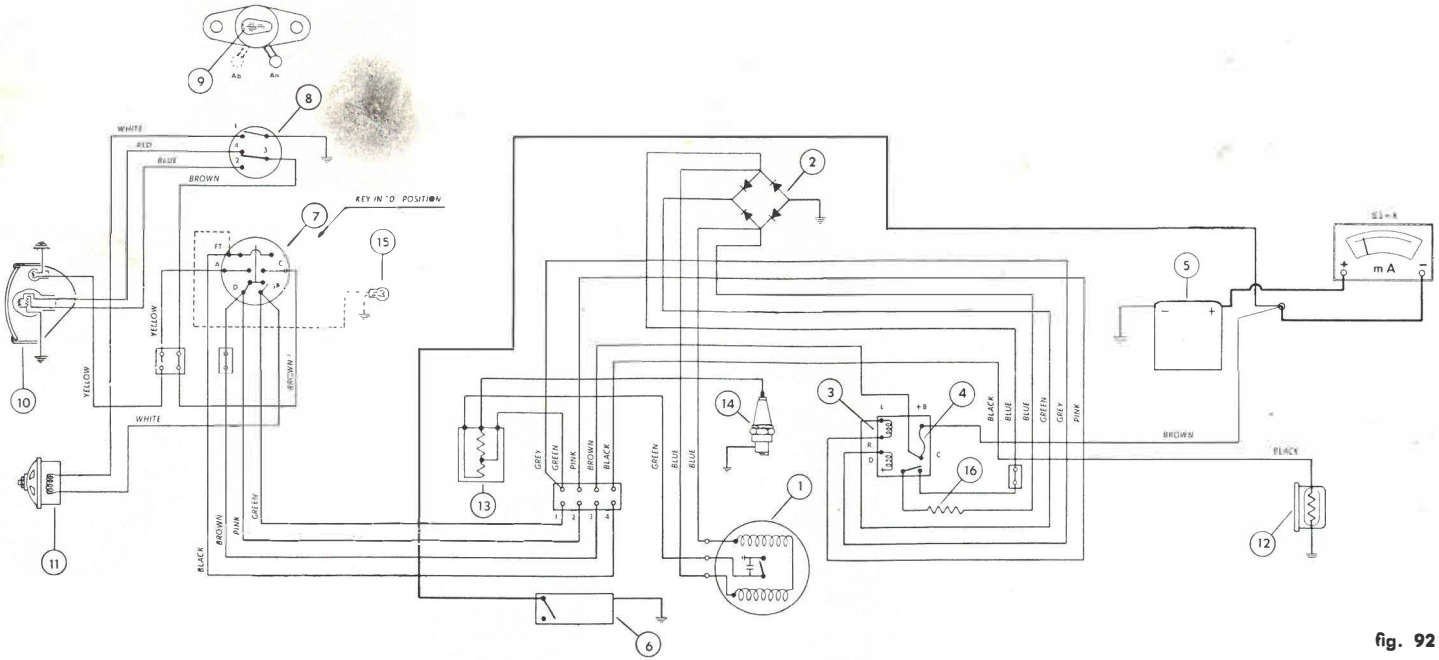


fig. 92

the cable from battery terminal (+) and the centre red cable from the terminal plate located under the saddle. Insert the megger or the insulation tester between the cable to the battery terminal (+) and the earth. A value corresponding to ⩾ 5 MΩ will mean that insulation is all right. To check continuity connect the megger to the cable leading to the battery positive terminal and the red cable ; reading of « O » on the dial will indicate continuity.

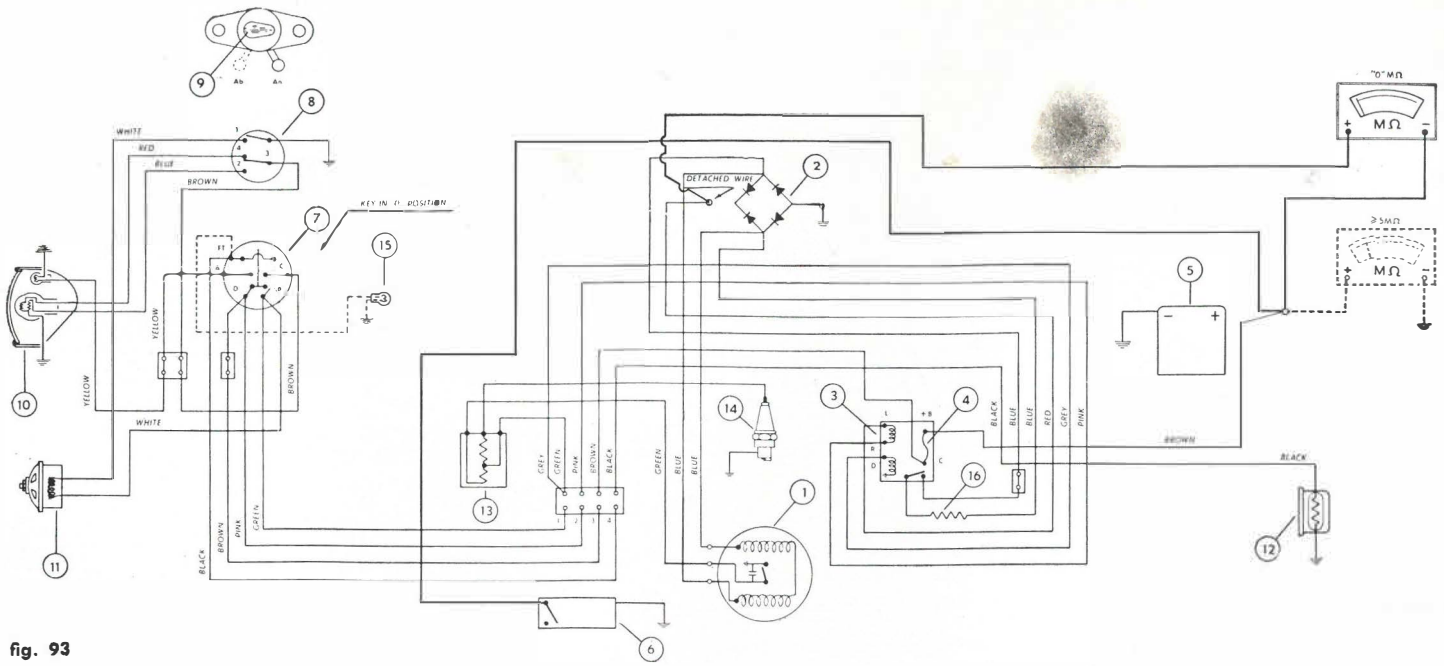


fig. 93

b) Police plate lamp circuit and a.c. supply to the rectifier (fig. 94). Disconnect the red cable and the two blue cables from the terminal plate under the saddle, remove the bulb from the police plate lamp and the eventual speedometer bulb and, holding the switch key in « I » position, check insulation rate between earth and bulb socket to which the feeding wire is connected and between earth and one of the two blue cables previously detached from the terminal plate under the saddle (insulation rate should be ≥ 5 MΩ). Continuity should de checked by inserting the instrument between the bulb socket

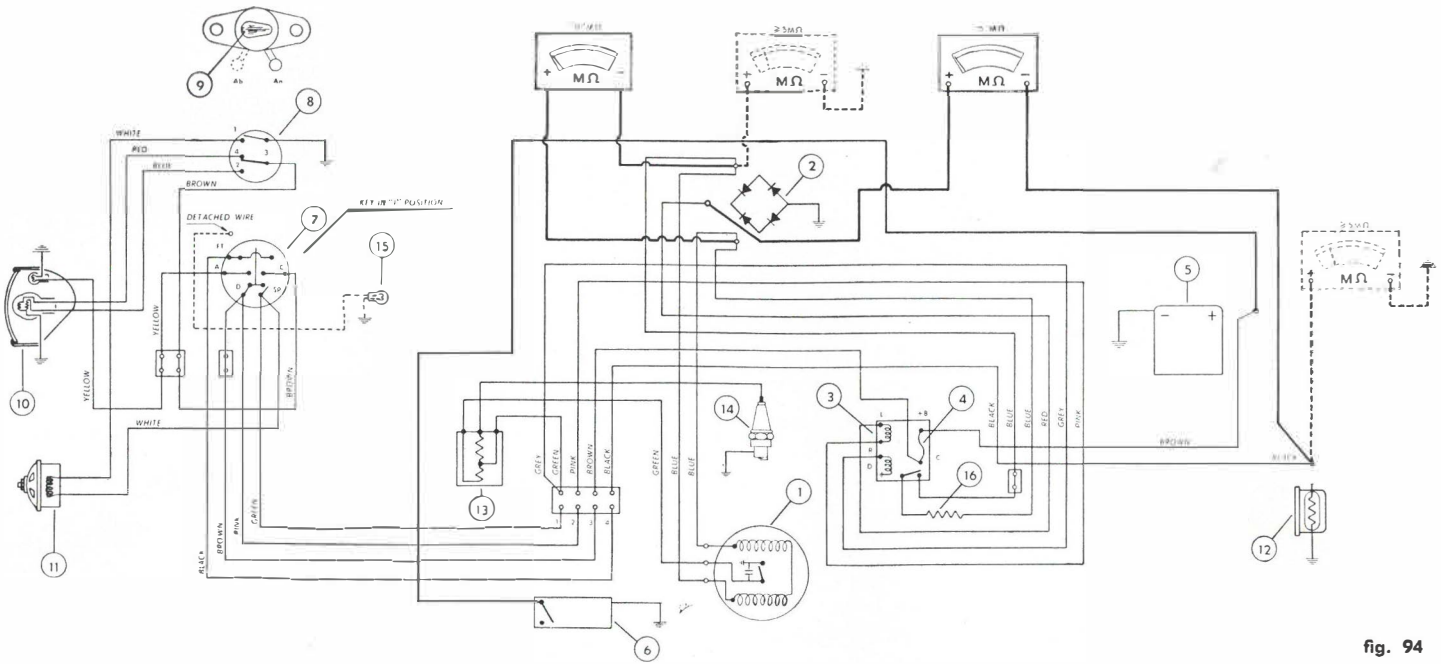


fig. 94

and the red cable and between the two blue cables of the terminal plate respectively.

c) H.T. coil and horn circuit, voltage regulator coil supply (See fig. 95). Disconnect the grey wire from the voltage regulator terminal; next with the key in « O » position measure insulation between grey cable and earth (Insulation rate should be ⩾ 5 MΩ). Make sure that the contact-breaker points are opened by hand rotating tre crankshaft.
When checking the circuit continuity make sure that the instrument pointer indicates a value of « O »

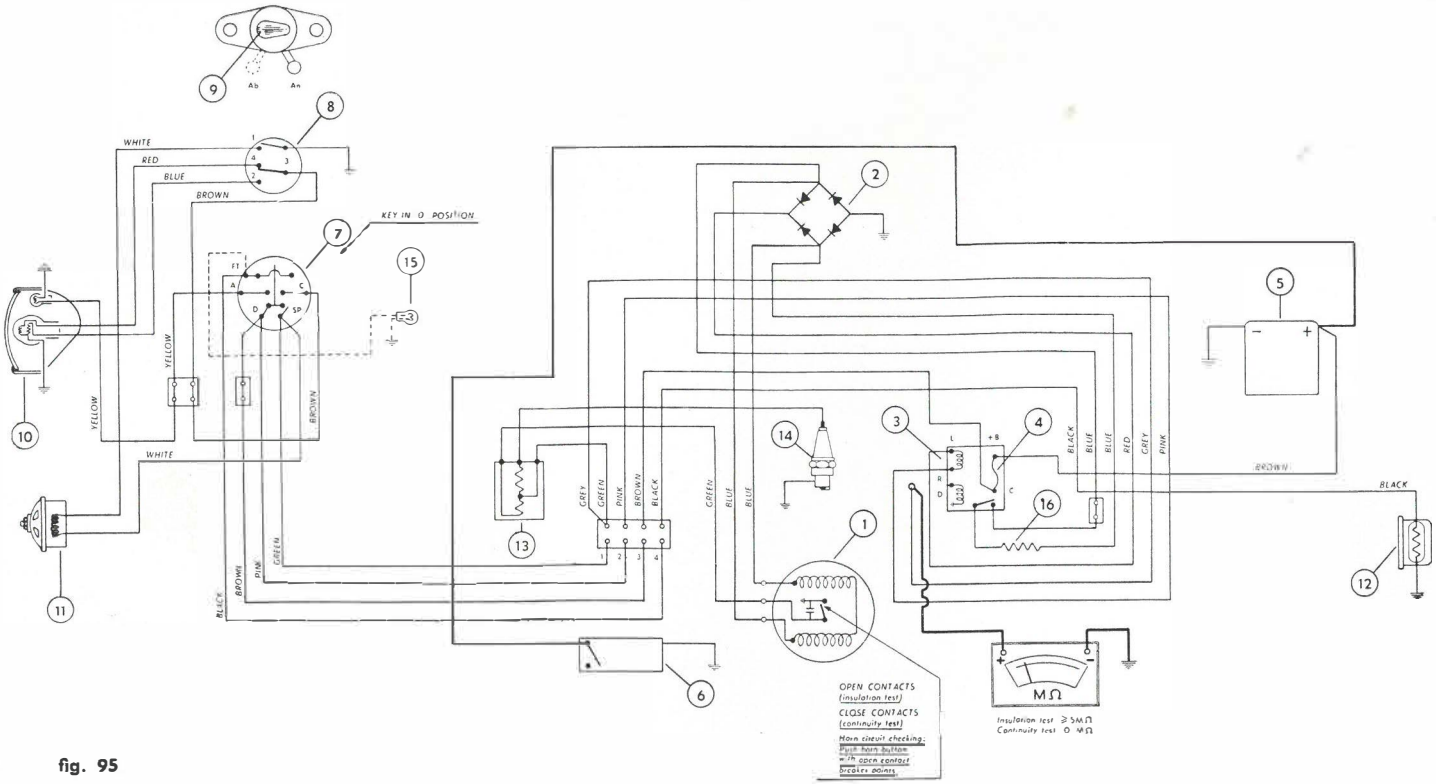


fig. 95

with close contact-breaker points (the horn circuit continuity may be checked by opening the contact-breaker points and depressing the horn button).

d) Headlamp circuit (fig. 96). Remove bulbs from their sockets in the headlamp and with key in « O » position measure insulation between earth and termi-

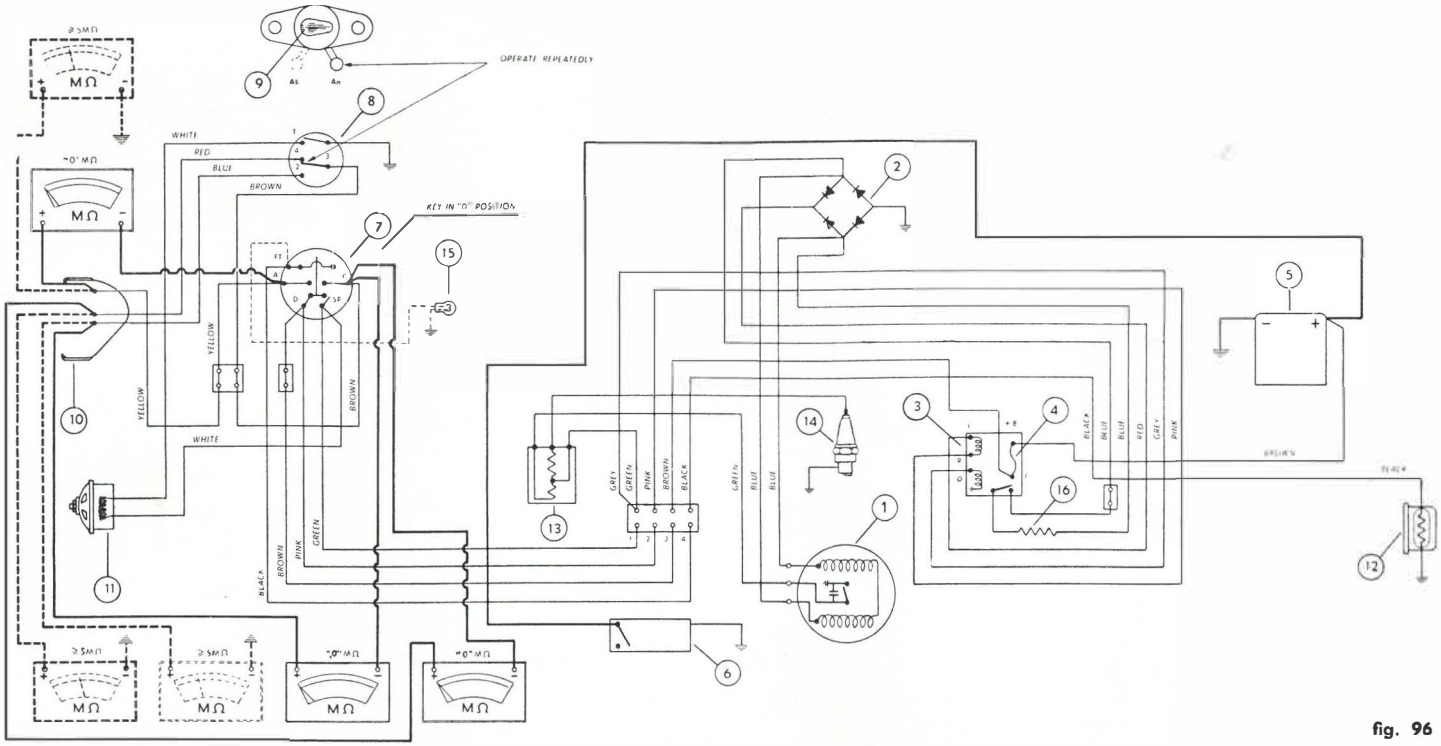


fig. 96

nals connected to red, yellow and blue cables (while checking red and blue cables, operate repeatedly the double-throw switch - main and dipped beam).

Insulation rate should be ⩾ 5 MΩ.

Continuity test should be carried out by connecting the instrument (—) terminal to the switch A and C terminals respectively.

COMBINATION-TESTER FOR CHECKING ELECTRICAL EQUIPMENT

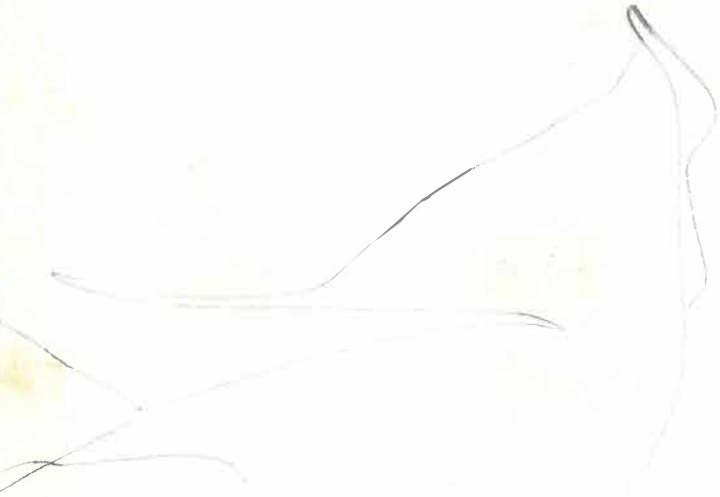
When the combination-tester for checking Lambretta electrical equipment is available, the various operations are greatly facilitated.
The Scheme on the combination-tester case, will be a useful aid for the tests.

INSTRUCTIONS FOR USE AND MAINTENANCE

IMPORTANT: NEVER TURN THE ENGINE WITHOUT CONNECTING BATTERIES TO ELECTRICAL CIRCUIT.
SHOULD THE STARTING OPERATION FAIL, WAIT AT LEAST 10 SECONDS BEFORE SHIFTING THE STARTING LEVER AGAIN, SO AS TO AVOID DAMAGING BOTH MOTOR PINION OND CLUTCH BELL TEETH.

Batteries: Refer to paragraph No. 2 - page 145.

Motor: After the first 500 km (300 miles) and then after 1000 km (600 miles) check if the engine oil does not penetrate into the gear chamber. A special threaded plug, placed in the flange lower portion, permits eliminating oil sediments. Every 10.000 km (6200 miles) check conditions of commutator and brushes.
Ascertain whether the motor starting lever has a small clearance beyond the stroke end stop (2-3 mm); in the negative case, adjust by means of the knurled nut, which should be firmly tightened with the counternut after being adjusted. Every 10.000 km (6200 miles) dismantle the motor and slightly file the contacts, if necessary.



SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
A) **STARTER MOTOR**			
Either the motor does not turn or it fails to start the engine because of low cranking speed.	**1)** Discharged or partially discharged batteries with shorted cells or sulphated plates.	**1)** Voltage at the battery terminals and voltage of each cell. Ascertain if electrolyte level is 5-10 mm (0,19''-0,30) above plate tops. An arrow on the wall of the BOSCH battery containers indicates the exact level. Test specific gravity in each cell.	**1)** Add distilled water only; see that liquid reaches the prescribed level. Do not fill too high that electrolyte be lost through the vent plugs. Recharge, if necessary (Oper. No. 2). In any case check if insufficient charge is caused by troubles in the machine electric circuit (see paragraphs « Batteries do not keep charge » - « Batteries do not charge »).
	2) Perished earth cable or faulty connection to the battery.	**2)** Test cable continuity and inspect for unsoldered terminals.	**2)** File smooth terminals, replace them, or the cable. File smooth battery terminal. After reassembling, coat with thick neutral grease.
	3) Connecting bridge of the batteries either corroded or not firmly secured to battery terminals.	**3)** Matching surfaces.	**3)** File smooth the matching surfaces or replace the connecting bridge. Tighten the connecting bolts. Coat with thick neutral grease.

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
	4) Cable between batteries and motor broken or faulty connected to batteries or motor.	**4)** Continuity, Terminals. Terminal joint on the cable. Cable attachment on the motor. Cable attachment rubber protection on the motor.	**4)** File smooth cable terminals or replace them. Replace the cable. File smooth battery terminal. Remove corroded spots from the cable attachment on the motor. After reassembling, coat with thick neutral grease. Replace cable attachment rubber protection, if damaged. Carefully push the rubber protection as far as it will go.
	5) Motor switch contacts do not close the circuit.	**5)** Switch stroke may be insufficient or switch control cable jammed. Check contacts for corrosion.	**5)** Adjust control cable stroke by operating the knurled nut. Oil the cable. True contacts or replace them, if necessary.
	6) Worn motor brushes do not contact the commutator.	**6)** Remove brushes and verify.	**6)** Replace the brushes.
	7) Dirty commutator.	**7)** Dismantle and check armature.	**7)** Clean each segment and wash with petrol. Whenever the commutator is scored, turn it smooth.
	8) Motor armature is either seized or bound by the bronze bushings.	**8)** Remove the motor from its flange and try rotating it by hand.	**8)** Replace bronze bushings.
	9) The motor inner circuit is disconnected.	**9)** Check continuity.	**9)** Replace the motor.
	10) The motor inner circuit is shorted.	**10)** Check if current input exceeds 50 A.	**10)** Replace the motor.

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
	11) Oil penetrates from engine crankcase into motor gear chamber.	**11)** Check for oil in gear chamber by removing the plug placed at its bottom.	**11)** Drain oil through plug hole. Should this inconvenience occur frequently although the plug has been removed every 1.000 km or monthly, check the sliding axle of the driving pinion to locate the leakage source.
	12) Revolving of the engine is bound owing either to: — use of excessively heavy oil or to — mechanical failure.	**12)** Bear in mind hat the oil to be used should correspond to SAE 30. By cold weather use SAE 20. Ascertain if failure depends upon seized piston, rotor rubbing on the stator, etc.	**12)** Replace with proper oil. Eiminate failure by replacing damaged components.
Motor operates correctly but engine fails to start.	**1)** Incorrect ignition.	**1)** Check spark, after removing spark plug from the cylinder head, by holding it against the cranckase. In case of weak, incorrect or lacking spark ascertain whether: — spark plug is faulty — fuse is burnt — h.t. coil circuit is either open or poorly insulated (Carry out Oper. No. 6c) — h.t. coil is efficient — current leakage occurs in either h.t. cable between coil and spark plug or spark plug terminal.	**1)** Replace damaged components. Replace the fuse only after locating the failure source. (See « Fuse burns »).
	2) Incorrect carburation, air suction in the cranckcase, etc.	**2)** See specific instructions.	**2)** Operate according to instructions concernig the mechanical failures.

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
Motor revolves without cranking the engine.	Defective free-wheel joint (motor transmission side).	Remove the motor from its flange and rotate the pinion by hand.	Wash the joint with petrol; if this does not correct the trouble, replace the joint.
Motor emits a buzzing noise whilst running.	The armature is out-of-center with respect to pole pieces.	Check clearance on armature bronze bushings.	Replace bronze bushings.
Motor gears are noisy and engage improperly.	Damaged toothing.	Check motor pinion and clutch bell toothing conditions.	Replace the damaged part.
After cranking the engine, gear noise is still noticed in the motor.	Motor pinion does not disengage after starting the engine.	Check for smooth sliding of the control rod, which may result unsatisfactory owing to warped control rod as a consequence of either shocks or oxidation.	Restore smoothness of the control rod.
B) **BATTERIES**			
Batteries do not keep charge.	**1)** Parking of vehicle with main switch key in I - II or III position.	**1)** With closed contact-breaker points, batteries supply 3 A current continuously. Check h.t. coil and batteries.	
	2) Battery either sulphated or with shorted cell.	**2)** After giving the battery a refreshing charge check voltage at battery terminals and at each cell, as well as density of electrolyte. Repeat measurement after two hours.	**2)** Replace battery.
	3) Abnormal current leakage through the rectifier.	**3)** Measure reverse current supplied by the rectifier (Operation No. 5).	**3)** Replace rectifier.
	4) Defective circuit insulation.	**4)** Carry out the insulation test (Oper. No. 6 a).	**4)** Eliminate insulation fault.
	5) Improper bulbs.	**5)** Make sure that with stationary engine and main and tail lights on, the current input from battery does not exceed 2,6A (Rotate the crankshaft by hand and ascertain that contact-breaker points are open).	**5)** Replace with proper bulbs. Never allow fitting of set components other than prescribed.

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
Batteries gassing and electrolyte leakage.	1) Broken resistance.	1) Check continuity between the two resistance terminals.	1) Replace resistance.
	2) Resistance connection wires broken or voltage regulator out of rating.	2) Check voltage regulator rating (Oper. No. 4) Should the above test indicate that the voltage regulator does not cut in the resistance, check circuit continuity between blue wires ends, after detaching them from both the resistance terminal and terminal plate close to the voltage regulator.	2) Eliminate circuit discontinuity. Replace voltage regulator if out of rating.
	3) One or more battery cells are shorted.	3) Check voltage of each cell.	3) Replace the faulty battery.
Batteries do not charge.	1) Burnt fuse.	1) Verify.	1) Replace the fuse only after eliminating the cause of the inconvenience (See Paragraph «Fuse burns»).
	2) Battery feeding circuit is open.	2) Check circuit continuity (Oper. No. 6.a).	2) Eliminate circuit discontinuity.
	3) Poor earthing contact of the rectifier.	3) Fit, for testing purpose, an additional cable between rectifier casing and earth.	3) Clean mating surfaces between rectifier support and saddle support. Tighten saddle bolts.
	4) Faulty rectifier.	4) The rectifier gets excessively hot after a short operation time. Replace it, for testing purpose, with a new one and check whether charging current to batteries (Op. No. 3) is correct.	4) Replace the faulty rectifier.
	5) Supply from flywheel magneto is insufficient.	5) Check both insulation and continuity of magneto low tension coil circuit (Oper. No. 6 b).	5) Eliminate discontinuity or poor insulation sources. Should charging current be still insufficient, either remagnetize the flywheel magneto or replace flywheel magneto group entirely.

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
C) **VOLTAGE REGULATOR a. FUSE GROUP**			
The voltage regulator chatters.	**1)** Fuse either burnt or detached from its support.	**1)** Inspect.	**1)** Replace the fuse only after locating the failure source (See Paragraph «Fuse burns »).
	2) Battery feeding circuit is open.	**2)** Test circuit continuity (Oper. No. 6 a).	**2)** Eliminate circuit discontinuity.
	3) Batteries are not connected.	**3)** Check battery pole connections and earthing cable. (Make sure that earthing cable terminals are not unsoldered).	**3)** Remove corroded spots, if any, and tighten bolt nuts firmly.
Fuse burns.	**1)** No circuit insulation, causing discharge intensity, exceeding 8 A.	**1)** After disconnecting the batteries, replace the burnt fuse and carry out No. 6a, 6b, 6c, 6d insulation tests. Next ascertain whether all bulbs are fitted to their socket. (While performing insulation test No. 6c turn the handlebar from one to the other end and see that no wrong contacts occur).	**1)** Eliminate short circuit.
	2) Short circuit when fitting the cover to the voltage regulator terminal plate.	**2)** This trouble should be given consideration only when no failure has resulted from the above insulation tests.	**2)** When fitting the cover, first insert the tongue into its groove so as to facilitate closing.
D) **RECTIFIER**			
Rectifier heats excessively (Blueing of the paint).	Flashings occur into the rectifier.	Check charging current (Oper. No. 3).	Replace rectifier.

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
E) **MAIN SWITCH AND DOUBLE-THROW SWITCH**			
Unsteady brightness of the lamps in some switch positions.	Defective contacts inside the switch or double-throw switch, or poor connections at terminals.	Check whether trouble gets worse when both main switch and double-throw switch are striken by hand or when wires connected to terminals are shacken.	Tighten terminal screws. Replace main switch. Remove double-throw switch cover and file contacts.
F) **BULBS**			
With engine at rest lights do not burn and with engine running brightness of the bulbs varies according to engine revolutions.	**1)** Batteries are disconnected.	**1)** Check both terminal clamping at batteries poles and earthing cable.	**1)** File contacts; replace earth cable if perished.
	2) Fuse is burnt.	**2)** Examine.	**2)** Replace the fuse only after eliminating the trouble source.
	3) Circuit is open.	**3)** Check circuit continuity (Oper. No. 6a).	**3)** Eliminate circuit burnout.
Burning out of one or more bulbs with engine running at high revolution rate	**1)** Batteries are disconnected.	**1)** Check both terminal clamping at batteries poles and earthing cable.	**1)** File contacts; replace the earth cable if perished.
	2) Fuse is burnt.	**2)** Examine.	**2)** Replace fuse only after eliminating the trouble source.
	3) Improper bulbs (voltage lower than prescribed).	**3)** Inspect bulbs.	**3)** Replace with proper bulbs.
Lights burn dim.	**1)** Current leakage in bulb circuit.	**1)** Check circuit insulation (Oper. No 6d).	**1)** Remove insulation trouble.
	2) Incorrect earth contact of bulb sockets.	**2)** Fit an additional cable between socket and earth, for testing purpose.	**2)** Eliminate earth contact trouble.

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
	3) Incorrect bulbs (voltage higher than prescribed).	**3)** Check bulbs.	**3)** Replace with proper bulbs.
G) **HORN**			
With engine at rest the horn does not function; with engine running horn functions unevenly; with lights on, when operating horn button, engine tends stopping.	**1)** Batteries are disconnected.	**1)** Check both terminal clamping at batteries poles and earthing cable.	**1)** True contacts; replace earthing cable if perished.
	2) Fuse is burnt.	**2)** Inspect.	**2)** Replace fuse only after eliminating the trouble source.
	3) Circuit is open.	**3)** Test circuit continuity (Oper. No. 6a).	**3)** Eliminate circuit burnout.
Horn does not function.	**1)** The horn circuit is open.	**1)** Check circuit continuity.	**1)** Eliminate circuit burnout.
	2) Defective horn button.	**2)** Check earthing of double-throw switch cover.	**2)** True contacts; the strip should be bent so as to provide a regular contact.
	3) Damaged horn.	**3)** Test horn by connecting terminals to a 12 V battery poles directly.	**3)** Replace horn.
In some positions of the handlebar horn functions without depressing the button.	Cable from horn to push button is earthed.	Make sure that the cable is not peeled. Ascertain whether, when turning the handlebar the horn terminal does not come too near to any outercable so as to generate a wrong contact owing either to the wire end projecting from the terminal or to pressure screw.	Replace the outercable or the cable itself. Eliminate the cause of the inconvenience. Modify the cable path; cut the wire end projecting from the terminal. Remove the horn and remount it in upside-down position so that the terminal is shifted from l.h. to r.h. or viceversa.

TOOL LIST

1) STANDARD TOOLS

This list comprises the standard tools used at our works. They can be obtained from any accessory or tool stores. Reference is made to the ABC Catalogue (known all over the world) in order to facilitate the purchase of the tools.

Innocenti Standard	N A M E	Ref.
2000/200	Screwdriver, length 7.874"	ABC/1510
2000/300	Screwriver, length 11.811"	ABC/1510
2007/200	Screwdriver electrician, length 7.874"	ABC/1564
2009/8	Hexagon wrench, 8 mm (0.315")	ABC/2942
2010/24	Hexagon wrench, 24 mm (0.945")	ABC/2945
2010/19	Hexagon wrench, 19 mm (0.748")	ABC/2945
2013/20.22	Hexagon double wrench, 20-22 mm (0.787"-0.866")	ABC/2940
2014/14.17	Hexagon double wrench, 14-17 mm (0.554"-0.669")	UNI/308
2015/10.12	Hexagon double wrench, 10-12 mm (0.394"-0.472")	ABC/2946
2025/5	Hexagon wrench for screws, 5 mm (0.197")	—
2025/6	Hexagon wrench for screws, 6 mm (0.236")	—
2025/10	Hexagon wrench for schews, 10 mm (0.394")	—
2027/8.10	Tubular wrench with two heads, 8-10 mm (0.315"-0.394")	ABC/3030
2027/14.17	Tubular wrench with two heads, 14-17 mm (0.551"-0.669")	ABC/3030

Innocenti Standard	NAME	Ref.
2032/24	Wrench with bent handle, 24 mm (0.945")	ABC/3054
2039/10	« T » wrench with sliding handle, 10 mm (0.394")	ABC/3060
2050/190	Seeger ring pliers with straight points, length 190 mm (7.480")	ABC/3264
2050/240	Seeger ring pliers with bent points, length 240 mm (9.480")	ABC/3264
2051/190	Seeger ring pliers with bent points, length 190 mm (7.480")	ABC/3265
2052/160	Seeger ring pliers with straight points, length 190 mm (6.299")	ABC/3266
2055/190	Universal pliers with knurled handles	ABC/1730
2302/300	Steel hammer 0,66 lb.	ABC/3430
2307/400	Steel hammer 0,88 lb.	—
2307/300	Aluminium hammer 0,66 In.	—
2307/1000	Aluminium hammer 2,205 lb.	ABC/3470
2318/400	Rubber mallet, 0,88 lb.	ABC/3472
2319/500	Leather mallet, 1,10 lb.	ABC/3430
2010/13	Hexagon wrench, mm 30 (1,18") (n. 2 tools)	ABC/2942
2010/30	Hexagon wrench mm 13 (0,512") (n. 2 tools)	ABC/2942
2016/27.29	Tubular wrench with 2 heads, 27-29 mm (1,06"-1,14")	ABC/2942
2026/27.24	Bent universal wrench, 27-24 mm (1,06"-0,945")	ABC/3023

2) SPECIAL TOOLS

This list comprises special tools and devices used at our works. Their use will be found useful too by the Service Stations.

Dwg. N°	N A M E
35603	Wrench, wheel nut campling (page 51)
37058	Puller, flywheel magneto cover (page 44)
37061	Remover, rear wheel (page 51)
37101	Wrench, clutch drum locking (page 48-82)
37276/1	Wrench, 19 mm (0.748''), crankshaft nut
37338	Wrench, for 2F 122
37337	Wrench, tubular, clutch bell fixing nut (page 82)
37380	Wrench, hexagonal screws tightening (page 46-47)
38131	Wrench, stand nut tightening
38489	Puller, needle bush

Dwg. N°	NAME
38935	Replacer, clutch bearing (page 81)
39127	Punch, needle bush installing
39146	Puller, clutch bell
39406	Puller, crankshaft bearings (page 60)
39982	Puller, frame top ball cup dismantling (page 64)
40295	Wrench, starter spring charging
40482	Wrench, steering adjuster cup (page 63)
40490	Wrench, steering adjuster threaded ring (page 63)
40529	Wrench, clutch cover fixing screws
40530	Screwdriver, screws 2F 157
40804/1	Puller, steering adjuster ball seat (page 65)
41595	Tool for mounting stand spring
42290	Control bearing, clutch bevel gear play
42291	Control bearing, rear wheel pinion play (page 87)
42507	Plate, transmission case mounting (page 86)
42510	Device of rotary type, for engine assembling
42589	Puller, rear bevel pinion (page 55-111)
42621	Device, front suspension pre-loading (page 94)

Dwg. N°	NAME
42987	Punch, rear bevel pinion group installing (page 86)
42988	Punch, rear bevel pinion group dismantling (page 56-57)
43170	Puller, clutch bell bearing (page 49)
43257	Aligner, transmission case and rear wheel bearing
43281	Spacer for rear bevel pinion (page 86)
43282	Punch, secondary shaft bushing mounting (page 84)
43283	Punch, gasket and Seeger ring for rear wheel bearing installing
43291	Wrench, crankcase and transmission case screws
43303	Puller, torsion bar lever bushing (page 61-62)
43349	Punch, bevel pinion gasket installing (page 84)
43362	Punch, brake shoe cam bushing installing
43370	Wrench, rear bevel pair gear adjustment control (page 55-85-87-110)
43373	Puller, brake shoe cam bushing (page 54)
43382	Wrench, gearbox adjustment (page 90-95)
43385	Double wrench, oil cap
43102	Punch for 7 T 611
46604	Preloading device for the rear springing (page 62-92)
49045	Punch, bevel pinion installing (11M-330/331) (page 81)

Dwg. N°	NAME
49123	Wrench, tank ring mounting (with saddle)
49131	Wrench, crankshaft rotation
49188	Puller, flywheel magneto flange (page 44)
49189	Puller for crankshaft pinion (page 60)
49194	Pliers, piston installing (11M-322)
49195	Wrench, cylinder head locking nut
49199	Puller, gudgeon pin (page 58-82)
49200	Puller, main shaft bearing removal from crankcase (page 60)
49210	Lock wrench for slackening the pinion nut tightening (page 44-82)
49221	Crankarm locking wrench for bevel pinion nut tightening (page 59-79)
49255	Wrench, exhaust pipe threaded ring
49256	Wrench, clutch pin locking (page 49)
49639	Spanner for locking of oil caps on the crankcase
48059	Device for checking U.D.P.
49628	Tool for locking the crankshaft the oil caps on the crankcase (page 44)
49640	Spanner for loosening the oil caps on the crankcase
49704	Wrench, hexagonal front tank screw («D»)
49753	Device for clutch bell discs installing (page 47)

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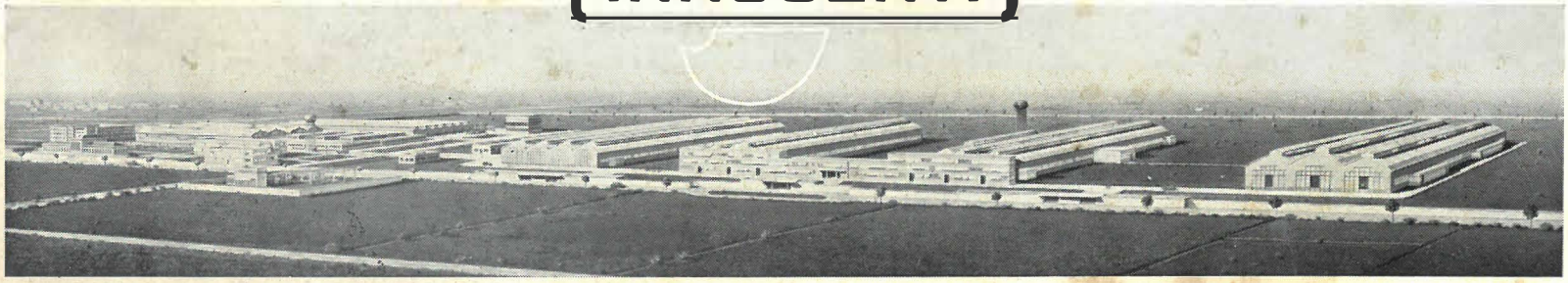

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