DOUGLAS
BRISTOL

# Vespa

150 c c Standard

## SERVICE STATION MANUAL

FOR MODELS WITH ENGINE FRAME PREFIX: V. B. A.

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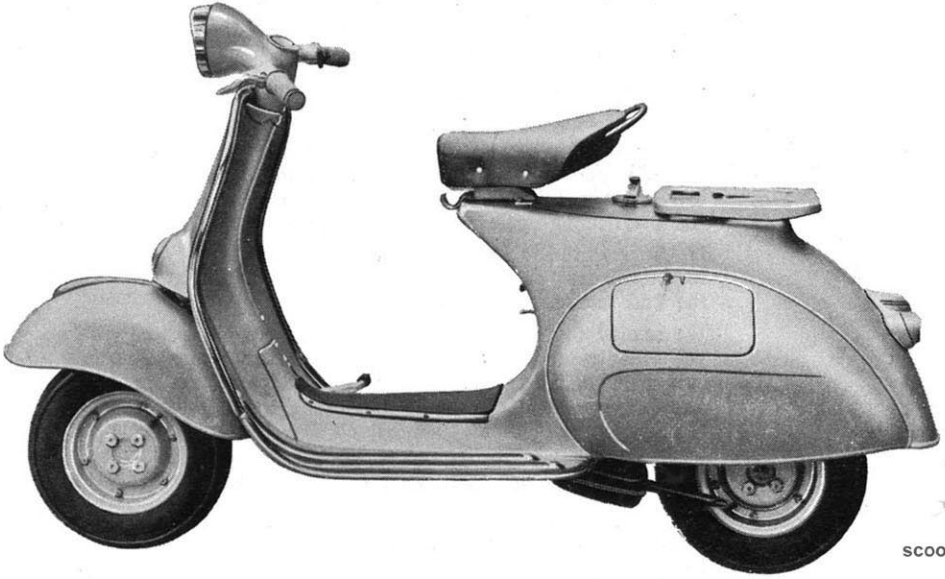

Fig. 1. Vespa 150

In accordance with the Douglas policy of progressive improvement, the right is reserved to alter any details of price, specification, accessories, and equipment, without notice, and without incurring any obligation.

This Manual has been issued to enable Service Stations to give first-class service to the Vespa owner.

They should, therefore, follow the detailed instructions carefully, particularly the sections concerning fault finding and remedies, this should help them to carry out servicing and overhauling operations more efficiently.

**It is essential that dismantling, re-assembling and inspections are carried out with suitable tools listed in the 2nd section of the manual.**

We remind the Retailers that, in order to obtain the best performance of the **Vespa,** faulty parts must be replaced with genuine **Vespa** spares. On the other hand, using parts of not genuine **Vespa** manufacture will invalidate any unexpired guarantee.

**This manual is valid for Vespa 150 with engine and frame serial numbers completed by prefix VBA.**

When referring to this publication, it is essential to quote this reference :- LB8143/500/6.60/150 Standard.

# INTRODUCTION

The continued technical progress of the Vespa during the last years has raised this vehicle to a standard of the highest quality. The new **Vespa 150** with its virtually new engine and its improved line, marks unquestionably a decisive step forward.

The engine not only combines the previous experience of Piaggio in the "two-stroke" field, but also introduces a new system of distribution by rotary valve, designed to improve performance, and to permit the use of a mixture of petrol and oil in the ratio of 50 to 1.

The carburettor is placed on the crankcase, exactly above one of the crankwebs. The intake pipe leads therefore into the pre-compression chamber and the fresh charge contacts directly the con. rod big end; in this way the bearings are so efficiently lubricated as to permit reducing, as mentioned above, the percentage of oil in the petrol.

This reduction and the effective cooling of the piston cylinder unit which the new type of intake ensures, offers a double advantage; power is increased while carbonisation is reduced to almost nothing; clients will therefore be pleased to find that decarbonising will seldom be necessary.

To effect the new intake, one of the webs of the crankshaft rotates very close to the crankcase, without touching it; a portion in the perifery of said web is ground off, and controls the fuel flow to the pre-compression chamber, thus acting as a rotary valve.

The recess on the web perifery has been shaped in such a way as to give the maximum volumetric efficiency.

It must be noted that crankweb and crankcase are kept gas tight by the film of oil which forms between them and not by direct contact; in this way the system is not subject to wear by friction, as is usually the case with similar devices.

The intake pipe is very short; it is therefore only the carburettor which slows down the flow of fresh charge to the engine.

The advantages of a correct feeding system are therefore clear; more power with low revs, and so more elastic engine.

The improvement which the rotary valve brings to the thermo-dynamic performance of the engine can be appreciated by considering the flatness of the power curve; this, as is well known, makes the engine capable of functioning on a wide r.p.m. range and of adjusting itself automatically, with slight variation of speed, to all forms of resistance which the scooter must overcome (head wind, gradients, etc. . . . ).

The proverbial climbing ability of the Vespa is enhanced in this model. All gradients normally encountered on main roads can easily be climbed in 3rd gear, even with two people on board; any slope can be climbed at speed in 2nd gear, while the 1st gear gives initial acceleration and is particularly useful on bad surfaces and side roads. Another advantage of the rotary valve is that it eliminates back pressure, i.e. prevents some of the fresh fuel from being pushed back from the pre-compression chamber towards the carburettor and wasted, at the beginning of the downward stroke of the piston.

Special studies and experiments have been carried out with a view to improving carburation, and brilliant results have been obtained by using a new carburettor similar to those used in the car industry, with plate-shaped slide valve and immersed jets.

This has reduced fuel consumption in comparison with the previous type and improved the general performance of the engine.

The new carburettor is incorporated into the filter box into which air enters from the inside of the stressed skin body, after being filtered by a special porous element in synthetic resin.

This system helps to reduce noise, and with the new silencer, itself a new model, the vehicle is even quieter than the previous one, already well known for its quietness.

The introduction of more modern solutions to machining problems, already successfully tried out in the Vespa 125, has resulted in a more robust though considerably lighter vehicle.

The electric wiring has been improved to meet the higher standard of the machine; a stop light with switch automatically operated by the rear brake control pedal and a headlamp with photometric properties similar to those in car headlamps

have been introduced. A bigger battery and, consequently, a rectifier of higher amperage have been installed; the flywheel magneto has higher output than in the previous model.

Various other technical improvements have been made to the new scooter; the gear-change mechanism has been enclosed in order to protect it from dust, mud and atmospheric deterioration.

The choke valve on the carburettor is in a more accessible place and can more quickly be brought into play.

The general appearance of the **Vespa 150** is most pleasing: it is equipped with a new oval speedometer which is easier to read, with chromium plated shield protection and with a rubber mat which gives a more comfortable and elegant finish to the machine.

The colour of the paint chosen for the body work together with the chrome and other finishings combine to give the vehicle an elegant appearance and emphasise its balanced and modern line.

# 1.
# TECHNICAL DATA - DESCRIPTION

# TECHNICAL DATA - DESCRIPTION

| | | | |
|---|---|---|---|
| Fuel consumption approx | 128 miles per imp. gal. | Wheel base | 46·5″ |
| Max. speed | 53 m.p.h. | Handlebars width | 27·9″ |
| Carrying capacity | 2 persons and 22 lbs. of luggage | Scooter length | 68·3″ |
| Max. gradient climbable | 32% (1 in 3·1) | Scooter height | 40·1″ |
| Operating range | 225 miles | Ground clearance | 5·1″ |
| Fuel tank capacity | 1·7 gals. | Minimum turning circle | 59″ |
| Reserve fuel (included) | 0·3 gals. | Weight (full tank) | 205 lbs. |

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## IDENTIFICATION DATA

Serial numbers with prefix VBA are stamped on both engine and frame, in the positions indicated on Fig. 2. Such numbers and prefix identify the Vespa as prescribed by law and are repeated on the test card and other documents of the scooter.

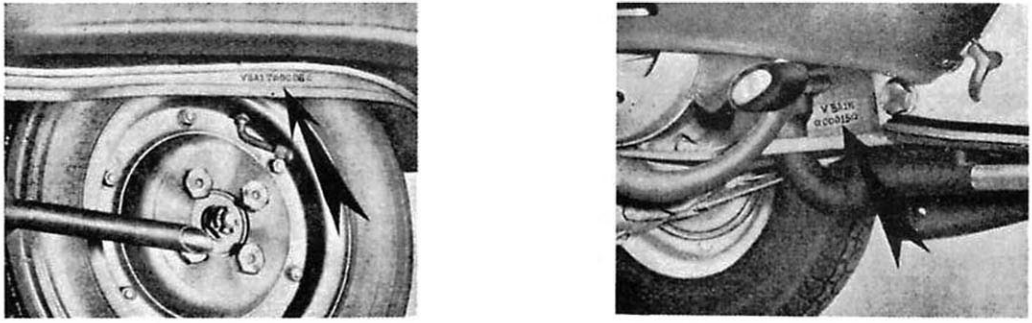


**Fig. 2. Stamping on frame and engine.**

## ENGINE

Single, horizontal cylinder, two-stroke, with deflector piston and rotary valve, i.e.: flow of fuel vapours to the cylinder is controlled by the rotation of a crankweb (Fig. 7).

**The engine operates on 2% petrol-oil mixture.**

| | |
|---|---|
| **Bore** | 57 mm (2.24″) |
| **Stroke** | 57 mm (2·24″) |
| **Displacement** | 145·5 c.c. (8·88 cu. in.) |
| **Compression ratio** | 6·5 to 1 |
| **BHP at 5,000 r.p.m.** | 5·5 |

**Engine installation.** The engine is pivoted to the chassis of the scooter through the cylinder arm of the crankcase half, clutch side, provided with a spindle and two rubber bushes (see Fig. 3).
Its vibrations are damped by the rear suspension with variable rate coil spring and hydraulic damper.
The rear wheel is secured to the end of the mainshaft.

**Fuel supply** by gravity with petrol-oil mixture. Fuel tank with total capacity of 1·7 imp. gallons (comprising an emergency reserve of about 0·3 imp.

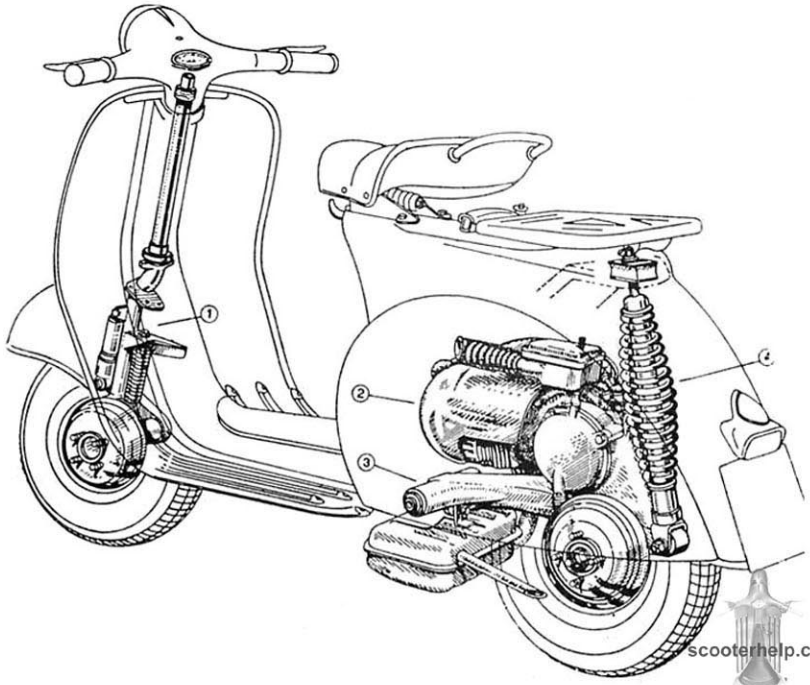



**Fig. 3**

**Engine installation and suspension.**

1. Steering column and front suspension. 2. Engine. 3. Crankcase half, clutch side, with swinging arm. 4. Rear suspension spring with double acting hydraulic damper.

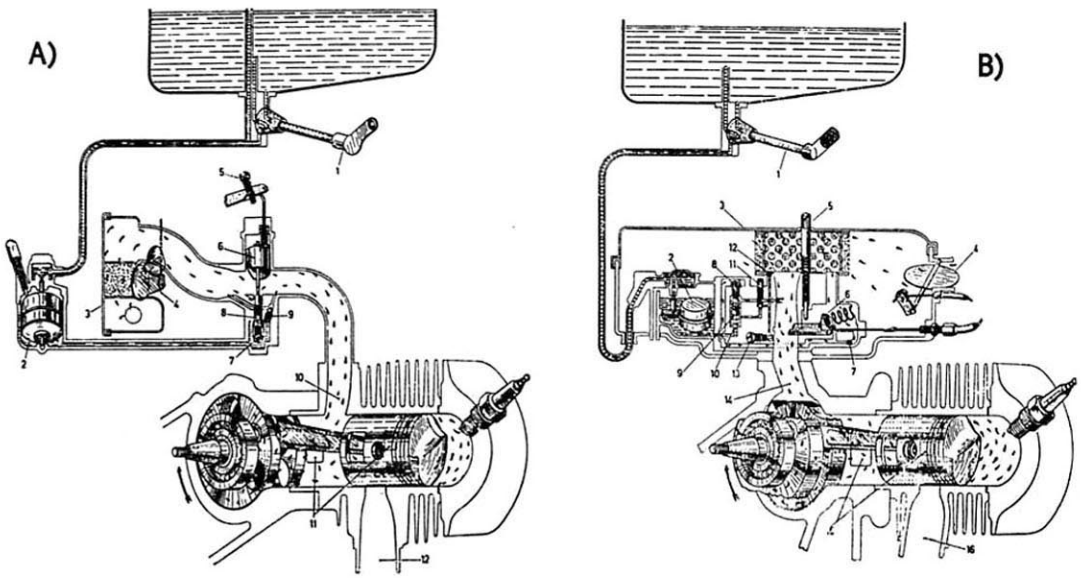



**Fig. 4. Feeding scheme on Vespa 150 VB1 (A) and on the new Vespa 150 VBA (B)**

**(A)** 1. Fuel cock. 2. Float. 3. Air cleaner. 4. Choke. 5. Idling adjuster. 6. Throttle slide. 7. Main jet. 8. Spray nozzle. 9. Idling jet. 10. Intake port. 11. Transfer ports. 12. Exhaust duct.

**(B)** 1. Fuel cock. 2. Float. 3. Air cleaner with carburettor. 4. Choke. 5. Set screw for throttle slide. 6. Throttle slide. 7. Air vent for main jet. 8. Hole on mixer top. 9. Mixer. 10. Main jet. 11. Idling jet. 12. Air vent for idling jet. 13. Idling adjuster. 14. Intake port. 15. Transfer ports. 16. Exhaust duct.

gallons). Three-way cock (reserve, open, closed; see Fig. 4B).

Dell'Orto **carburettor** SI 20/17 embodied in the silencing air cleaner case, provided with a plate-shaped slide valve, immersed jets and choke. Bore diameter: 17 mm (43/64″). Main jet: 96/100 mm (0·037″). Idling jet: 38/100 mm (0·015″). Air vent for main jet: 1 mm (0·039″). Air hole on mixer top: 1·8 mm (0·07″). Holes on mixer body 1 mm (0·039″). Air vent for idling jet: 1·6 mm (0·063″). Spray nozzle: 2 mm (0·078″). Air intake from inside the body.

**Cylinder** of special cast iron with light alloy, pressure die cast **head,** secured on the crankcase by means of four studs.

**Piston** in light alloy with low thermal expansion, high heat resistance and hardness when run hot.

**Crankshaft.** The crankshaft with internal flywheels has tapering ends with key ways for assembly of clutch and rotor respectively; the crankpin is force-fitted into the crankwebs and the con. rod big end is mated therewith through a row of special rollers. One of the crankwebs rotates very close to the crankcase with no direct contact with the latter; a milled portion on its circumference controls the opening and closing of the intake port.

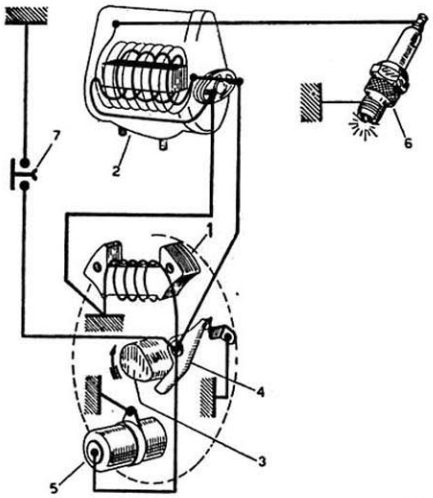



**Fig. 5. Ignition diagram.**

1. H.T. coil in flywheel magneto. 2. External ignition coil. 3. Rotor cam. 4. Breaker. 5. Condenser. 6. Sparkplug. 7. Engine cut-out on switch.

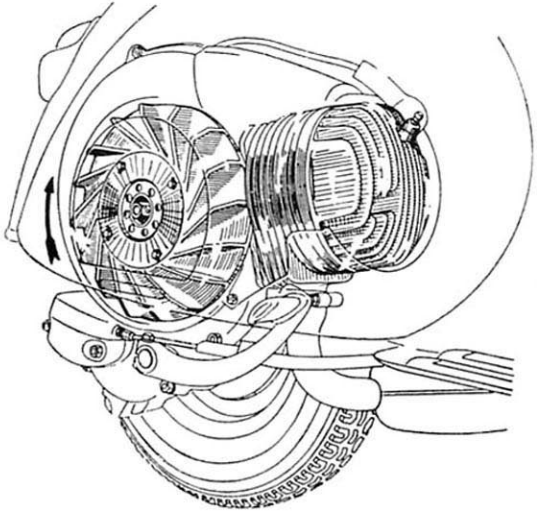


**Fig. 6. Cooling system.**

The **con. rod** small end is mated with the gudgeon pin through a needle cage.

**Main ball bearings** with cage (lubricated by the oil in the fuel mixture sucked into the pre-compression chamber) and provided with oil seals against their outer surfaces.

**Crankcase** in two pieces, pressure die cast in light alloy. A cylindrical arm is cast-in with the clutch side crankcase half to secure the engine on the body; the intake pipe is also cast-in. The other half forms an involute shroud directing to cylinder and cylinder head the cooling air stream blown by the fan.

**Lubrication** of the cylinder, piston, gudgeon pin, connecting rod, crankshaft and main bearings is attended to by the content of oil in the fuel mixture. Both clutch and gear box operate in oil bath.

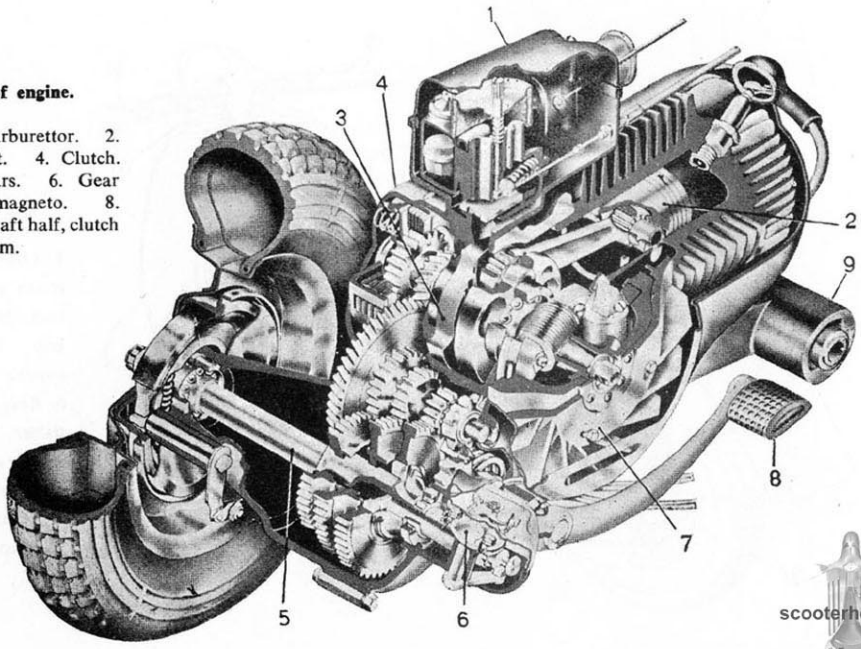
**Ignition** by an external H.T. coil with primary winding fed by another coil inside the flywheel magneto (see Fig. 5. Nos. 2 and 1).
Sparkplug—K.L.G. F.75. Gap .023/.026. A.C. 42 F. Gap .022. LODGE 2 H.N. Gap .022/.026. CHAMPION L.81. Gap .025.



**Cooling** ensured at all engine speeds by a centrifugal fan (Fig. 6).

**Fig. 7. Section of engine.**

1. Air cleaner and carburettor. 2. Piston. 3. Crankshaft. 4. Clutch. 5. Mainshaft and gears. 6. Gear shifter. 7. Flywheel magneto. 8. Kickstarter. 9. Crankshaft half, clutch side, with swinging arm.



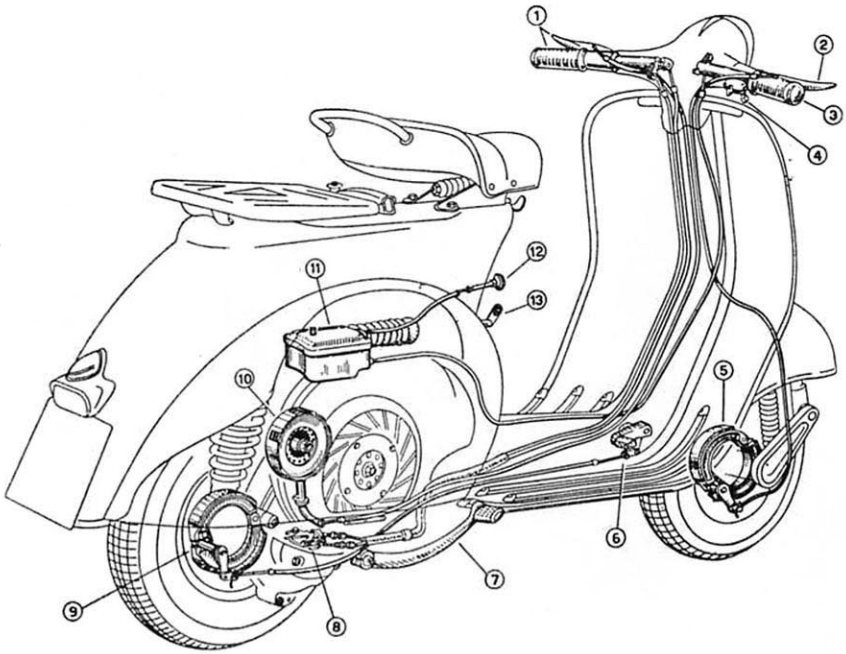



**Fig. 8. Vespa Controls.**

1. Gear change twistgrip with clutch control lever. 2. Front brake lever. 3. Throttle control grip. 4. Light and dimmer switch. 5. Front brake shoes. 6. Rear brake pedal. 7. Kick-starter. 8. Gear index plate. 9. Rear brake shoes. 10. Clutch. 11. Carburettor, air cleaner. 12. Choke control lever. 13. Fuel cock.

**Transmission.** The engine drives directly the rear wheel through clutch, cush drive and gear box (see the engine section on Fig. 7).
Engine to wheel transmission ratios:

| | |
|---|---|
| First : | 12·2 to 1 |
| Second : | 7·46 to 1 |
| Third : | 4·73 to 1 |

**Clutch.** Multiplate (see Fig. 7), with lining adhering on the driving discs.
Control by lever on the left-hand side of handlebars and adjustable cable (see Fig. 8).

**Gear box.** 3-speed drive with mesh gears in oil bath. Its adjustable twistgrip control is coupled with the clutch lever and located on the left-hand side of handlebars (see Figs. 7 and 8).

**Starting** by means of kickstarter located on the right-hand side of scooter (see Fig. 7). The multiple gear and consequently the engine are set in motion through a ratchet sector and a gear by operating the kickstarter.

**Silencer** of the expansion and absorption combined type with high silencing effect.

## FRAME

Stressed skin **body** of pressed sheet with streamlined, monocoque type structure (see Fig. 9). It

**Particular attention has been given to the design of the silencer and air filter in accordance with Ministerial request to reduce noise level to the absolute minimum. We recommend that these parts are maintained in good order.**

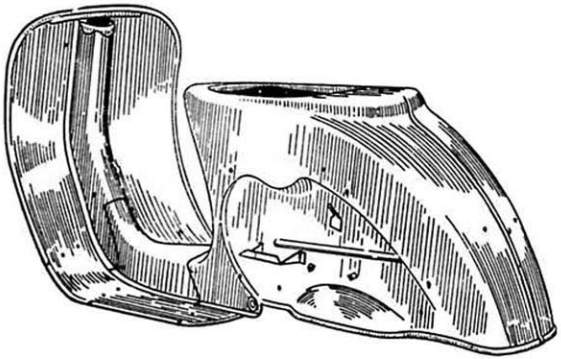


**Fig. 9. Stressed skin body.**

gives full protection to the driver, to the passenger and to the vehicle units; it is completed in this function by the mudguard and, on the two sides, by the steel sheet engine cowling and tool box.

**Handlebars** in light alloy, with arrangement for headlamp and speedometer (see Fig. 3).
All control cables and electric wires, to be connected to the handlebars, are concealed therein.

**Steering lock.** A suitable security lock is arranged on the frame, near the handlebars. Turning the key anticlockwise and the handlebars to the left, the lock engages the lug welded on the steering column, so that the machine can only turn round (see Fig. 10, No. 2).
Turn the key clockwise (No. 1) to release the scooter.

**Steering column, suspensions and wheels.** The steering column bears the handlebars, clamped on its top end, and the front wheel swinging hub, pivoted at its bottom end through a stub axle (see Fig. 3).
Front suspension with coil spring and double acting hydraulic damper.
Rear suspension with a variable rate coil spring and coaxial, double-acting hydraulic damper.
The wheels are interchangeable and have rims of pressed steel sheet (⌀ 8″). Tyre dia.: 3·50 x 8″.

**Saddle** of the nose-pivoted, sprung type with central springing adjustable to the driver's weight.

**Brakes.** Expanding type with cable control (see Fig. 8).
Front: Lever on right-hand side of handlebars.
Rear: Control pedal on right-hand side of floorboard.

**Central stand.** A two-leg stand is arranged under the floorboard. A strong return spring holds it in contact with the floorboard and keeps it from vibrating while the scooter is being ridden.

**We recommend not to lubricate the security lock even if it does not function properly. Do not attempt to ride the scooter unless the key is in, and remains in, the lock and the handlebars move freely.**

## ELECTRIC WIRING

Both horn and lighting system (nominal voltage: 6V) are supplied with either alternating (six-pole flywheel magneto) or direct current (6V-7Ah battery, re-charged by the flywheel magneto through a metal rectifier) as follows (see Figs. 12-13) :

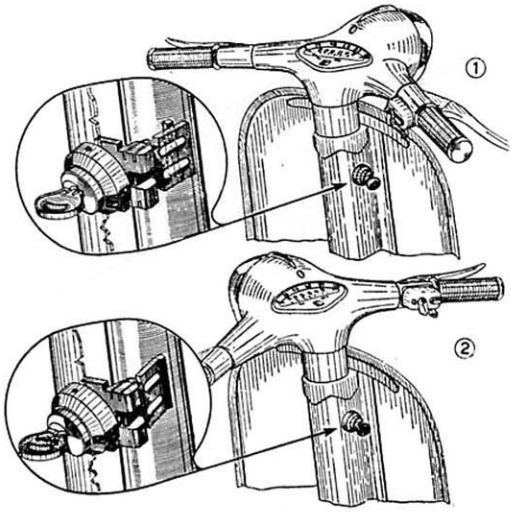



**Fig. 10. Security lock.**

1. Normal position. 2. Closed.

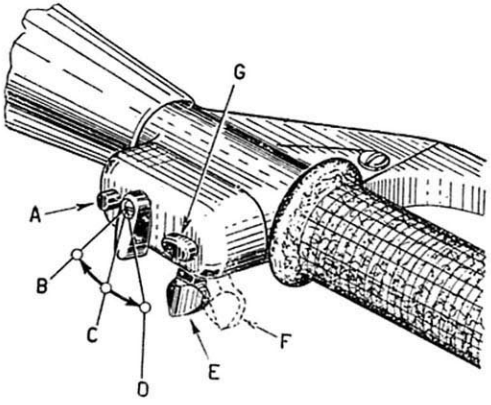



**Fig. 11. Light and dimmer switch positions.**

(A) Cut-out. (B) Pilot light, tail lamp and speedometer bulb on. (C) Lights off. (D) Headlamp, tail lamp and speedometer bulb on. (E) Traffic beam. (F) Country beam. (G) Horn button.

—**head lamp** ( ⌀ 115 mm) installed on the handlebars; its 25/25W double filament bulb (traffic and country beam) and the 1.5W pilot light are fed with alternating and direct current respectively.

—**tail lamp** with red reflector; the 3W bulb is fed with either a.c. (rear light) or d.c. (parking); the 5W bulb for the STOP light is fed with d.c.

—**horn :** alternating current.

—**speedometer :** the 0·6W bulb is fed with either a.c. or d.c.

The light and dimmer **switch** with two levers is installed on the right-hand side of the handlebars (Fig. 11). The switch has also two push buttons for cut-out and horn respectively.

## TOOL KIT

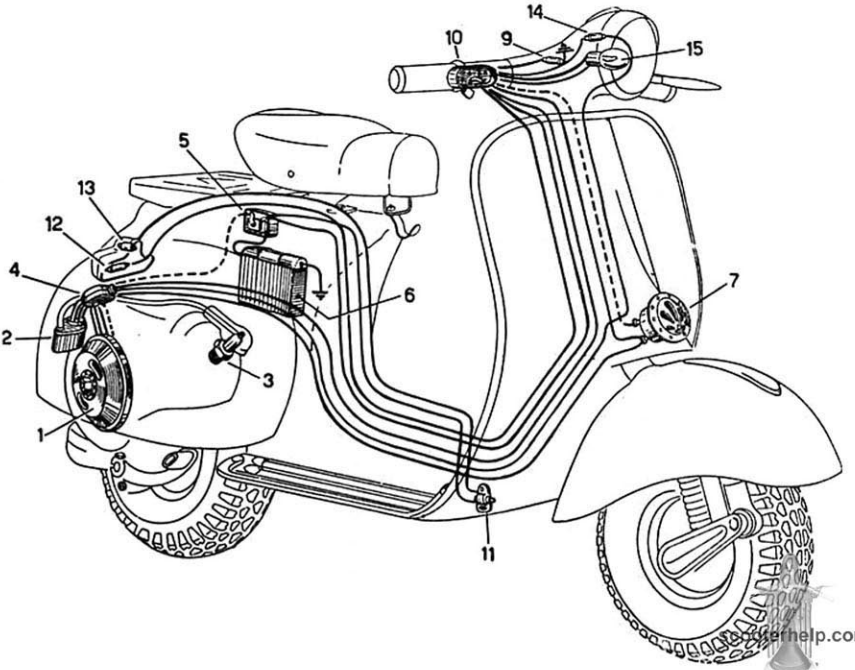
1 four-ended box wrench (11-14-21-22 mm); 2 double open-ended wrenches (7-10 and 11-14 mm); 1 single open-ended wrench (8 mm); 1 screwdriver).

These tools are contained in a canvas roll which is placed in the left wing together with the booklet " Operation and Maintenance."

**Fig. 12. Cable harness.**

1. Flywheel magneto. 2. External ignition coil. 3. Spark-plug. 4. Low tension terminal. 5. Rectifier with 8A fuse. 6. Battery (6V- 7 Ah). 7. Horn. 8. Inside view of headlamp. 9. Speedometer bulb (6V-0·6W). 10. Main switch. 11. STOP light switch. 12. Tail lamp (6V-3W). 13. STOP light (6V-5W). 14. Pilot light (6V-1·5W). 15. Double filament bulb (6V-25/25W).

**N.B.** White cables are indicated with black, dotted lines.



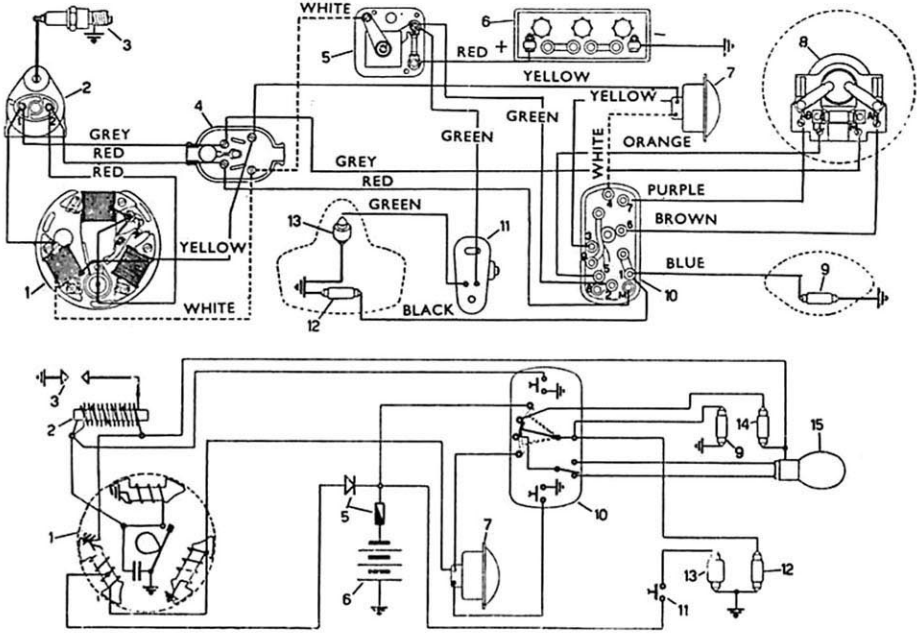



**Fig. 13. Wiring diagram.**

## ACCESSORIES

On request the **Vespa 150** can be equipped with the following accessories (see Fig. 14).
**Rear saddle** of the nose-pivoted, sprung type, to be secured to three chassis holes after removing the luggage carrier. The central spring is adjustable to the driver's weight. A foam rubber **pillion seat** can be used instead of the rear saddle. The seat can be secured to the rear luggage carrier of the scooter. Both rear saddle and foam rubber seat are small and attractive looking and give remarkable comfort to the passenger, thus completing the efficiency of suspension.

**Spare wheel** and **bracket.** The wheel can be secured in two ways to the scooter.

(a) in front, through a light alloy bracket secured to the scooter longeron by means of two screws.

(b) at the rear, through a steel sheet pressing, provided with spacers, to be clamped onto the frame, under the luggage carrier or the rear saddle, by means of the three screws securing the latter.

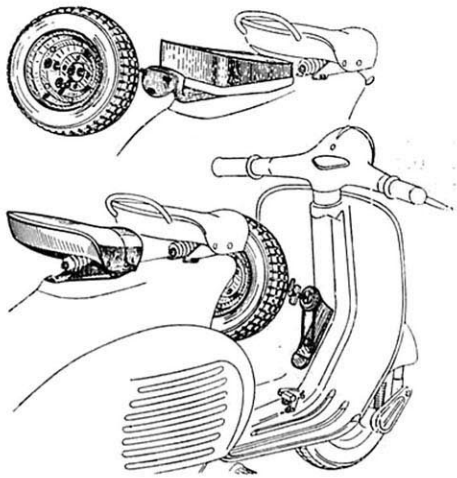


**Fig. 14. Fitting accessories on scooter.**

# OPERATION

We remind customers that they should comply with instructions outlined in the booklet "Operation and Maintenance."
The directions below should be strictly adhered to as far as running-in period, tyre pressure, oil to petrol ratio of the fuel mixture, oil and other lubricants to be used are concerned.
Fault finding, remedies, overhauls, repairs, etc., are dealt with in respective sections of the manual.

**Fuel** to be used both during and after running-in should be a 2% petrol-oil mixture, namely, a mixture consisting of 20 c.c. of ESSO SAE 30 Two-Stroke Oil per litre of petrol (about $\frac{1}{4}$ pint per $1\frac{1}{2}$ gallons respectively).
We recommend to use good quality, standard grade car petrol, and to mix it with oil thoroughly. Keep the breather on the filling cap clean.

**Running-in.** Important rules to be followed while running-in, 1,200 miles.

Do not exceed the following speeds :

| | |
|---|---|
| 1st gear | 13 m.p.h. |
| 2nd gear | 22 m.p.h. |
| 3rd gear | 34 m.p.h. |

Do not hold these max. speeds for long periods, neither use full throttle opening up-hill.
Change the oil in the gear box and check nuts, screws, and bolts are not slack after the first 600 miles.

**Slow running adjustment.** Idling revs can be raised or reduced respectively by simply tightening or slackening either with a screwdriver or by hand, the knurled slotted screw on air cleaner steel sheet cover (see Fig. 4B, No. 5). This screw stops the slide valve of the throttle.
The adjuster screw for the throttle control cable is installed on the air cleaner case. This screw is to be re-set only when necessary and while dismantling and re-assembling. Opposite to said adjuster screw there is on the air cleaner case a plugged hole for access for another screw (spring-loaded) with a tapering end (see Fig. 4B, No. 13). This screw controls the flow of carburated air through the duct from the idling jet, and consequently the idling revs. We recommend to the customers to keep from re-setting this screw unless strictly indispensable or during dismantling and re-assembling operations that should, anyway, be entrusted to a Service Station.

# LUBRICATION CHART

| Part to be lubricated | | Lubrication | | | | |
|---|---|---|---|---|---|---|
| Every 2,500 | Every 5,000 | *Shell | *B.P. | Esso | Wakefield | Mobil |
| Gear-box topping-up | Gear-box change oil | Shell 2T Two-Stroke Oil or Shell X-100 30 | Energol Two-Stroke Oil or Energol SAE. 30 | Esso Extra Motor Oil 20W/30 | Castrol XL | Mobiloil A |
| Front suspension<br>Felt pad on fly-wheel cam<br>Joints on brake control<br>Speedo flexible drive | Control cables<br>Gear change quadrant | Retinax A | Energrease L.2 | Esso Multi-Purpose Grease H | Castrolease L.M. | Mobilgrease M.P. |
| Engine at each re-fuelling | | Shell 2T Two-Stroke Oil in ratio of 2% or ¼-pint to 1½ galls. petrol | Energol Two-Stroke Oil in ratio of 2% or ¼-pint to 1½ galls. petrol | Essolube 30 in ratio of 2% or ¼-pint to 1½ galls. petrol.<br>Esso Two-Stroke Motor Oil in ratio of ¼-pint to 1 gall. petrol | Castrol XL in ratio of 2% or ¼-pint to 1½ galls. petrol.<br>Castrol Two-Stroke Oil in ratio of ¼-pint to 1 gall. petrol | Mobiloil A in ratio of 2% or ¼-pint to 1½ galls. petrol.<br>Mobil-Mix in ratio of ¼-pint to 1 gall. petrol |

*Marketed also by National Benzole Co. Ltd., by arrangement with Shell-Mex & B.P. Ltd.

| | |
|---|---|
| Hydraulic Dampers | When not working efficiently consult your Dealer. If servicing is required, they should always be returned to the Works |

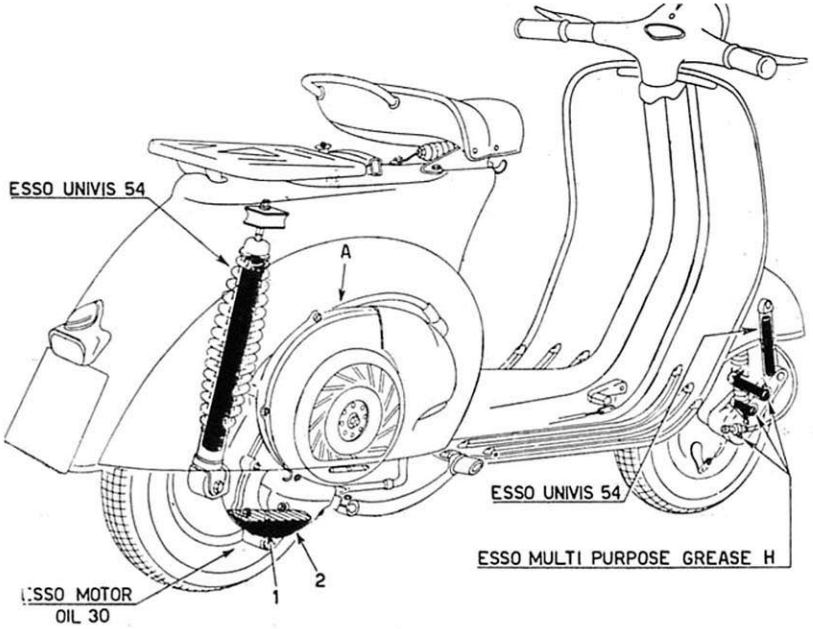



**Fig. 15. Lubrication scheme.**

A. Engine lubricated by the fuel mixture. 1. Filling hole. 2. Draining hole.

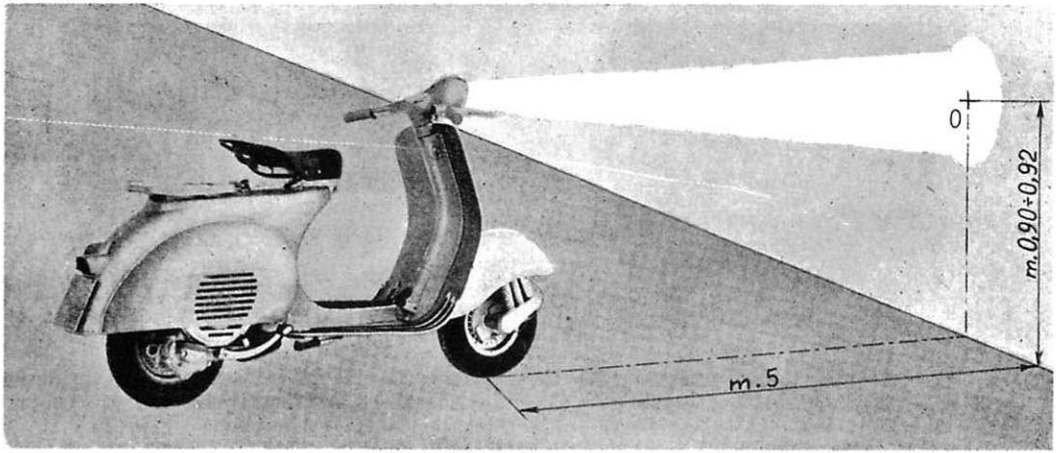



Fig. 16. Adjustment of headlamp.

**Setting the headlamp.** The correct orientation of the main beam can be obtained both horizontally and vertically as follows:

Check that tyres are correct pressures.

Place the scooter on a level floor in front of a white wall as seen on Fig. 16.

Start the engine, hold the throttle control twist-grip at about one-third and set the switch on " country beam."

With two persons on the Vespa, slacken the two screws securing the headlamp, then move

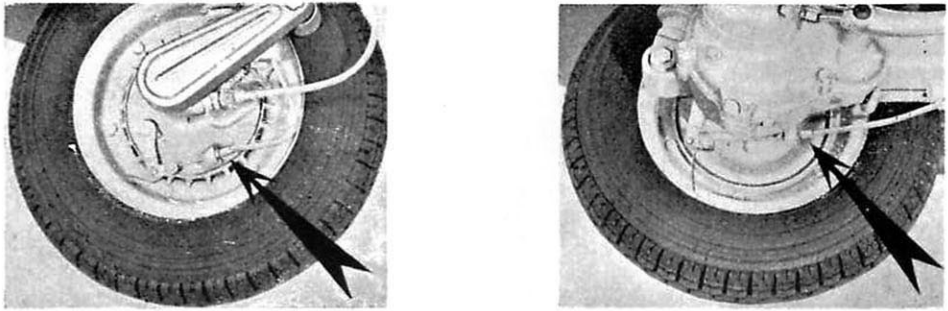


**Fig. 17. Brake adjustment.**

the latter in its housing as required in order that the beam axis coincides with the point " O " marked on the wall.
Tighten the screws firmly.

This operation can be carried out also with driver only sitting on the saddle. In such case, of course, the beam alignment should be altered whenever the scooter is being ridden by both driver and passenger.

**Tyre pressure.** See page 29.

**Battery service.** Follow the directions on the card accompanying each battery for what may concern service and normal recharge.

**Brake adjustment.** Brakes are properly adjusted if :

the wheel rotates freely when respective control lever or pedal are in resting position;
the braking action starts as soon as respective controls are operated.

These conditions are achieved by adjusting the cables by means of screws indicated with arrows in Fig. 17.

**Laying up.** In such a case proceed as follows :

1. Clean the scooter thoroughly.
2. Remove the air cleaner cover and the cleaner itself. Start the engine and run it at low revs in neutral. Then pump 60 c.c. of Esso Motor Oil 30 into the carburettor intake by means of an oil can.
3. Rest the floorboard on two wooden blocks in order to take weight off the tyres.
4. Drain all fuel from the tank.
5. Grease all unpainted metal parts.

## TYRE PRESSURE CHART

## FOR MODEL 150 c.c.

| MODEL | DUNLOP | | | PIRELLI | | |
|---|---|---|---|---|---|---|
| | Front | Rear | Sidecar | Front | Rear | Sidecar |
| 150 c.c. (Std.) Solo ..... ..... | 16 | 20 | — | 16 | 22 | — |
| Pillion ..... | 16 | 32 | — | 16 | 32 | — |
| Sidecar ..... | 16 | 24 | 16 | 18 | 24 | 16 |

# 2.
# TOOLING

# TOOLING

All tools required for dismantling, re-assembling and overhauling the **Vespa 150** (prefix VBA) are listed in this section in numerical order.
Previous tools which can still be used are indicated in the second column.
The equipment is indispensable. The success of the various operations depends on its continuous and proper use.

---

**Every operation is to be done with the proper tools, and according to directions in this manual. We advise the Retailers to provide their shops with all tools required for the operations they are supposed to carry out and to acquaint themselves with their use.**

---

# TOOLING FOR DISMANTLING, RE-ASSEMBLING AND OVERHAULING VESPA 150 VBA

| Tool. No. | Previous tool still for use | TOOL NAME | GROUP | PAGE | NOTES |
|---|---|---|---|---|---|
| 5479/A | | Hand press for hydraulic dampers | Dampers | 104-105 | |
| 7259/R | | Test fixture for hydraulic dampers | Dampers | 108 | |
| 8002/R (a) | 6488/A | Engine test stand | Engine | 94 | (a) Retailers who have this tool already must order the new unit 8608/R and alter the stand as indicated on page 94. |
| 8290/R | { 4938/A 5115/A } | Flywheel mageto test stand | Flywheel | 77 | |
| T. 12380/C | | Crankshaft alignment fixture | Engine | 129 | |
| 13768/C | | Base fixture for assembling coils on stator | Flywheel | 75 | |
| 15104/C | | Inspection template for steering column (base) | Steering c. | 100 | |
| 15118/C | | Inspection template for steering column (top) | Steering c. | 100 | |
| T. 15772/C (b) | | Jig for frame inspection | Frame | 102 | (b) Retailers who have this tool already must order the new parts 31, 32, 33. |
| 550804 | | Punch | Flywheel | 71 | |
| 550805 | | Punch | Flywheel | 71 | |
| T. 0013782 | 0013782 | Turn bearer for engine support table | Engine | 42 | |
| 0013964 | | Face-pin wrench for holding flywheel | Flywheel | 45 | |
| | 0014000 (c) | Tool for clamping the steering column in the vice | Steering c. | — | (c) Not indispensable (steering column may also be clamped in vice with aluminium pads); see page 58. |
| T. 0014499 | | Ball bearing extractor (front wheel axle and crankshaft) | Steering c. | 53-59 | |
| 0014566 | | Hook wrench for lock ring of steering column top bearing | Engine | 56 | |
| | T.0015192 0015192 (d) | Box wrench for nut retaining the flywheel | Steering c. | — | |
| T. 0015283 | | Mandril for turning the flywheel | Flywheel | 72 | |
| 0015284 | | Balancing mandril for flywheel | Flywheel | 73 | (d) Standard 14 mm box wrench. |
| 0015413 | | Tool for unriveting plate washers of cush gear | Engine | 89 | |

| Tool No. | Previous tool still for use | TOOL NAME | GROUP | PAGE | NOTES |
|---|---|---|---|---|---|
| | T.0016029 } 0016029 (e) } | Tube for assembling bottom ball race of steering column bottom bearing | Steering c. | 135 | |
| 0016030 | | Flexible shank wrench for securing tool box | Engine | 60 | |
| T. 0016205 | | Timing gauge | Engine | 134 | (e) A 530 mm (20·8″) long, 5·7 mm (0·19″-0·27″) thick tube with 36 mm (1·4″) I.D. is a suitable substitute for this tool. |
| | 0016538 | Decarbonising tool for muffler exhaust pipe | Engine | — | |
| T. 0016561 | 0016561 | Extractor for bottom ball race of steering column bottom bearing | Steering c. | 57 | |
| 0016741 | | Gap gauge for breaker points and spark-plug electrodes | Engine | 113 | |
| 0017004 (f) | | Special screwdriver | Steering c. | 55 | |
| | T.0017102 (g) | Extractor for bushes of front wheel axle | Steering c. | — | (f) A screwdriver for slotted nuts can be used as well (see Fig. 46 (a) and (b), page 55). |
| T. 0017104 | | Long nose pliers for circlips | Engine | 45-50 | |
| | 0017129 (h) | Single open-ended wrenches for nut and bolt securing breaker spring | Flywheel | — | |
| 0017549 | | Face-pin wrench for dismantling and re-assembling the front damper | Dampers | 104 | |
| 0017802 | | Wedge | Engine | 128-132 | |
| 0017808 | | Pilot sleeve for passing the crankshaft through oil seal of clutch side crankcase | Engine | 131 | (g) Not indispensable (a metal drift may be used as well). |
| 0017820 | | Drift for removal of wrist-pin | Engine | 45 | |
| 0017831 | | Pilot sleeve for passing the crankshaft through oil seal of flywheel side crankcase | Engine | 132 | (h) Standard 6 mm wrenches. |
| 0017843 | | Punch for removing crankcase oil seal | Steering c. | 50 | |
| 0017898 | | Punch for assembling bushes for front wheel needles | Steering c. | 135 | |

| Tool No. | Previous tool still for use | TOOL NAME | GROUP | PAGE | NOTES |
|---|---|---|---|---|---|
| | 0017985 (i) | Box wrench for lubricators | Steering c. | — | |
| 0018094 | | Feeler gauge for inspecting axial play of gear pinions | Engine | 70 | |
| 0018111 | | Hook wrench for threaded ring of security lock | Frame | 62 | |
| T. 0018119 | | Tool for assembly and removal of components | Engine | 125 | (i) Standard 11 mm box wrench. |
| T. 0018190 (j) | | Tool for assembly and removal of components for engine attachment frame and rear suspension | Engine | 90-93 | (j) To be used in conjunction with tool T. 0022552 or T. 0022553. |
| 0018204 | | Pilot sleeve on stem on front damper for assembling rubber packings. | Dampers | 104 | |
| 0018205 | | Pilot sleeve for fitting felt ring | Steering c. | 104 | |
| 0018219 | | Wrench for securing front damper to steering column | Engine | 58 | (k) Not indispensable (clamp the mainshaft in vice by means of aluminium pads). |
| | T. 0019273 (k) | Mainshaft holder for bending the edge of lock washer | Engine | — | |
| T. 0019353 | | Box wrench for castle nut retaining the clutch | Engine | 48 | |
| T. 0019354 | | Hook wrench for retaining the clutch | Engine | 48 | |
| 0019978 | | Heater (220V - 50 Hz) | Engine | 130 | |
| T. 0020185 (l) | | Equipment for consumption tests | Frame | 109 | (l) Retailers who have this tool already must order parts 53, 54, 55, 56 and 57. |
| 0020720 | | Joint wrench for adjustment of saddle spring | Engine | 136 | |
| T. 0020781 | | Punch for assembling mainshaft inner ball bearing | Dampers | 124 | |
| T. 0020811 | | Rod for reciprocating piston of front damper to expel air | Dampers | 104 | |
| T. 0020824 | | Base of tools for assembling rubber bush and liner on damper body | Dampers | 104-105 | |

| Tool No. | Previous tool still for use | TOOL NAME | GROUP | PAGE | NOTES |
|---|---|---|---|---|---|
| T. 0020826 | | Tool set for assembling liner and rubber bush on body of front damper. | Dampers | 105 | |
| T. 0020827 | | Tool set for assembling liner and rubber bush on stem support of front damper | Dampers | 105 | |
| T. 0020828 | | Sleeve for assembling discharge valve into inner tube of front and rear dampers | Engine | 104 | |
| T. 0020837 | T. 0014812 | Punch for withdrawal of mainshaft | Steering c. | 51 | (m) Retailers who have this tool already must order part 11. |
| T. 0020841 | T. 0018130 | Punch for withdrawal of front wheel axle | Steering c. | 58 | |
| T. 0020842 | | Punch for withdrawal of bottom ball race of steering column upper bearing | Handlebars | 56 | |
| 0021063 | | Handlebars extractor | Frame | 54 | |
| T. 0021064 (m) | | Flexible shank wrench for fuel tap | Engine | 62 | (n) Retailers who have this tool already must order part 1 which has been altered. |
| T. 0021071 | T. 0014924 | Tool for inserting oil seal on crankcase half, flywheel side | Steering c. | 130 | |
| T. 0021084 | 0015309 | "L" handle box wrench for nuts securing front wheel bearing and rear wheel flange | Engine | 41 | |
| T. 0021265 | T. 0016310 | Flywheel extractor | Engine | 46 | (o) To be altered (see page 71). |
| T. 0021330 (n) | | Tool for assembling the bottom ball race of upper bearing and upper ball race of bottom bearing of the steering column | Steering c. | 134 | |
| T. 0021467 | T. 0018182 | Extractor for main bearings from crankcase | Engine | 51 | |
| T. 0021481 (o) | T. 0015724 (o) | Supporting block for riveting | Flywheel | 71 | |
| T. 0022192 | | Riveting fixture for taper pin of gear shifter | Engine | 87 | |

| Tool No. | Previous tool still for use | TOOL NAME | GROUP | PAGE | NOTES |
|---|---|---|---|---|---|
| T. 0022342 | | Tool for assembling the pawl of gear sector | Engine | 90 | |
| T. 0022407 | | Wrench for threaded ring retaining ball bearing of crankcase half, clutch side | Engine | 52-133 | |
| T. 0022442 | | Extractor for roller bearing of crankcase half, flywheel side | Engine | 50 | |
| T. 0022449 | | Engine support table | Engine | 42 | |
| T. 0022453 | | Tool for assembling sleeve with front brake lever housing on handlebars | Handlebars | 98 | |
| T. 0022460 | | Extractor for removing sleeve with front brake lever housing from handlebars | Handlebars | 97 | (p) Delivered with engine test stand 8002/R. |
| T. 0022465 | | Pliers for circlip on crankcase half, clutch side | Engine | 53-126 | |
| T. 0022467 | | Crankcase support (flywheel side) for assembling the ball bearing | Engine | 126 | |
| T. 0022472 | | Punch for dismantling and assembling oil seal on threaded ring fixing the bearing of crankcase half, clutch side. | Engine | 52-133 | (q) To be used in conjunction with tool T. 0018190. |
| T. 0022473 | | Tool for assembling the roller bearing on crankcase half, flywheel side | Engine | 126 | |
| T. 0022480 | | Extractor for ball bearing of crankcase half, clutch side | Engine | 53 | |
| T. 0022517 (p) | | Wrench for operating the gear shifter | Engine | 98 | |
| T. 0022519 | | Wrench for screwed plug of rear damper | Dampers | 107 | |
| T. 0022547 | | Magnetiser | Flywheel | 74 | |
| T. 0022552 (q) | | Tool for withdrawing the rubber bushes and inner spindle from crankcase arm, clutch side | Engine | 90 | |

| Tool No. | Previous tool still for use | TOOL NAME | GROUP | PAGE | NOTES |
|---|---|---|---|---|---|
| T. 0022553 (q) | | Tool for withdrawing and assembling the rubber bush and liner for attachment of rear damper | Engine | 90-93 | |
| T. 0022555 | | Punch for bending outwards the edge of inner spindle on crankcase arm, clutch side | Engine | 92 | |
| T. 0022567 | | Tool for assembling the bushes and inner spindle on crankcase arm, clutch side | Engine | 91 | |
| T. 0022587 | | Tool for centering the inner spindle in the crankcase arm, clutch side | Engine | 92 | |
| T. 0023223 | | Tool for assembling and stripping the clutch and for checking axial play of plates | Engine | 84 | |
| T. 0023234 | T. 0015046 } T. 0020322 } | Tool for checking transmissible statical moment of clutch | Engine | 85 | |
| T. 0023278 | | Flywheel magneto timing fixture | Flywheel | 81-134 | |
| T. 0023589 | | Punch for withdrawing and assembling oil seal of crankcase half, clutch side | Engine | 53-130 | |
| T. 0023590 | | Fixture for assembling shield protector | Frame | 103 | |
| 0023638 | | Longnose pliers for circlips | Engine | 125 | |
| T. 0023745 | | Extractor for crankcase half, flywheel side, and crankshaft | Engine | 49 | |

# 3.
# DISMANTLING

# DISMANTLING

This section gives the directions for complete dismantling of the scooter and its sub-assemblies.

When not otherwise specified, the succession of operations in each figure is indicated by the alphabetical order of letters, which are marked in accordance with the parts to be dismantled. Tools are shown with their drawing numbers, whilst open-ended wrenches, box wrenches, and screwdrivers are indicated with respective symbols

and hexagon dimensions.

When no tool is pointed out, the operation can be carried out by hand.

Use of monkey wrenches, hammers, chisels and emergency tools of any kind is strictly to be avoided. Only by means of the tools listed in the proper section of this manual, and by using them to do the job they have been designed for, can any operation be quickly and successfully carried out on the scooter without damaging the parts involved. Place all dismantled parts so that they cannot be mixed up with components of other machines.

Washers and other small parts are not pointed out on the figures; it is advisable to keep washers, bolts, nuts, etc., together with respective parts, in order to avoid losing or confusing them when re-assembling.

Dismantling of the scooter is to be carried out carefully and under the best conditions of cleanliness. Use two containers with paraffin and petrol respectively; wash the parts in the first and rinse them in the second one. Wipe the parts dry with clean and good quality rags or, better, blow them dry.

Should the re-assembly be postponed for a while, protect all loose components from dust and oxidation.

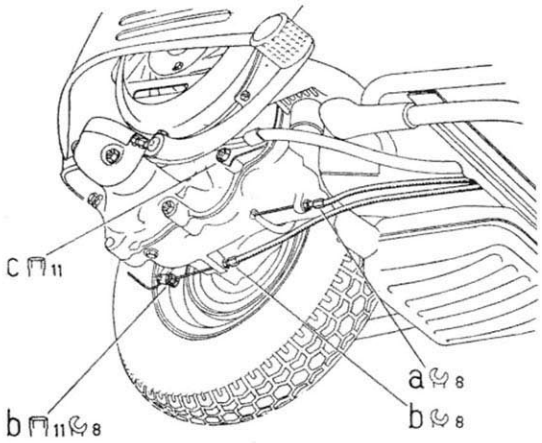



**Fig. 18**

(a) Disconnect the clutch control cable (slide out the cable from the clutch control lever and undo the adjuster all the way through).
(b) Disconnect the rear brake control cable (slacken the clamp, undo the adjuster completely and slide the cable out).
(c) Unscrew nut of clip retaining the gear change control cables.

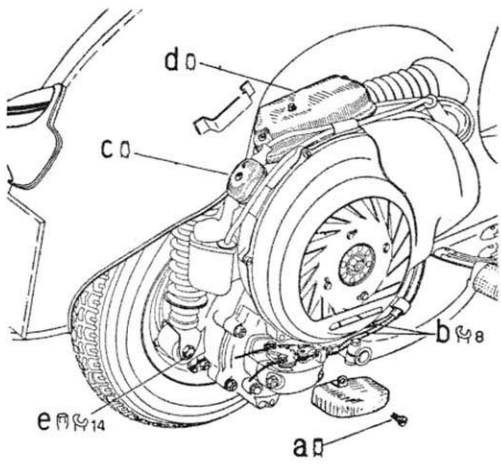



**Fig. 19**

(a) Cover of gear index plate casing.
(b) Gear change control cables with nipples (undo the adjusters all the way through).
(c) Cover of low tension terminal.
(d) Air cleaner cover.
(e) Bolt anchoring rear hydraulic damper.

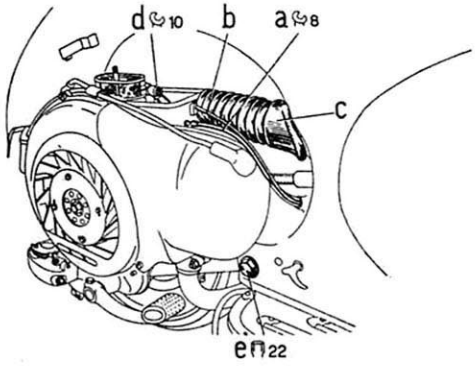



Fig. 20

(a) Throttle control cable (disengage the cable nipple from end of the throttle slide control rod; undo the adjuster completely). (b) Choke control cable (release the cable from choke valve lever and slide it out). (c) Rubber bellows. (d) Fuel hose. (e) Bolt anchoring engine to frame. Remove the components for attachment of the crankcase half, clutch side, to the frame as shown in paragraphs 7a and 7b of section "Overhauls". Withdraw the engine and secure it on support table T. 0022449.

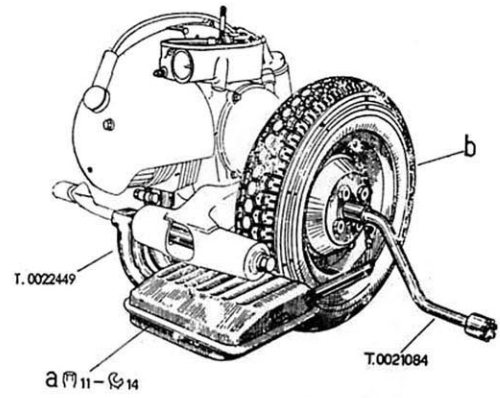



Fig. 21

(a) Silencer.
(b) Wheel with brake drum and flange.
Unscrew the four nut diagonally and evenly by means of a 22 mm box wrench for detaching the wheel from the drum. Undo the two screws retaining the brake drum on the flange.

**N.B.** For replacing tyres, see booklet "Operation and Maintenance".

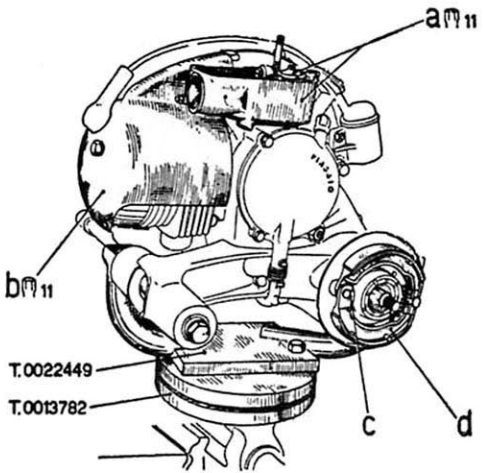



Fig. 22

(a) Carburettor and air cleaner case. (b) Cooling hood (disconnect the H.T. lead from the sparkplug). (c) Circlip on brake shoe pivot. (d) Brake shoes.

**N.B.** The brake shoes can be replaced and their pivot removed also with the engine assembled on the scooter, after withdrawing the brake drum and the wheel. In such a case, leaning the machine on the tool box side may cause oil to drip.

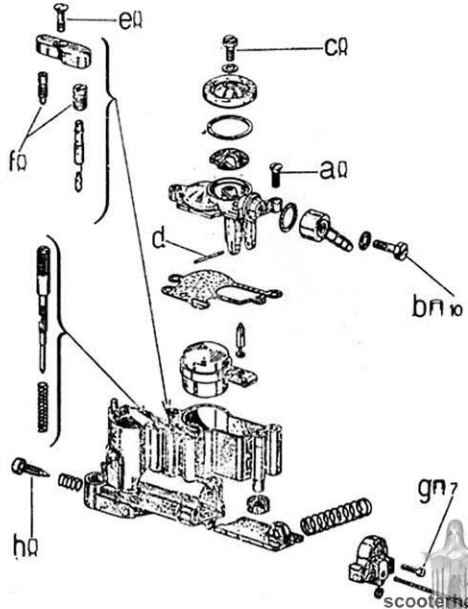



**Fig. 23**

Components of air cleaner and carburettor (the latter in numerical order). Wash the air cleaner as shown in the section "Fault Finding", paragraph 2.

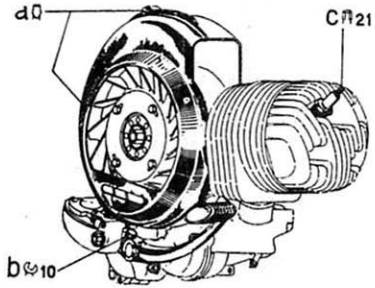



Fig. 24

(a) Fan housing cover. (b) Kickstarter (remove the clamp bolt and pull out the kickstarter). (c) Sparkplug.

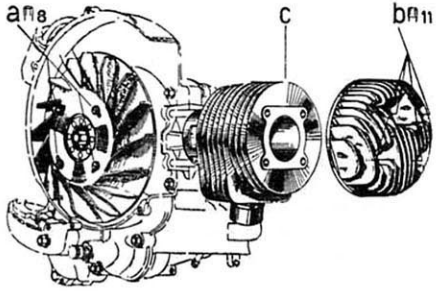



Fig. 25

(a) Fan (straighten up the edges of the tab washers). (b) Cylinder head. (c) Cylinder.

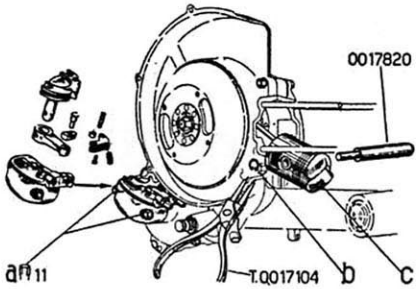



**Fig. 26.**

(a) Gear index plate casing (select 3rd gear). (b) Circlips retaining the gudgeon pin. (c) Gudgeon pin (drift 0017820) and piston. Slide the needle cage out of the con. rod small end.

**N.B.** See the section "Overhauls", paragraph 4, for dismantling and re-assembling the gear shifter.

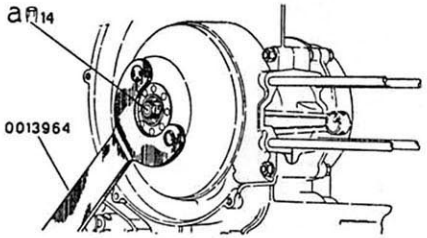



**Fig. 27**

Flywheel magneto. When not successful with this procedure, operate as follows:

Remove the circlip with long nose pliers T.0017104 (operation similar to that shown at point "b" in Fig. 26).

Remove the flywheel nut with tools and following procedure shown in this figure.

Operate by means of extractor T. 0021265 as indicated in Fig. 28.

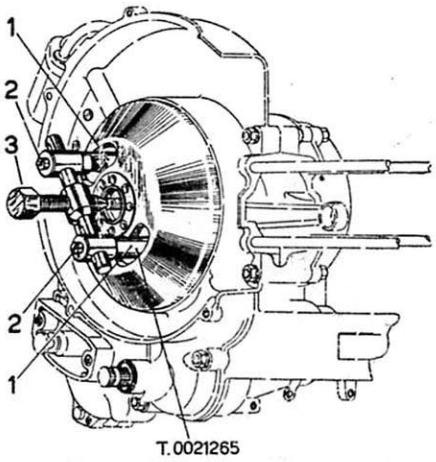



Fig. 28

Flywheel.
Use tool T. 0021265; fit the tool legs "1" into rotor holes and let them slide towards the centre of their axle to rest on the cam collar; tighten screws "2"; operate by means of a 19 mm wrench on the central threaded pin "3" until the flywheel is extracted.

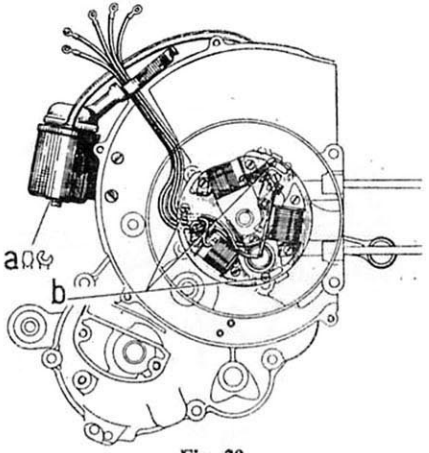



Fig. 29

(a) External ignition coil. (b) Woodruff key and stator. (Overhaul, timing and test: see section "Overhauls", paragraphs 1c to 1m).

**N.B.** Make a reference mark on both stator and crankcase before undoing the screws, to make sure the two parts are re-assembled in the original position. Place the stator inside the rotor.

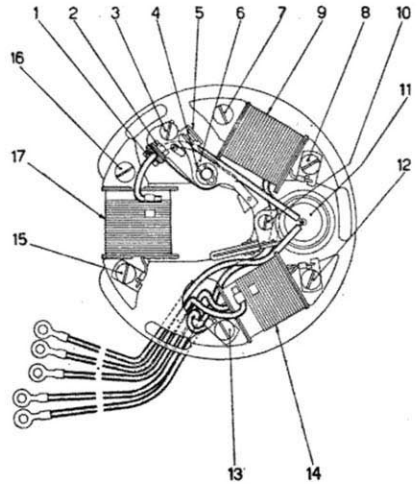



**Fig. 30**

Stator components (follow the numerical order when dismantling).

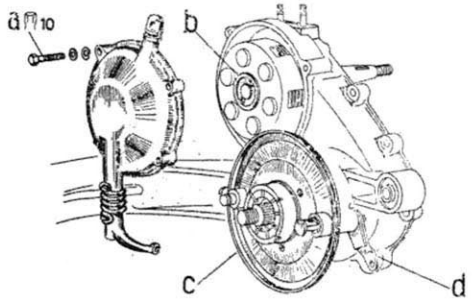



**Fig. 31**

(a) Clutch cover. (b) Centralising plate (operate with a screwdriver for removing the circlip). (c) Dust cover (remove the three screws). (d) Brake operating lever (split pin) and cam.

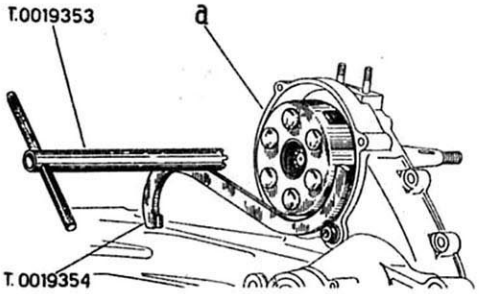



Fig. 32

Clutch body (for dismantling, see section "Overhauls", paragraphs 3a to 3d), and woodruff key.

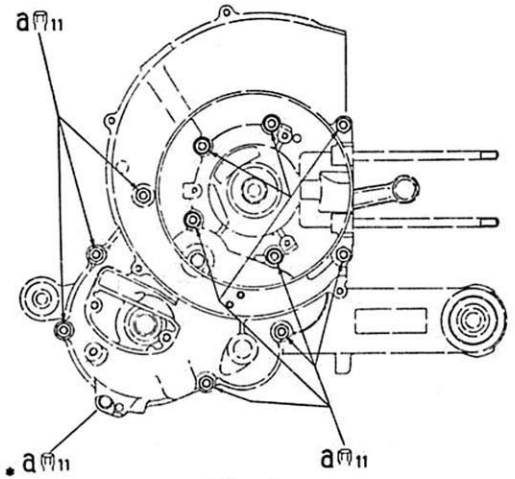



Fig 33

Crankcase bolts (unscrew diagonally and evenly)

**N.B.** The bolt marked with an asterisk is assembled in opposite sense in respect to the other bolts, when re-assembling, see that the longer bolt runs through pivoting arm of crankcase half, clutch side.

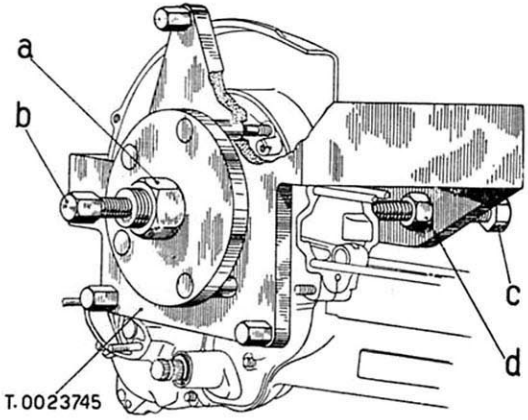



**Fig. 34.**

Crankcase half, flywheel side and crankshaft.
Set a pan for the engine oil to drip into, place the tool T. 0023745 on crankcase half, flywheel side and secure (see figure).
Screw down "c" until it stops against the crankshaft and secure by means of jam-nut "d".
Screw down "a" so as to push forward the plate provided with four pins. In this way the latter press against the four central studs of crankcase half, clutch side, so that the other crankcase half is detached. Unscrew "d" and "c". Release the tool and the flywheel side crankcase half and then screw down "b" in order to remove the crankshaft. Take care to hold the crankshaft to avoid its falling and being damaged.

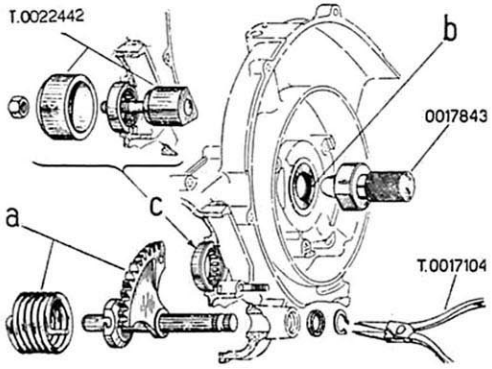



**Fig. 35**

(a) Starter unit.

(b) Oil seal on crankcase half, flywheel side.

**N.B.** This operation can be carried out only if the flywheel side main bearing remains on the crankshaft; if instead it slides off with the crankcase half, remove the ball bearing with the procedure illustrated in Fig. 36 before dismantling the oil seal.

(c) Mainshaft roller bearing.
Use tool T. 0022442; insert the threaded part of extractor through the bearing and through the "bell" of the tool; place the latter against the crankcase half; screw nut on extractor, thus pulling the bearing off.

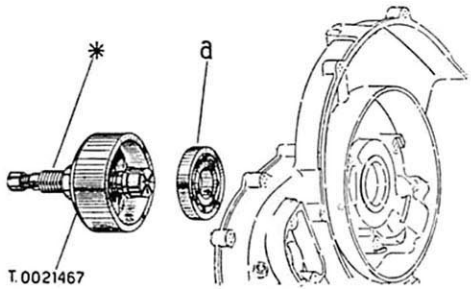



Fig. 36

Main bearings (if they remain in the crankcase).
( * ) Use part "1" of tool.

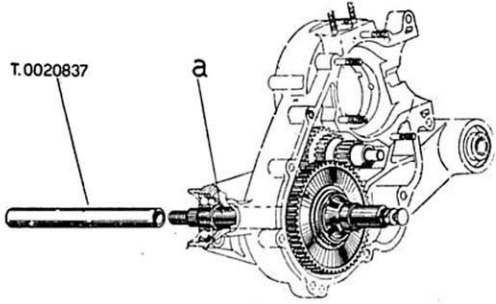



Fig. 37

Mainshaft with gear pinions and gear change mechanism (tap slightly on tube T. 0020837 to expel the unit).

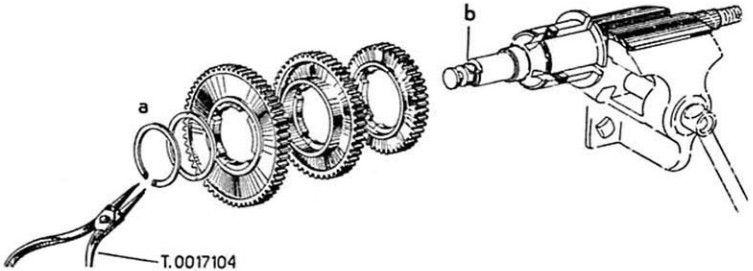



**Fig. 38**

Mainshaft unit. **N.B.** We remind that the selector is left-hand threaded. For withdrawing the guide bush of selector stem, straighten up the edges of the tab washer by means of a screwdriver.

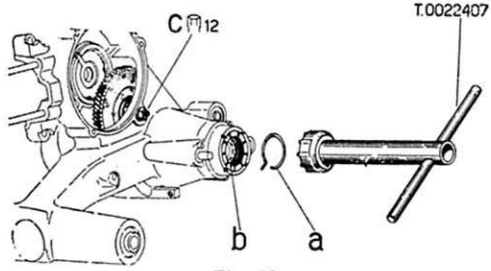



**Fig. 39**

(a) Circlip. (b) Threaded ring (left-hand threaded). (c) Gear cluster. Collect the 23 rollers. For dismantling the unit, see action "Overhauls", paragraph 5.

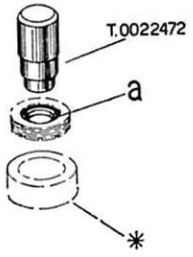



**Fig. 40**

Oil seal in the threaded ring.
(*) For removing the oil seal place the threaded ring on a piece of pipe having i.d. of 40 mm (1·57").

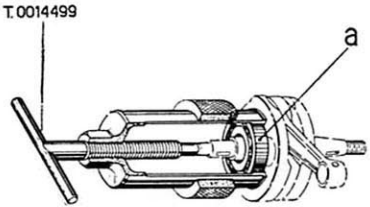



**Fig. 41**
Main bearings.

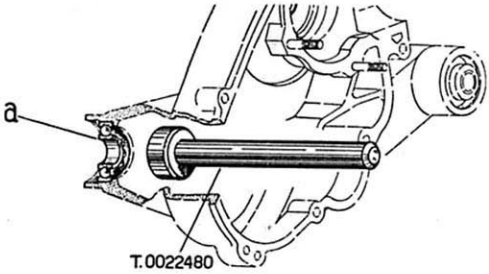



**Fig. 42**
Mainshaft ball bearing.

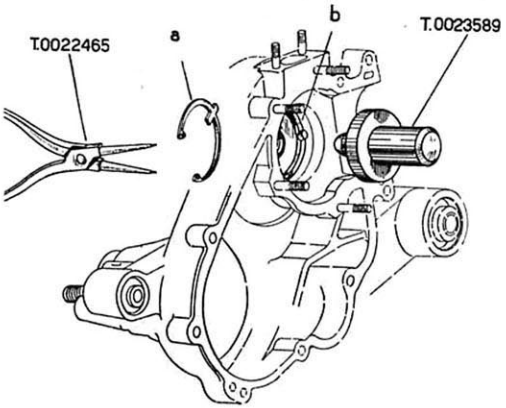



**Fig. 43**

(a) Circlip retaining the oil seal. (b) Oil seal of crankcase clutch side.

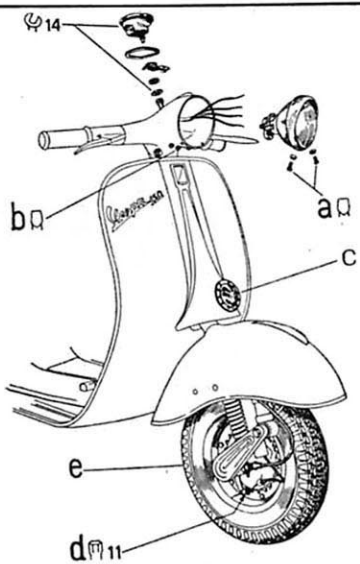



Fig. 44

(a) Headlamp (disconnect the wires). (b) speedometer (lift the instrument off its housing and unscrew the threaded ring). (c) Horn (remove the screws and disconnect the wires). (d) Brake cable (disconnect at the bottom end). (e) Wheel. Unscrew the four nuts (not shown in the figure) diagonally and gradually.

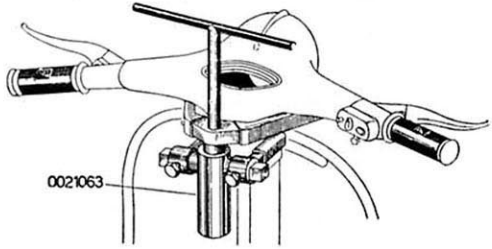



Fig. 45

(a) Handlebars.
Slide brake cable out of the steering column.

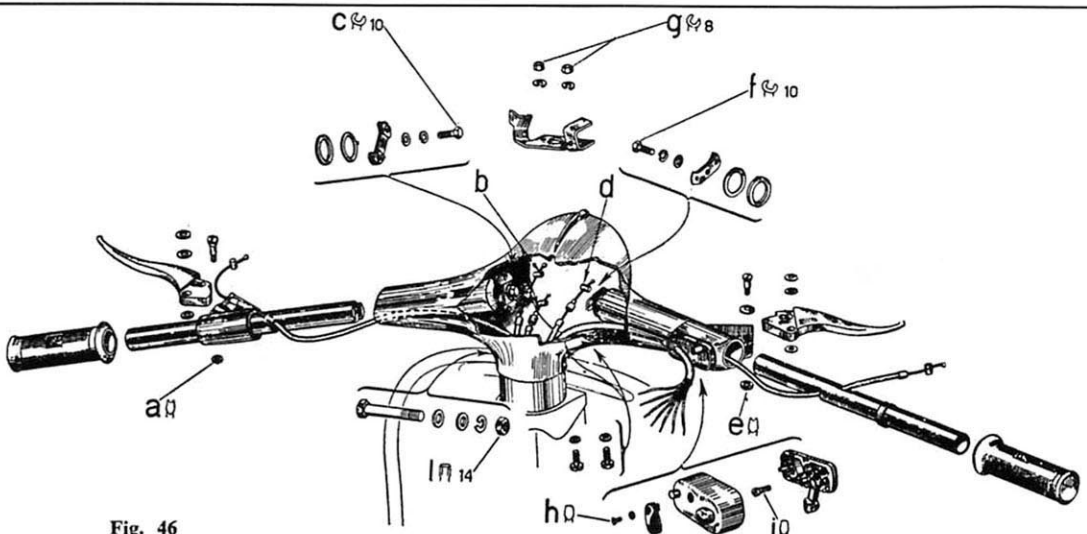



Fig. 46

(a) Handlebar components. This operation is also possible leaving the handlebars secured on top of the steering column.
(b) Light and dimmer switch. See at section "Overhauls", paragraphs 9a and 9b, how to replace the sleeve with front brake lever housing on handlebars.

**N.B.** The screwdriver for operations "a" and "b" may be either the specific 0017004, or a normal one with its blade shaped as shown in the figure.

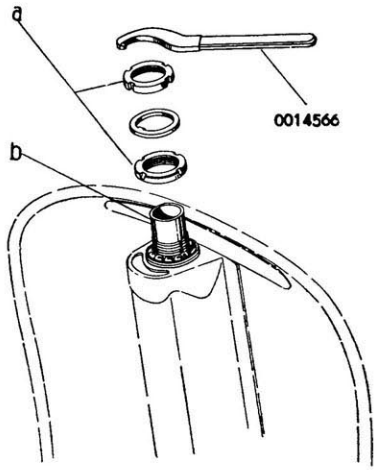



**Fig. 47**

(a) Top ball bearing.
(b) Slide off steering column downwards.

**N.B.** Collect balls, inspect them and, if necessary, replace.

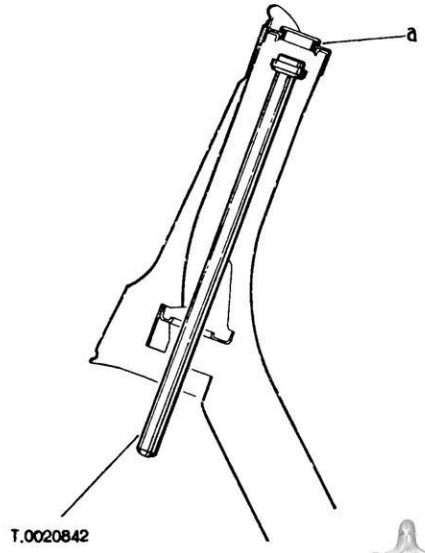



**Fig. 48**

Bottom race of top ball bearing.

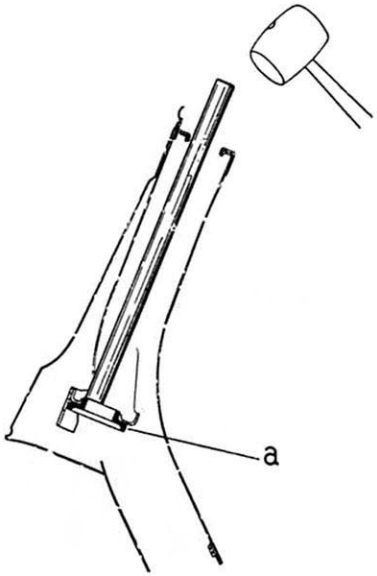
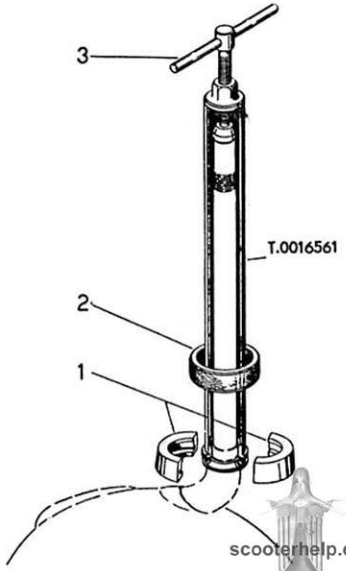



**Fig. 49** (left)

Upper race of steering column bottom bearing.

**Fig. 50** (right)

Dust cover and lower race of bottom ball bearing.
Use tool T. 0016561. Engage the parts to be extracted by means of split ring "1"; lower the knurled ring "2" to clamp the split ring "1". Screw down "3" until both race and dust cover are released.



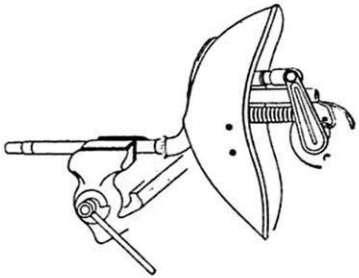
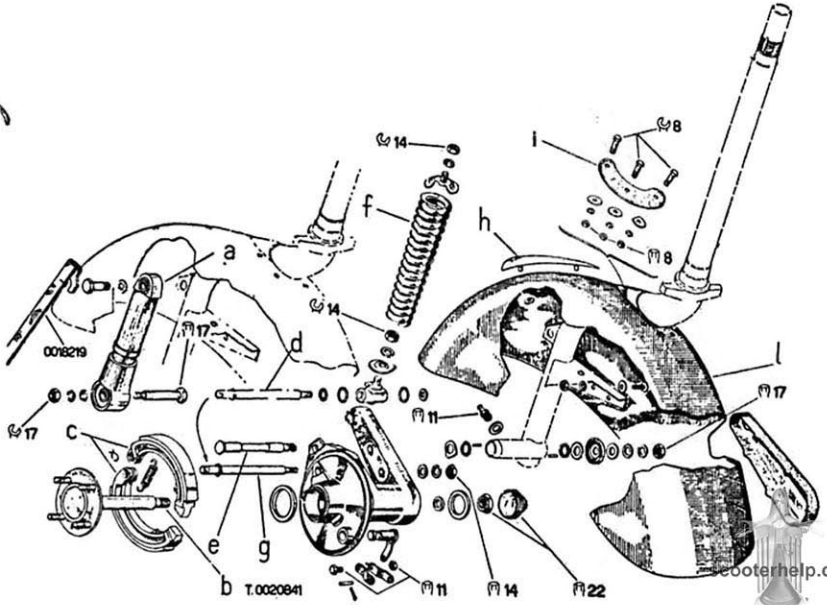


**Fig. 51**

Place the steering column in the vice and dismantle the unit following the order of the letters. For withdrawing the wheel spindle, use tool T. 0020841 in a similar way as the tool T. 0020837, shown in Fig. 37 for the mainshaft.



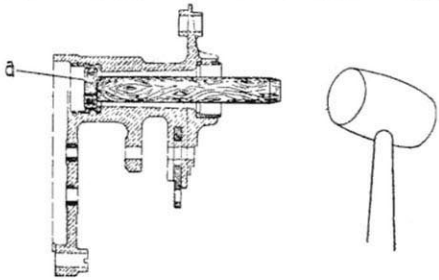
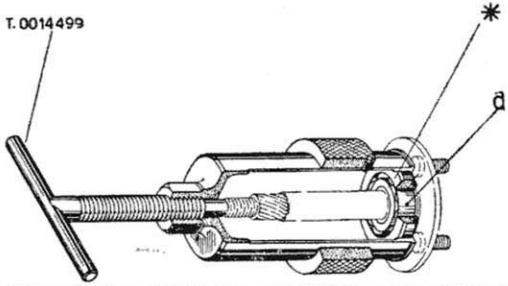



**Fig. 52** (above) Wheel hub bearing.

**Fig. 53** (below) Wheel spindle bearing.
(*) Use part "8" of tool T. 0014499.



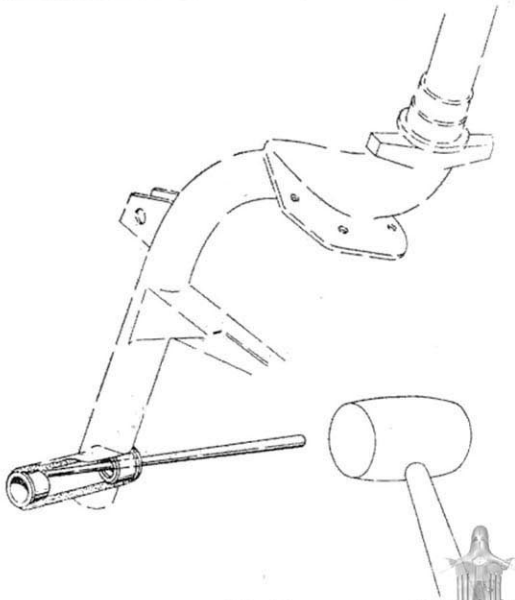



**Fig. 54**
Liners for wheel spindle.

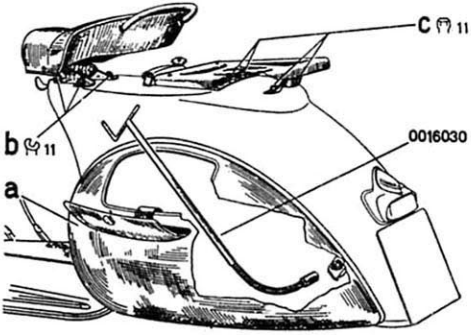



**Fig. 55**

(a) Tool box. (b) Saddle. (c) Luggage carrier.

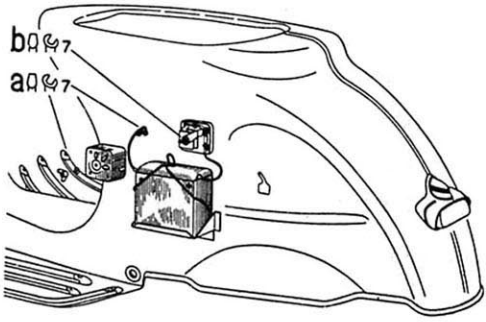



**Fig. 56**

(a) Battery. (b) Rectifier.

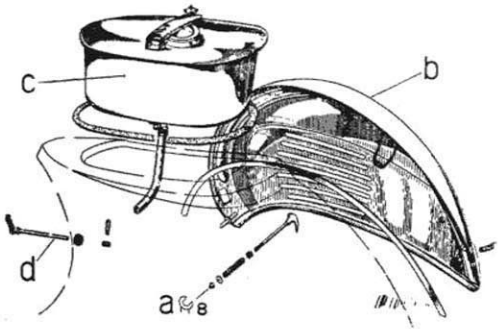



**Fig. 57**

(a) Engine cowling clamp lever. (b) Engine cowling. (c) Fuel tank with cock. (d) Fuel cock rod.

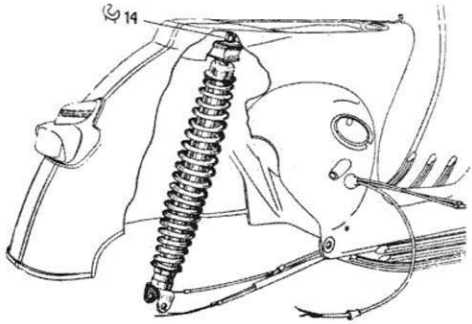



**Fig. 58**

Rear suspension.

## DISMANTLING THE FUEL TAP

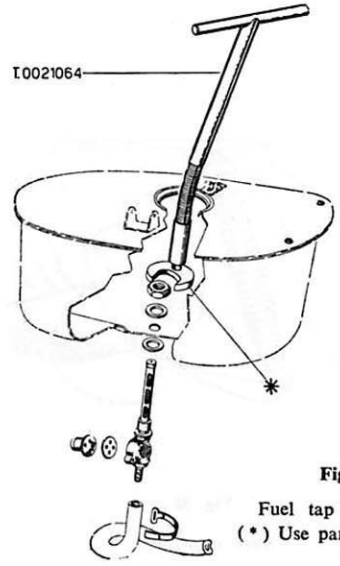



**Fig. 59**

Fuel tap and hose.
(*) Use part "11" of tool.

## REMOVAL OF SECURITY LOCK

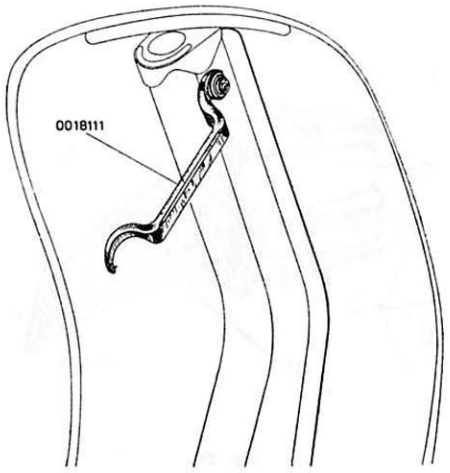



**Fig. 60**

Security lock (never lubricate).

## REMOVAL OF CENTRAL STAND AND TAIL LAMP

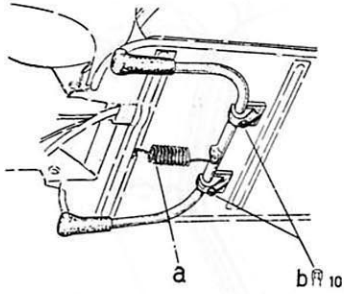



**Fig. 61.** Central stand.

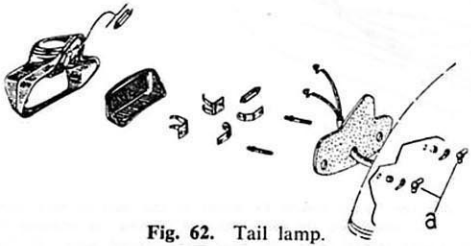



**Fig. 62.** Tail lamp.

## REMOVAL OF REAR BRAKE PEDAL

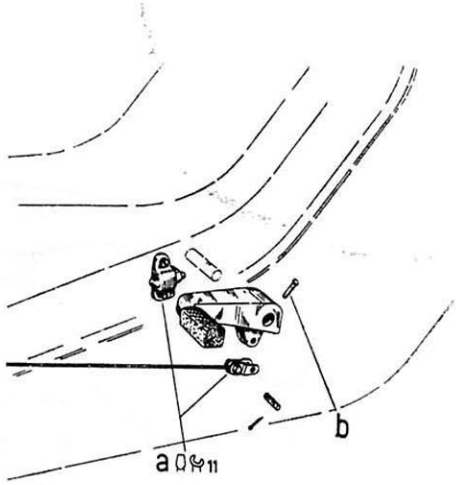



**Fig. 63**

Rear brake pedal with STOP light contacter.

**N.B.** Push down pedal to withdraw holding pin "b".

## REMOVAL OF CABLE HARNESS AND CONTROL CABLES

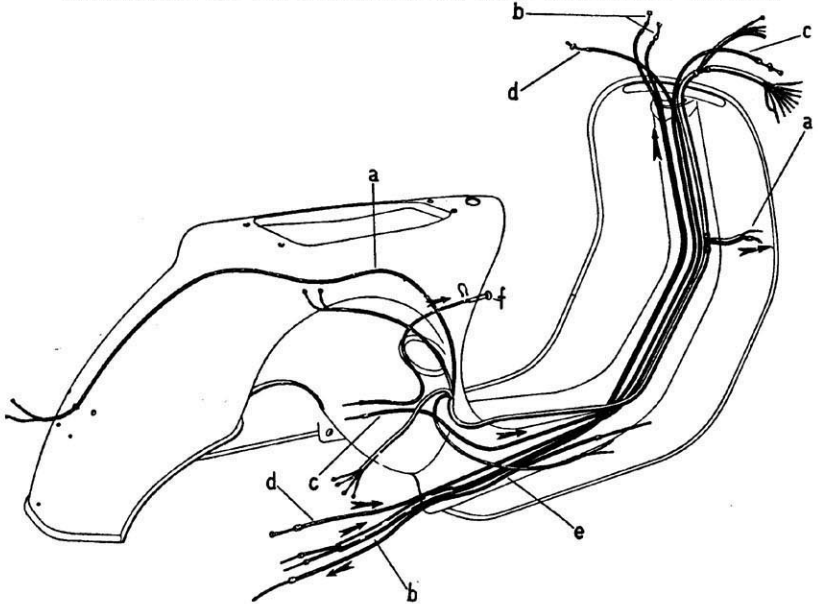



**Fig. 64**

**N.B.** In order to facilitate the re-assembly of new parts, a pilot wire (to remain inside the frame) should be bound to the ends of both control cables and electric wires when withdrawing them. Withdraw following the arrows, after unsoldering the cable tags and opening the retaining clips.
(a) Cable harness. (b) Gear change control cables. (c) Throttle control cable. (d) Clutch control cable. (e) Rear brake control cable. (f) Choke control cable.

# PERMISSIBLE TOLERANCES - UNIT OVERHAUL - FAULT FINDING

**(A) Tables of permissible assembling tolerances.**

These tables indicate the tolerances to be adhered to with new parts and the tolerance limits permissible for used parts.

**(B) Directions concerning overhauls, tests and special assemblies.**

This part deals with the following operations not mentioned in sections "Dismantling" and "Re-assembling".

1. Flywheel magneto.
   (a) Replacing the cam. (b) Re-magnetising the rotor. (c) Overhauling the stator. (d) Description of flywheel magneto test stand. (e) Test preliminaries. (f) Timing test. (g) Test at minimum revs. (h) Efficiency test. (i) Checking current intensity and voltage. (l) Overspeed test. (m) Timing the flywheel magneto without the test stand.
2. Rectifier inspection.
3. Clutch.
   (a) Replacement of clutch plates. (b) Checking total axial play of clutch plates. (c) Checking the transmissible statical movement. (d) Cable adjustment.
4. Gear shifter.
   (a) Replacement of lever. (b) Control adjustment.
5. Dismantling and re-assembling the cush drive.
6. Replacement of the pawl in the gear sector of starter assembly.
7. Attachment of engine to frame.
   (a) Removal. (b) Re-assembly.
8. Engine test on stand.
   (a) Description. (b) Propeller adjustment. (c) Consumption test on stand. (d) Standard test.
9. Replacement of handlebars sleeve.
   (a) Removal. (b) Re-assembly.

10. Replacement of steering cover.

11. Replacement of " Piaggio " medallion.

12. Replacement of twistgrips, beading of engine bonnet and rubber mat.

13. Alignment check of steering column.

14. Alignment check of frame.

15. Painting.
(a) Preparing the products. (b) Procedure "A". (c) Procedure " B ".

16. Shield protector.
(a) Removal. (b) Re-assembly.

17. Overhaul and working test of hydraulic dampers.
(a) Front damper. (b) Rear damper. (c) Notes.

18. Consumption test on the road.
(a) Premise. (b) Preparing the scooter. (c) Road test. (d) Calculating fuel consumption.

**(C) Tables to guide fault finding, respective remedies and directions to follow.**

The tables are composed according to the various scooter assemblies; they indicate the pages where directions are given for carrying out correctly the required operations. This section deals widely with all irregularities, troubles or faults which might be experienced by **Vespa** users.

Remedies and directions to be followed for eliminating the troubles are indicated in detail for every case.

All operations involved for tracing and locating faults, the consequent inspection and all necessary overhauls and adjustments must be carried out carefully and quickly by the Retailer, in order to return the scooter to the owner in the best possible condition, not to mention the prestige and personal advantage to the Retailer himself.

**Retailers should therefore study this section thoroughly, and carefully read paragraphs applicable whenever they have to inspect and test the scooter for locating and eliminating defects of any kind.**

---

**IMPORTANT. Overhaul of the crankshaft is not foreseen.**

## (A) ASSEMBLY TOLERANCES

These tables indicate the play prescribed for piston rings, cylinder and piston, piston and gudgeon pin, wrist pin and needle cage of con. rod small end, shoulder rings.

### PISTON RINGS

| Drg. No. | Part Name | Normal dimensions | Max. play | |
|---|---|---|---|---|
| | | | at assembly | after use |
| 80021<br>26578 | Ring, piston | Ø=57 | A=0·2–0·35 | A=2 |
| 83001<br>22690 | Ring, piston, 1st o/s | Ø=57·2 | | |
| 83002<br>27691 | Ring, piston, 2nd o/s | Ø=57·4 | | |
| 83003<br>27692 | Ring, piston, 3rd o/s | Ø=57·6 | | |
| 83004<br>27693 | Ring, piston, 4th o/s | Ø=57·8 | | |

All dimensions are in millimetres.

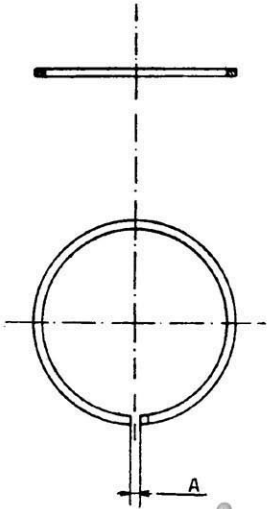



Fig. 65

## PISTON AND GUDGEON PIN

| Drg. No. | Part name | Normal dimensions | Max. play | |
|---|---|---|---|---|
| | | | at assembly | after use |
| — | Piston, normal | P = 15+0 −0·011 | R = 0 | R = 2/100 |
| 2/13127 | Gudgeon pin | Q = 15−0·009 −0·017 | | |

## CON. ROD - NEEDLE CAGE - GUDGEON PIN

| Drg. No. | Part name | Category | Normal dimensions | Max. play | |
|---|---|---|---|---|---|
| | | | | at assembly | after use |
| — | Con. rod | 1 | B = 19−0·003 +0·006 | A = 0·002−0·023 | A = 0·025 |
| | | 2 | B = 19+0·001 +0·010 | | |
| | | 3 | B = 19+0·005 +0·014 | | |
| 84291 | Cage, needle | 1 | C = 2−0 +0·002 | | |
| | | 2 | C = 2+0·002 +0·004 | | |
| | | 3 | C = 2+0·004 +0·006 | | |
| 2/13127 | Gudgeon pin | | Q = 15−0·009 −0·017 | | |

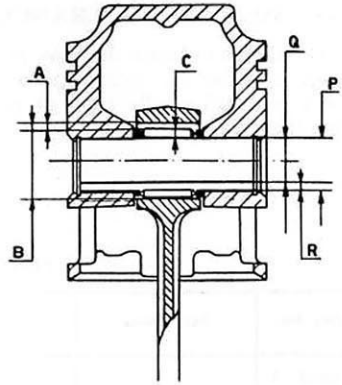



**Fig. 66**

Con. rods and needle cages of the same category should be assembled (see table). The category is marked on the con. rod small end (electric pencil) and on the edge of the needle cage (one, two or three notches depending on the category). Max. permissible axial play of con. rod on crankpin after use : 0·7 mm (0·027").

All dimensions are in millimetres.

## CYLINDER AND PISTON

| Part name | Normal dimensions | Max. play | |
|---|---|---|---|
| | | at assembly | after use |
| Cylinder, normal | E= 57−0 +0·019 | A=16/100 | A=20/100 |
| Piston, normal | C= 56·865±0·010 | | |
| Cylinder, 1st o/s | E= 57·2−0 +0·019 | | |
| Piston, 1st o/s | C= 57·065±0·010 | | |
| Cylinder, 2nd o/s | E= 57·4−0 +0·019 | | |
| Piston, 2nd o/s | C= 57·265±0·010 | | |
| Cylinder, 3rd o/s | E= 57·6−0 +0·019 | | |
| Piston, 3rd o/s | C= 57·465±0·010 | | |
| Cylinder, 4th o/s | E= 57·8−0 +0·019 | | |
| Piston, 4th o/s | C= 57·665±0·010 | | |

All dimensions are in millimetres.

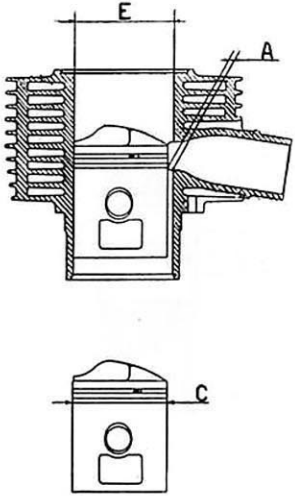



Fig. 67

**Cylinders and pistons supplied as spare parts by the Manufacturer are marked with alphabet letters. The dimension "C" is also marked on the piston (see Fig. 66). In order to ensure the prescribed play of piston and cylinder, when both new, see that they are marked with the same letter. If, instead, the cylinder is ground and a new, oversize piston is assembled, it is essential that the dimension "E", with its tolerance, is obtained. Said dimension is to be checked on a plane normal to the gudgeon pin and containing the con. rod axis.**

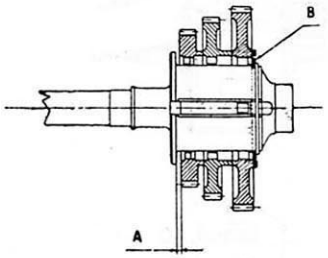



**Fig. 68**

When prescribed play at "A" is exceeded with use of normal size shoulder ring "B", replace the latter by another of proper o/size.
Inspect by means of feeler gauge 0018094.

**SHOULDER RINGS**

| Drg. No. | Part name | Normal dimensions | Max. play | |
|---|---|---|---|---|
| | | | at assembly | after use |
| 18558 | Shoulder ring | 2·05+0 −0·06 | A=0·15−0·30 | A=0·50 |
| 20321 | Shoulder ring, 1st o/s | 2·25+0 −0·06 | | |
| 20322 | Shoulder ring, 2nd o/s | 2·45+0 −0·06 | | |
| 20323 | Shoulder ring, 3rd o/s | 2·65+0 −0·06 | | |
| 20324 | Shoulder ring, 4th o/s | 2·85+0 −0·06 | | |

All dimensions are in millimetres.

## 1. FLYWHEEL MAGNETO OVERHAUL

### 1a Replacing the cam

1. Make a mark on inner face of rotor to indicate the position of the key way on the cam.
2. Grind off the rivet heads on the outer face of the rotor.
3. Remove washer "a" (see Fig. 69), then push the rivets out by means of the pin punch 550805.
4. Assemble the new cam following the mark (paragraph 1), then bore out the holes by means of a 4·5 mm reamer (0·177") the cam itself functioning as a drill jig.
5. Bore out to 4·5 (0·177") the holes of washer "a" mentioned in paragraph 3; mount washer on outer face of rotor, then the cam and o/size rivets; clench the latter, following the sequence as indicated in Fig. 69, by means of supporting block T. 0021481 and riveting punch 550804.

**N.B.** In order to lock the washer "a" properly under the rivet heads, recess the supporting block T. 0021481 (or the previous block T. 0015724 still employable) so that the

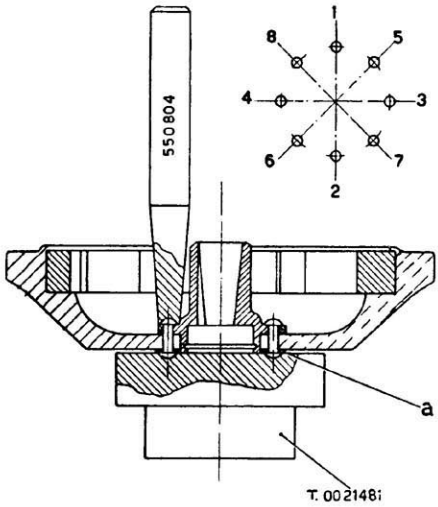



**Fig. 69.** Riveting the rotor cam.

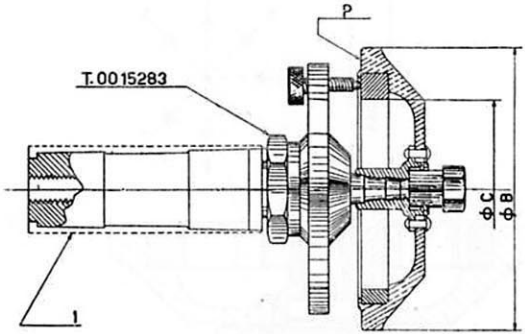



**Fig. 70.** Checking dia. concentricity.

**N.B.** Mandrel "1" is delivered with cylindrical stem (dotted line) for fitting to any available lathe.

protruding portion of the cam is housed therein without resting on the block surface.

6. By means of mandril T. 0015283 and a dial gauge ensure that both dia. "B" and "C" are concentric (see Fig. 70) and plane "P" is normal to rotating axis. Skim dia. "B" on a lathe if the error exceeds 0·3 mm (·00118″). Fasten the rotor, by dia. "B", on an independent chuck lathe with dial gauge, and skim dia. "C" if it is not cencentric; take care not to exceed the max. size of 106·4 mm (4·2″). In order to avoid that the three screws of the tool press on the aluminium edge of the rotor. Retailers who have the old mandril should chamfer the screw tips accordingly.
7. Check diameters for concentricity again by means of mandril 0015284 and dial gauge (see Fig. 71). Use the same mandril to check the rotor for balance on the two rails "a" shown in said figure. If necessary, balance the rotor properly by drilling some blind holes on the face of the pole piece (see "F" in Fig. 71).

### 1b Re-magnetising the rotor

1. Clean with very fine emery paper the inner diameter of rotor. Wipe the surface with clean rags soaked with paraffin, then dry.

2. Place the rotor into the magnetising fixture, drg. No. 0022547 (see Fig. 72) so that one of the three **south** poles of the latter covers completely the pole piece of the rotor opposite to the key way on the cam.
   The fixture must be fed with d.c. not less than 22-24V, 90 A, which may be supplied either by a battery or through a converter or rectifier.
3. Depress the knife-switch seven times consecutively, each contact lasting 1·5 - 2 seconds.
4. Lift out and check the rotor for magnetisation; it should be capable of supporting a piece of iron of regular shape with a weight not less than 0·5 Kg. (1 lb. 2 oz.).
   **N.B.** Mate the rotor immediately with the stator or place three pieces of iron on its inner diameter in order not to lose magnetisation.

### 1c Stator overhaul

Replace coils by means of base fixture 13768/C (see Fig. 73) as follows:

1. Assemble the new coil (which is delivered with the laminations already finished on the lathe) with screws, finger tight.
2. Place the stator into suitable housing of part "b".

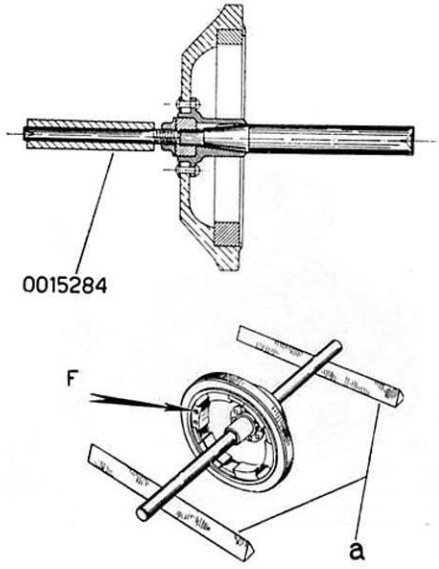



**Fig. 71.** Rotor balance inspection.
F: Blind holes drilled for balancing properly.

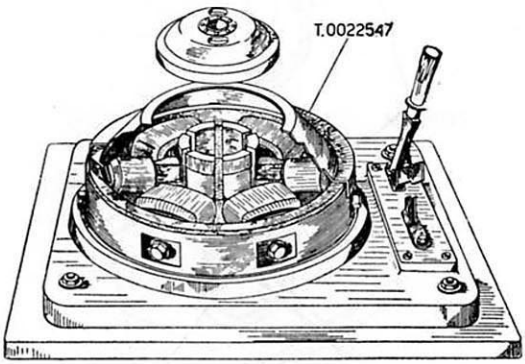



**Fig. 72.** Magnetiser.

3. Mate "a" properly to "b".
4. Hold the coil in such a position that the turned laminations are in contact with the I.D. of "a", then tighten the two screws securing the coil.

Use the part "b" of the fixture 13768/C as a support for dismantling and re-assembling the stator, and proceed with sequence indicated at page 47, Fig. 30.
Particular care is called for on following points while re-assembling :

(a) Secure the coils as indicated in the paragraphs 1-4 above.

(b) Rub the surface of the laminations where cable tag is fastened.

(c) The screw securing the adjuster cam should be tightened on completion of assembly, after adjusting to 0·3-0·5 mm (0·011 - 0·019") the gap between the breaker points. This adjustment is to be made on the flywheel magneto test stand, the skid of the breaker arm being on the point of maximum lift of the cam (see also timing instructions in the following pages).

(d) The lubricating felt should be set to press slightly against the smallest diameter of the cam.

### 1d Flywheel magneto test stand

The flywheel magneto test stand 8290/R (see Fig. 74) consists of the following units :

a repulsion motor, revolving in both senses with speed up to 5,000 r.p.m.
Specification : 220V-50Hz-2·1 h.p. at 2,400 r.p.m., revs counter, right-angle drive, dials covering a 0-30 speed range (multiplying factor: 200);

a two-position switch (min.-max.) to divide the speed range into two sections; from 0 to 2,000 and from 1,000 to 5,000 r.p.m. approx.;

a rotary spark gap consisting of a graded disc and a pointer integral with the flywheel shaft;

a support for the unit to be tested, with coupling between rotor and gear-up device. The support is normally provided with two clamp boards: one for connecting flywheel cables with standard tag, the other one for connecting flywheel cables with a pin-shaped tag (Vespa G.S.). Said cables can also be connected directly to the clamps on the panel, leaving off the clampboards;

a gear-up device with a ratio : 1 to 1·826;

a coupling betwen motor and gear-up device;

a bracket for the H.T. coil and a switch for switching in the revolving pointer and the three-

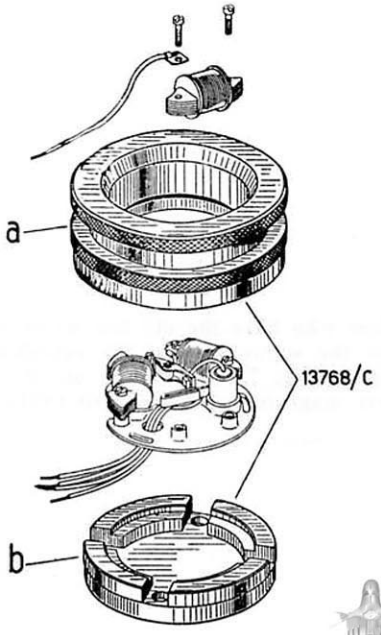



**Fig. 73.** Replacing the coils on the stator.

**Retailers who have the old test stand shall carry out on the stator support the modifications indicated on Fig. 75 in order to use it for testing flywheel magnetos of Vespa 150 (VBA).**

point spark gap which are to be connected to the H.T. coil by means of cables provided;

an instrument panel.

The instrument panel has the following installations :

(a) a high tension circuit including the three-point spark gap (Fig. 76).

(b) 11 resistors (shunting the spark gap) switched in by means of a lever, to measure the efficiency of the flywheel magneto;

(c) sets of bulbs to form the different loads according to the positions of the three switches illustrated hereunder;

(d) sets of impedances, rectifiers and batteries for the different vehicles.
They are automatically switched in or off during the test, in the same way as on the vehicle, by operating the main switches;

(e) horns (on alternating or direct current) with respective push buttons;

(f) a voltmeter and an ammeter.

(g) seven clamps, where the specific circuits are marked, for connecting the electric cables from the flywheel magneto (see **N.B.** pages 77 and 78);

(h) 3 main switches (1-2-3 of Fig. 74), each showing the specific positions for the different

flywheel magnetos to be tested (see page 80). They control respectively :

1. (L.H.) : the impedance, rectifier and battery;

2. (centre) : low tension loads, namely: lights off ("O"), direct current ("C.C."), alternating current ("C.A.").

3. (R.H.) : ohmic loads specific of the different models.

(i) 2 switches (4 and 5 in Fig. 74), with two positions, for Vespa Commercial and Vespa G.S. having battery coil ignition (see also page 80).

**N.B.** Connect the clamps as follows :

"M" : flywheel magneto earthing cable
"A.T.": high tension cable from the switching box of the external ignition coil for switching in the three-point spark gap.
"LUCE" : yellow, low tension cable.
The cable that on the scooter feeds current from flywheel to battery should not be connected to any clamp. The impedance-rectifier-battery unit on the test stand should be cut-off from the panel, f. i. by disconnecting one of the battery cables.

The other four clamps on the panel have the indications :

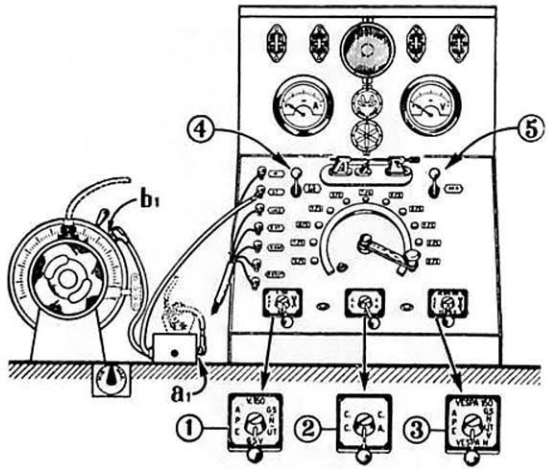



**Fig. 74.** Flywheel magneto test stand.

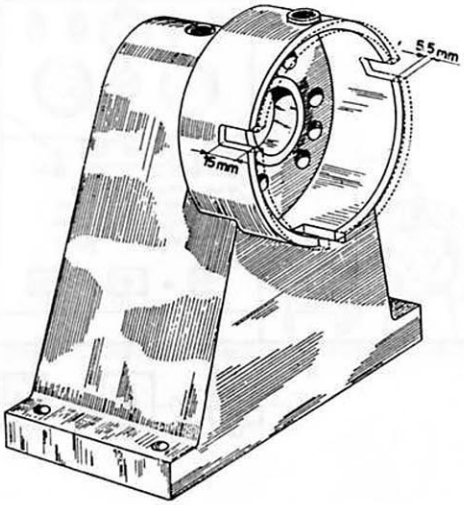



**Fig. 75.** Modified stator support.

"BOBINA A.T." for Vespa G.S. with battery coil ignition (starting from scooter with frame No. VS2T 0013301): d.c. cable from the battery to the primary winding of the ignition coil.

"RADDR. G.S.N.": cable for Vespa G.S. rectifier with half wave bridge (on scooter with frame No. VS2T 0013301 to 0023310).

"RADDR. G.S.UT." } Cables for Vespa G.S. rectifier with full wave bridge (starting from scooter with frame No VS3T 0023311).
"RADDR. G.S.UT." }

**1e Test preliminaries**

(a) Mount the ignition coil and the stator on respective supports, then secure the stator with the three screws.

(b) Take the black cable from the flywheel and connect it to clamp "1" of the primary winding of the external ignition coil (Fig. 74). Clamp "2" of said coil should be connected with the red cable from the flywheel magneto.

(c) Set the switches as indicated on table at page 80, section A.

(d) One of the two high tension cables coming from the switching box should be connected to clamp "b1" located on the rotary spark gap, and

the other to the H.T. clamp on the panel. The lead from the coil must be directly connected to clamp " a1 " (see Fig. 74).

### 1f Timing test

1. Draw a line from the shaft axis to one end of the ignition coil lamination and make a mark ("a", Fig. 77) where the line intersects the rotor bracket. Follow the same procedure for the other end of the lamination and mark point "b" accordingly.
2. Scribe a mark "c" on the rotor to indicate the middle of pole shoe opposite to the key way on the cam.
3. Mount the rotor on the shaft, seeing that the woodruff key fits in the key way, and secure.
4. Revolve the rotor by hand until the mark "c" tallies with mark "a", then read the position of the rotating pointer. Let mark "c" tally with "b", then read the position of the pointer again.
5. Bring the rotating pointer to a position halfway from those of previous readings (see point "4").
6. Run the rotor at 150-200 r.p.m. and check the timing of the breaker points by pushing the switch button; in such conditions, sparking

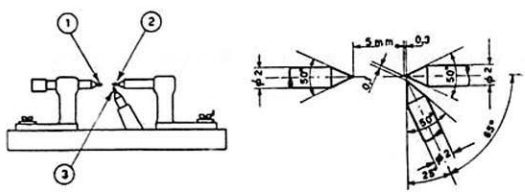



**Fig. 76.** Three-point sparkgap.
1. Adjustable point. 2. Fixed point. 3. Third point.

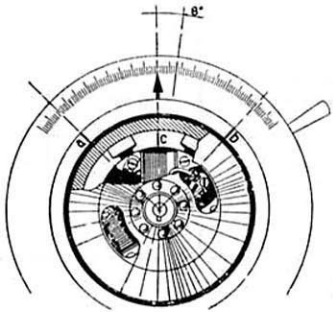



**Fig. 77.** Timing the stator.

**Switch positions on panel of flywheel magneto test stand 8290/R.**

| Machine | SWITCHES | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| **(A)** All Vespa models (not G.S.) | V.150 | "O" or "C.A." depending on the test | V.150 | Lever downwards | Lever downwards |
| **(B)** All Vespa 125 models | N | "O" or "C.A." depending on the test | Vespa N. | Lever downwards | Lever downwards |
| **(C)** Vespa G.S., Mod. 55<br>Vespa G.S., Mod. 56, 57, 58 | G.S.V.<br>G.S.N.UT. | "O" or "C.A." or "C.C." depending on the test | G.S.-N.UT.V. | Lever downwards | Lever downwards<br>G.S.N. Lever upwards |
| **(D)** Vespa Commercial 150 and Mod. "C" with normal starter assembly. | APE | "O" or "C.A." or "C.C." depending on the test | APE | Lever downwards or upwards (C.C. APE) depending on the test | Lever downwards |

should occur 8° in a clockwise direction after the position explained on point "5". If not, adjust the breaker points.

### 1g Test at minimum revs

At least 85% of sparks should occur when running the rotor at 150 r.p.m. with lights on and (0·197″) gap (see Fig. 76).

### 1h Efficiency test

Run at 1,500 and 4,000 r.p.m. with low tension load both on and off.
In such conditions, shunting the spark gap with non-inductive resistors, the efficiency, as expressed in micro-siemens, should be :

| | | 1,500 r.p.m. | | 4,000 r.p.m. | |
|---|---|---|---|---|---|
| L.T. circuit switched on | 2-4 | $\mu$ | S 4- 6 | $\mu$ | S |
| L.T. circuit switched off | 3-5 | | S 7-11 | | S |

Steady sparking should occur at the spark gap.

### 1i Checking current intensity and voltage

In the foregoing conditions and with L.T. load on (switch No. "2" in position "C.A.")

4·8 - 5·2 Amperes
6·8 - 7·6 Volts

should be obtained at 4,000 r.p.m.
The horn should not absorb over 1·7 Amperes.

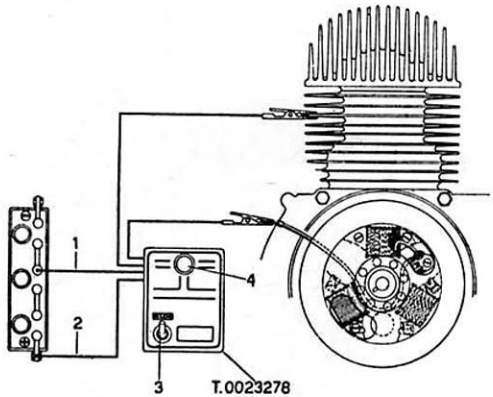



**Fig. 78**

Tool for timing the flywheel magneto without the test stand.

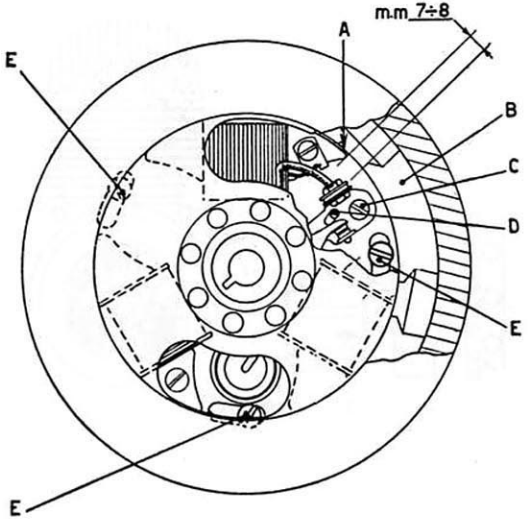



**Fig. 79.** Timing the flywheel magneto.

### 1l Overspeed test

Run the rotor at 5,000 r.p.m. for two minutes, with lights off. Steady sparking should occur at the spark gap during this test.

### 1m Timing of flywheel magneto with no test stand

The new tool T. 0023278 (see Fig. 78) shows exactly, without any need of a test stand, when breaker points begin to open; this is essential for obtaining the perfect timing of flywheel.
This tool is provided with a test circuit consisting of an electromagnetic vibrator and a 6V-1W bulb connected in parallel.

1. Remove fan cover and fan.
2. Connect one of the two clamps of tool T. 0023278 with the engine earth (e.g. the cylinder fins) and the other with the flywheel earthing cable.
3. Connect the cables "1" (green) and "2" (red) of the tool with a 4V direct current source, as indicated in Fig. 78. This voltage can be obtained from just two cells of a Vespa battery.
4. When the switch "3" is on, the vibrator starts; with breaker points closed, bulb "4" remains off; turning the rotor in a clockwise direction, the breaker points open and the

bulb lights. At this moment inspect, through the flywheel opening, to see the rotor position as regard to the H.T. feeding coil on stator; the flywheel is correctly timed, if the distance between the visible end "A" of the coil (see Fig. 79) and the edge "B" of the pole shoe of rotor opposite to the key way on the cam is 7-8 mm (0·27 - 0·31″).
If not, loosen screw "C" (see Fig. 79) and then set, by means of a screwdriver, the cam "D", which controls the position of breaker arm, until the bulb lights when points "A" and "B" are 7-8 mm (0·27-0·31″) away from each other.
Tighten screw "C" again.

5. Check by means of a standard feeler gauge that the gap between breaker points is 0·3-0·5 mm (0·011-0·019″). In the contrary case, replacement of breaker is called for.

6. Now you can start with the engine timing; remove the rotor, slacken the three screws "E" (see Fig. 79) retaining the stator on the crankcase. Then rotate the stator to the proper position for obtaining the required spark advance. Check the latter by means of timing gauge T.0016205 (see section "Re-Assembly").

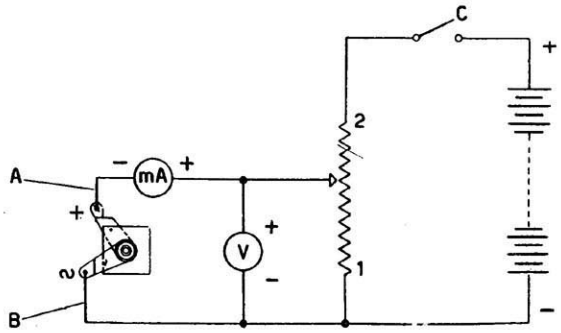



**Fig. 80.** Rectifier inspection.

**N.B.** Switch "3" must be left on just for the time necessary to see when breaker points begin to open, so as to limit the current consumption and the progressive discharge of the battery cells.

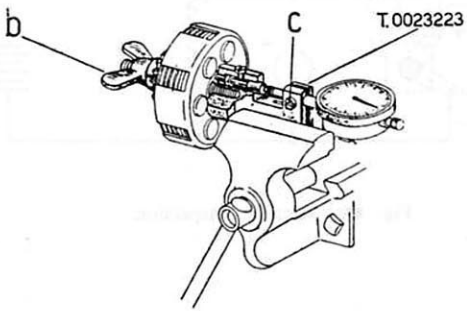



**Fig. 81**

Checking the total axial play of clutch plates.

## 2. INSPECTION OF RECTIFIER

In case of troubles in the d.c. circuit (battery becoming discharged, difficult re-charging, shorting, etc.), the efficiency of the rectifier should always be checked. For this, it will be sufficient to check the directional property, namely the efficiency of the " blocking " layer of the rectifier. The latter should be able to stand the very high " reverse " tension of the generator during the negative half period; in other words, its resistance to the current flow in the " forward " or conducting direction should be very low, whilst we expect a very high resistance to the current flow in the " reserve " direction. Have following equipment at your disposal :

(a) moving coil voltmeter for direct current, 0-30V scale;
(b) moving coil milliameter for direct current, 0-5 mA scale;
(c) sliding rheostat; R = 1,000 Ω current rated at 100 mA;
(d) battery consisting of four 6V-7Ah accumulators.

Set the rheostat on point "1" (see Fig. 80), connect the cables "A" and "B" respectively with terminals " + " and " ⏦ " of the rectifier.

Close switch "C", and adjust the tension on 6V and

20V value; the current flow in " reverse " direction should not exceed 1 mA at 6V and 10 mA at 20V.

## 3. CLUTCH

### 3a Replacing the plates

The tool T. 0023223 (see Fig. 81) is required for dismantling the clutch unit, as follows.

(a) Fit the clutch assy. in the tool.

(b) Tighten the wing nut "b" to compress the six springs, thus enabling extraction of retaining circlip.

The tool can be used in a similar way for re-assembling the unit.

### 3b. Checking total axial play of clutch plates

When replacing clutch components (plates or springs), Retailers should make sure, after re-assembly, that the total axial play for the clutch plates to disengage and the transmissible statical moment are within the limits indicated below. Operate as follows.

(a) Provide the tool T. 0023223 with a dial gauge to be secured with screw "c" (Fig. 81).

(b) Mount the clutch assy. on the tool.

(c) Tighten the wing nut "b" as far as possible: the total axial play for the plates to disengage,

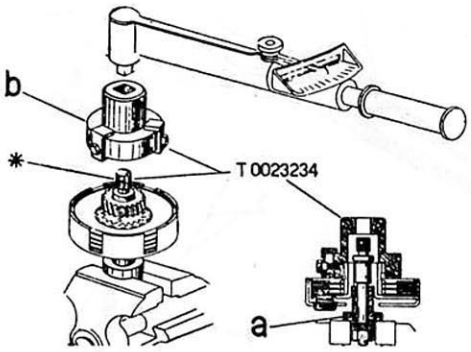



**Fig. 82**

Checking the transmissible statical moment.

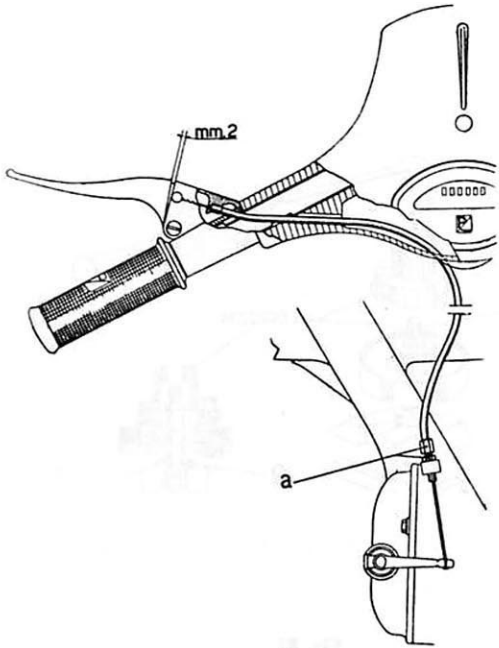



Fig. 83. Clutch control adjustment.

as read on the dial gauge, should correspond to 2·7 - 3·3 mm (0·106 - 0·129″) on new clutches and 2·7 - 3·9 mm (0·106 - 0·153″) on clutches run-in on the test stand.

### 3c Checking the transmissible statical moment

(a) Secure the clutch assy. in a vice by means of the pin (component No. 2 of tool T. 0023234, shown with an asterisk on Fig. 82) and the bush "a".

(b) Fit part "b" on the clutch gear so that the three stirrups engage under the set of spiral teeth, while their screws will fit between the teeth of the gear when tightening.

(c) Take a dynamometric wrench having sufficient accuracy to record values of 2 to 6 Kgm (14·5-43·4 ft/lbs), and see if the moment corresponds to 3 - 4·3 Kgm (21·7 - 31·2 ft/lbs) on new clutches and 2·2 - 4·3 Kgm (18 - 31·2 ft/lbs) on clutches run-in on the stand.

### 3d Control adjustment

Engage contemporarily with two 8 mm open-ended wrenches the hexagons of both adjuster screw "a" and lock nut in order to slacken the latter (see Fig. 83).

The cable is to be tensioned or loosened, as the case may be, so that the 2 mm gap (0·078″) of the

indicated points in respect to each other is attained before the control lever on engine starts operating.

## 4. GEAR SHIFTER

### 4a Replacement of internal operating lever

1. Mount the index plate casing on fixture T. 0022192 as shown in Fig. 84.
2. Rotate the shifter lever "a" 180° in a clockwise direction, in respect to the position shown on Fig. 84 to stop against the casing edge.
3. Push the pin a little inwards.
4. Rotate the lever "a" to original position, pull out the pin with pliers then slide the lever off.
5. Place the new lever "a" in correspondence of the stem housing.
6. Slide the quadrant "b" in and press in the pin as shown on Fig. 84.

**N.B.** Whenever the stirrup has been dismantled, the edge of the shifter casing is to be spot-punched on the slot of the stirrup pivot at re-assembly.

### 4b Control adjustment

Should the control have excessive play in neutral, tension either control cable by screwing back the respective adjuster screw ("a" in Fig. 85) with an open-ended wrench. If the cable tension in neutral is correct but the reference marks of the handlebars do not tally, tighten one of the adjuster screws

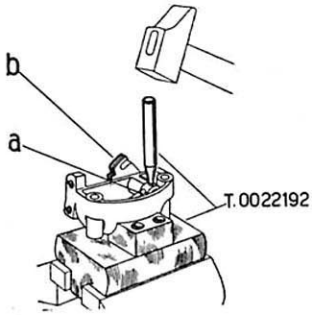



**Fig. 84.** Assembling the gear shifter internal lever.

**N.B.** Wrong play in the control may cause the clutch plates burning out even in normal running conditions.

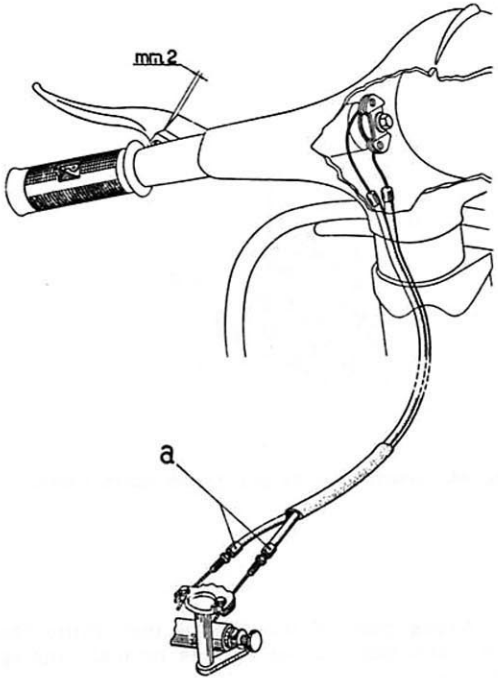



**Fig. 85.** Gear change control adjustment.

and unscrew the other one to the same extent, so that the cable tension is not altered.

## 5. CUSH GEAR

The cush gear is to be dismantled whenever the springs, or the outer gear or the gear cluster, have to be replaced. Remove the rivet heads, then place the cush gear on the tool 0015413 (Fig. 86) and drive the rivets out by means of a punch. The tool may be used in a similar way for re-assembling the unit.

## 6. REPLACEMENT OF PAWL ON GEAR SECTOR OF STARTER ASSEMBLY

By means of a ⌀ 4 - 4·5 mm (0·19 - 0·21") drill to half length the rivet securing the pawl on the gear sector; then drive the rivet out by means of a pin punch. Place the gear sector on tool T. 0022342 as shown on Fig. 87; the tool must be clamped in a vice.
Position the new pawl properly and then rivet it.

## 7. COMPONENTS FOR ATTACHMENT OF ENGINE TO FRAME

### 7a Removal

(a) Straighten up the spindle end, that shall slide through the rubber bushes, in the four points

where it had been spot-punched; remove the spacer, then engage the other spindle end by means of the tool and pull it out (see Fig. 88). Pry the rubber bushes off their seats by means of a screwdriver.

(b) Remove the liner and rubber bush for attachment to the rear suspension in a similar way.

**N.B.** In the above-mentioned operations, the tool T. 0018190 is to be used without parts Nos. 6 and 7, and tool T. 0022553 without part Nos. 3, 5, and 6.

### 7b Re-assembly

(1) Always use new bushes. Dip the bushes in a "Polvere Acquarex" solution (supplied by the Firm upon demand) consisting of 7 grams of powder per 2·5 litres of water (about 11 g per U.S.A. gal. or 13 g per imp. gal.). By the aid of a hydraulic press, with power of 5 t at least, force the rubber bushes **a** in position seeing that their tapering ends show as indicated in Fig. 89.

2. Fit the spindle **b** into tapering sleeve (part No. 12 of the tool) and secure by means of part No. 17, as shown on Fig. 90.
Place the whole as shown in the figure, lubricate the spindle with the "Acquarex"

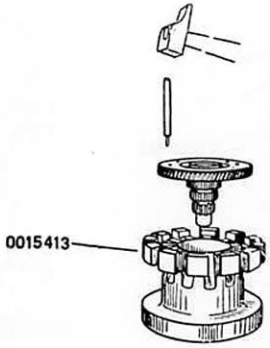



**Fig. 86**

Dismantling the cush gear.

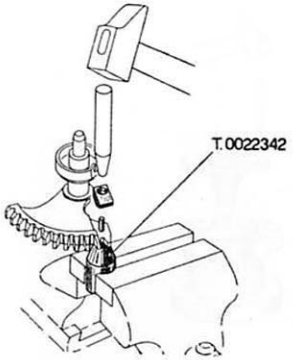



**Fig. 87.**
Assembling pawl on gear sector of starter assy.

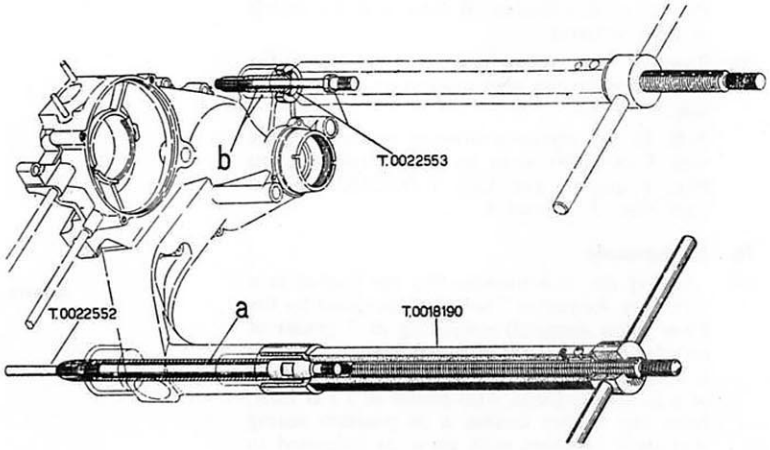



**Fig. 88**
Dismantling parts for attachment of engine to frame.

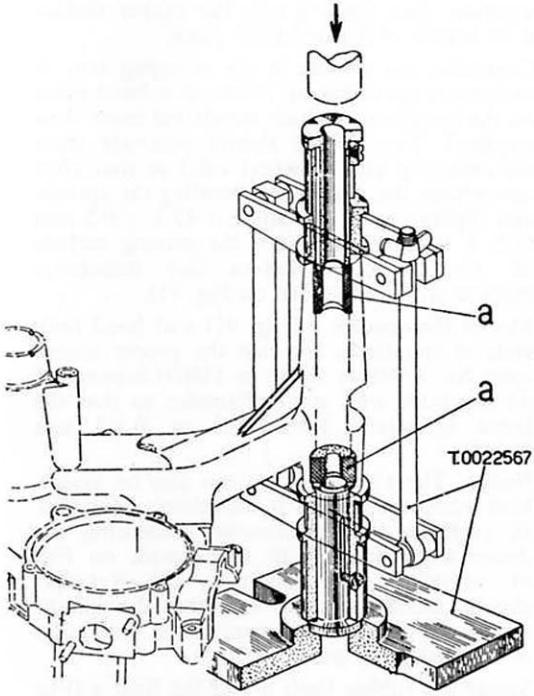
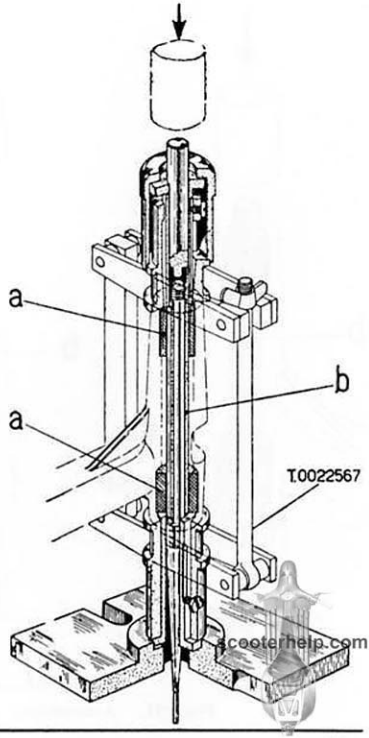



**Fig. 89** (left)

Assembling rubber bushes.

**Fig 90** (right)

Assembling the inner spindle fixing the engine.



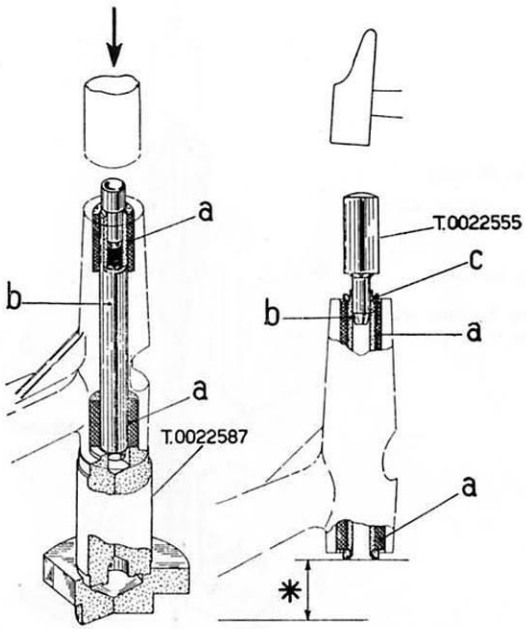



**Fig. 91.** Assembling spacers.

solution, then force it into the rubber bushes **a** by means of the hydraulic press.

3. Centralise the spindle in the swinging arm, if necessary, operating by means of a hand press on the spindle end which stands out more than required. The spindle should protrude from the swinging arm (flywheel side) so that after assembling the spacer and bending the spindle end (operation 4), the latter is 45·3 ± 0·5 mm (1·8 ± 0·02″) away from the joining surface of the crankcase halves (see dimension marked with an asterisk on Fig. 91).

4. Mount the spacers **c** (Fig. 91) and bend both ends of spindle **b.** See that the proper spacer (part No. 47946 or 48988 or 48989) is mounted on the bush with small diameter so that the latter is axially force-fitted by 0-1·5 mm (0·06″).

   **Notice.** These components can also be assembled when the engine is completely mounted. In such as case, of course, measuring the dimension marked with an asterisk on Fig. 91 would be very difficult; the Retailers should, therefore, make sure that the spindle stands out by the same amount on both sides of the swinging arm.

5. Smear the rubber bush **d** and the liner **e** (Fig. 92) with "Acquarex"; press the bush in by

hand, then assemble the liner by means of tool provided.

## 8. ENGINE TEST ON STAND

### 8a Description of the stand.

The engine test stand, Drg. 8002/R, consists of a metal table which carries the following structures (see Fig. 93).

1. Engine brackets and propeller unit with its drive.
2. A control board and a panel with different bulb sets which are switched on by means of a switch with different positions depending on which engine model is being tested.
   Two horns, for a.c. and d.c. respectively, are also fitted on the panel.
3. Fuel tank and burette for consumption test, supported by a sectioned iron frame located on the right-hand side of stand and independent therefrom.
   The fuel tank can easily be moved along a post, so that the central position of the burette is placed higher than the carburettor by the extent required for the different engine models (about 200 mm or 8″ for Vespa 150 engine).
4. A cock on the fuel line for turning on one of following circuits :

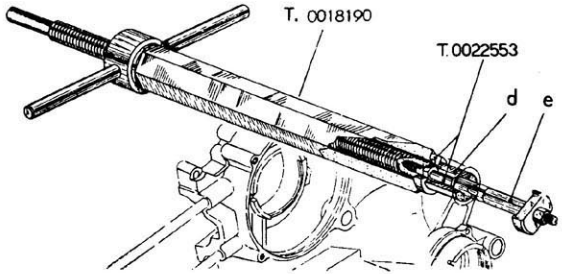
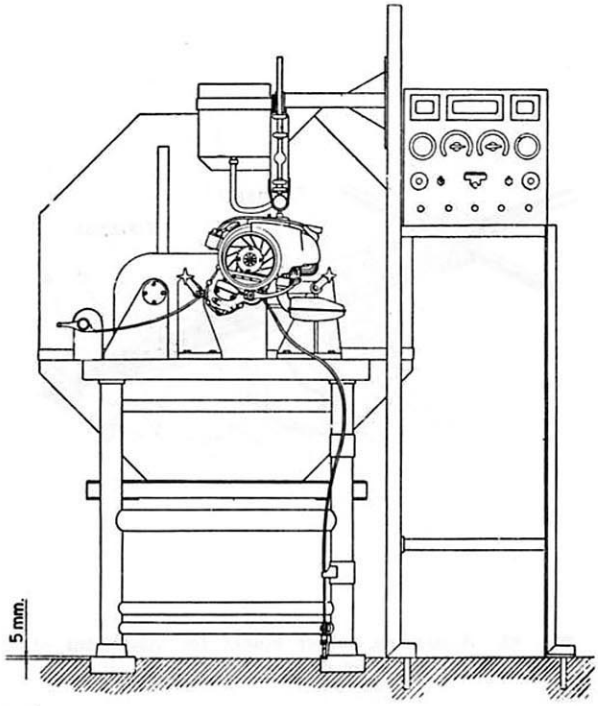



**Fig. 92.** Assembling rubber bushes for attachment of rear hydraulic damper.



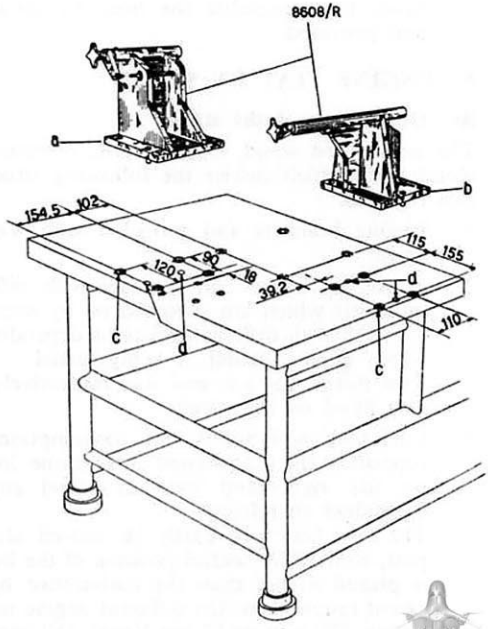




**Fig. 93** (left). Engine test stand.
**Fig. 94** (right). Modified engine test stand.

(a) from tank to carburettor (burette on)

(b) from burette to carburettor (tank off).

The burette capacity is "C" = 15 c.c.

5. Throttle control lever.

The propeller is directly driven by the engine; a suitable flange with dogs must be fitted on the end spline of the engine mainshaft: the flange drives mating dogs on end of propeller shaft, through an elastic and a calibrated joint.

The transmission ratio is therefore the same as that of the gear pinions, namely :

12·2 to 1 in 1st gear
7·46 to 1 in 2nd gear
4·73 to 1 in 3rd gear

The shaft where to check the r.p.m. by means of a portable counter is driven through two spur gears with transmission ratio 1 : 1.

The engine revolutions are equal to the figure shown by the rev. counter multiplied by the transmission ratio of the gear engaged. For instance : if the counter shows " 500 " with 3rd gear engaged, the engine revolutions are 500 x 4·73=2,365.

**N.B.** The test stand 8002/R can be used for testing all "Piaggio" engines. Make sure, before testing, that propeller blades are set to the pitch angle indicated thereon for the engine to be tested.

In order to test engine of Vespa 150 (prefix VBA). complete the stand as follows :

(a) Replace the standard engine bracket with the unit 8608/R consisting of two separate brackets ("a" and "b" in Fig. 94). Mount the 150 engine (VBA) on said brackets. The bracket "a" is not used for testing other engines (apart from Vespa 125 VNA); it can, however, remain on the stand.

(b) Mount the engine so that the lug with rubber buffer for attachment of the rear damper is housed on bracket "a" and the crankcase swinging arm on bracket "b".

(c) Retailers who have already the old test stand 8002/R shall order the unit 8608/R, then drill and tap the eight holes "c" on the stand as shown in Fig. 94; mount brackets "a" and "b" on the stand (with an engine on them) and secure with bolts, finger tight.
Find the right position where to secure the brackets firmly. Tighten the bolts, remove engine and drill four holes "d" for the centralising pins.

## 8b Adjustment of test propeller

The propeller adjustment must be checked periodically (at least once a month) with a test

engine tuned to deliver 1·9 h.p. at 3,430 r.p.m. in 3rd gear.

### 8c Fuel consumption test on the stand

The fuel to be used during and after running-in should be a 2% mixture of gasoline and **ESSO SAE Two-Stroke Oil** (20 c.c. of oil per litre of of petrol, or $\frac{1}{4}$ pint per $1\frac{1}{2}$ gallons respectively).

The specific gravity (sG) will be 0·720.

1. Feed the carburettor through the circuit "a" and run the engine at 3,430 r.p.m. in 3rd gear.
2. Turn on the circuit "b" and take note of the time "T" (seconds) spent for emptying the burette.

   Being "sG" the specific gravity of the fuel mixture and "C" the capacity of the burette, the specific consumption can be calculated by the following formula :

$$\text{Specific consumption (g/HP/h)} = \frac{1{,}900 \times C \times sG}{T}$$

If any engine parts have been replaced (particularly the piston and cylinder), run-in the engine for 25 minutes as said in following paragraph.
The consumption should thereafter result 420 to 480 g/HP/h.

### 8d Normal test

Mount the engine on test stand, then proceed as follows :

Make sure that the engine is in proper running order, that the clutch lever on the engine turns around smoothly and comes back to the stop easily.

Fill the gear box with **Esso Motor Oil 30** up to the prescribed level.

Make sure that the idling adjuster (Fig. 4B, No. 13) is screwed back by one turn in respect to the stop.

Turn on the feed circuit "a".

Under such conditions the engine is to be run-in as follows :

| Gear box position | Engine revs. | Time |
|---|---|---|
| 1st gear | 2,500 | 5′ |
| 2nd gear | 3,300 | 5′ |
| 3rd gear | 3,430 | 5′ |
| 3rd gear | 4,000 | 5′ |
| 3rd gear | 4,130 | 5′ |

After completion, check following points :

1. Fuel consumption (see paragraph 8c).
2. If sparkplug, nuts and screws are well tightened.
3. Starting with warm engine.

4. Idling : adjust to about 1,100 r.p.m. by means of the screw protruding from the air cleaner case (Fig. 4B, No. 5).
5. Acceleration in 3rd gear until " full throttle " is reached; hold this for 10 seconds and see that the engine runs regularly and exceeds 4,700 r.p.m.
6. Leaks; there should be no leaks of either oil or fuel.
7. Efficiency of the generator.
8. Clutch efficiency; with warm engine at idling revs. and clutch lever depressed to its fullest extent, the tooth sets on the sides of multiple and starter gears should not come into contact when the kickstarter is operated.
9. Absence of friction between stator and rotor of flywheel magneto.
10. Noisiness.
11. Change gears up and down, and see that the roller which limits the rotation of the gear change quadrant rests in the bottom of the slot corresponding to the gear engaged.
The ratchet quadrant should have a further short free movement before 1st and after 3rd gear positions.

**N.B.** Changing gears when the engine is on the test stand will be easier if the ratchet quadrant of

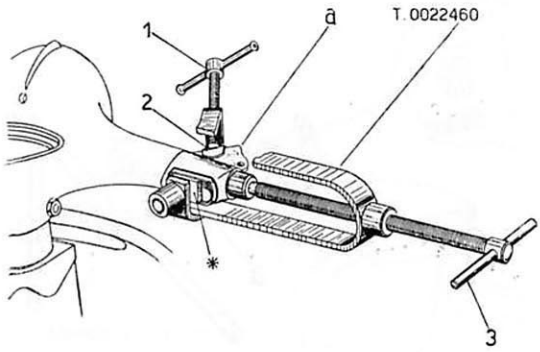



**Fig. 95.** Dismantling the handlebars sleeve.

the gear shifter is operated by means of wrench T. 0022517.

## 9. REPLACEMENT OF HANDLEBARS SLEEVE

### 9a Removal

Remove the speedometer head, the headlamp and dimmer switch after disconnecting respective cables.

Disconnect the front control cable (both wheel and handlebars sides) and the throttle control cable; slide off the former (with sheath) from the sleeve.

Use the tool T. 0022460 as shown on Fig. 95 after fitting component "19" (indicated with an asterisk on the figure); then place the latter into the switch housing.

Screw down the threaded rod "1" finger tight, taking care that part "2" rests on "a".

Insert the main threaded rod to stop against the handlebars barrel, then tighten screw "3" until the sleeve is extracted.

### 9b Re-assembly

Place the sleeve "a" in the tool T. 0022453, then use the latter as indicated on Fig. 96.

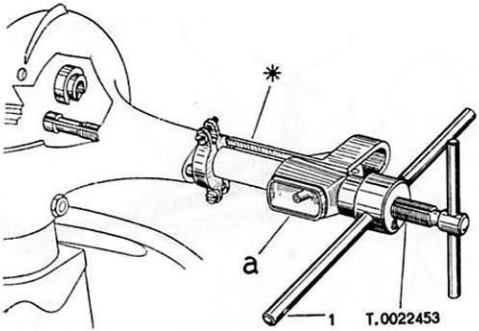



**Fig. 96.** Assembling the handlebars sleeve.

Use the centralising part "13" of the tool (asterisk), in order that the holes on sleeve "a" (for brake control cable and electric wires to the dimmer switch) coincide with the corresponding holes on handlebars.

Screw down "1" until the sleeve "a" stops against the flange of centralising part (asterisk). Remove said part and screw "1" further until "a" is in position, seeing that the holes on the sleeve and those on the handlebars coincide.

## 11. REPLACEMENT OF " PIAGGIO " MEDALLION

Clean the part accurately, then smear a thin, uniform layer of shellac " Teroson Werke ", model Terokal Union Zement 412.

Dry in air for about 5'.

Lay the medallion and press it slightly on the shield.

## 12. REPLACING TWISTGRIPS, BEADING OF ENGINE BONNET, RUBBER MAT

Clean the mating surfaces of the parts. Wash the twistgrip and the bonnet beading with petrol, if they can be re-employed.

Smear shellac " Bostik 322 " (twistgrips and beading) or " Bostik 1289 " (rubber mat).

Dry the rubber mat in air for some minutes.

Place the parts in position and press slightly.

Complete the assembly with the other components illustrated on the Parts List.

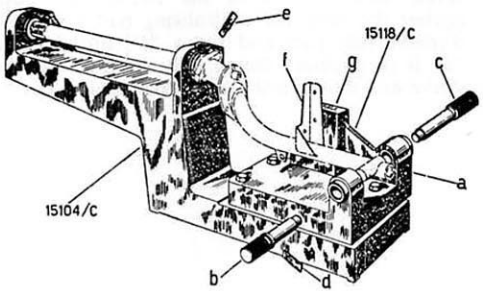



**Fig. 98.** Template for steering column inspection. Steering columns not perfectly aligned must be replaced with new ones, since straightening is not allowed.

## 13. STEERNG COLUMN INSPECTION

The template illustrated in Fig. 98 consists of two parts:

the base, drg. 15104/C, common for all models;

the top piece "a" which varies for the different models (for Vespa 150 VBA; drg. No. 15118/C).

Clamp the part in the template to check for alignment, and see that following conditions are reached :

pins "b" and "c" slide all the way through into their respective bushes;

the play between the ring on pin "b" and its respective bush is within the dimensions of both ends of gauge "d";

the play between central bush of the template and the light alloy flange of the steering column is within the dimensions of both ends of gauge "e";

the mudguard bracket of "f" tallies with the leg "g" on the template.

## 14. ALIGNMENT OF FRAME

Fit the bush "b" (part No. 33 of the tool) on rod "a"; slide the latter through the steering column housing and mount the other bush "c" in the top bearing housing.

Lay the frame on the jig T. 15772/C as shown on Fig. 99, and slide the rod "d" (part No. 31 of the tool) through the frame holes for the bolt securing the engine and through those on "e" (part No. 29); the rod should slide in smoothly. Insert the wooden wedge "f" under the floorboard, thus lifting the frame until the longeron surface stops against the lug of gauge "h", where " Vespa G.S. 56 - 150 V.B." etc. is stamped. Now see that following conditions are reached :

the tip of pin "a" falls inside the pad welded on the jig table;

the pin "g" enters the cavity of pin "a".

**Straightening (exclusively cold) of the frame is allowed only in case of minor deformation.**

## 15. PAINTING

**Strictly follow the procedure outlined below in order to obtain the best results in re-touching.**

(a) Rub down damaged area with 400.Grade " Wet or Dry " Emery Paper. Wipe dry and remove dust with Tack-rag.

(b) Spray with Primer Surfacer. When thoroughly dried, flat carefully with 400.Grade Paper Wet. Dry and wipe with Tack-rag.

(c) Spray with appropriate colour, Belco 300 Line.

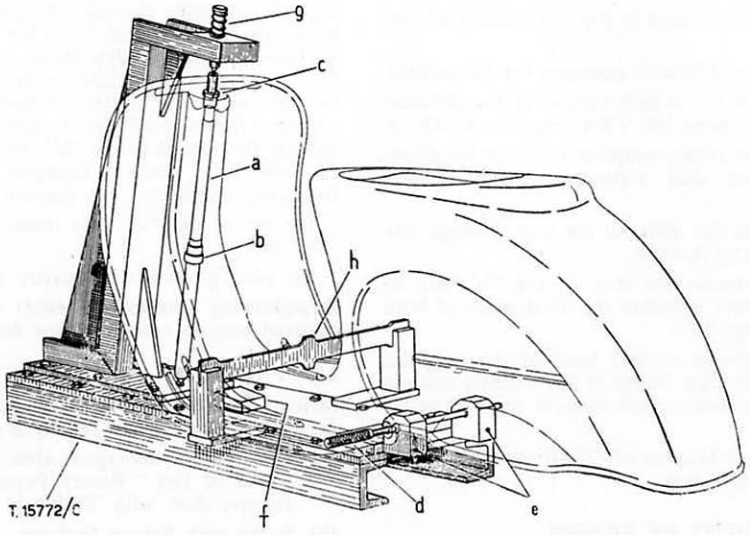



**Fig. 99.** Jig or frame inspection.

## 16. REPLACEMENT OF SHIELD PROTECTOR

**The old protector cannot be used again.**

### 16a Removal

Remove the handlebars, the outer aluminium channels from the floorboard and their end caps.

Prise up a lobe at the protector end by means of a screwdriver.

Catch the lobe with pliers and pull outwards. Proceed in this way on the whole length of the protector.

### 16b Re-assembly

Fit the new protector on the shield edge, starting from the top section. If necessary, use a rubber hammer for a better fitting.

Hold the protector in position by means of straps, as shown on Fig. 100.

Roll the top section of the protector (from "a" to "b" in the figure) by means of tool T. 0023590. Remove the strap "1", and keep rolling down to strap "2"; remove the latter and roll the residual length of the protector.

If small wrinkles form along the protector or the latter doesn't fit perfectly on the shield, tap the faulty sections with a wooden hammer and roll them again with the tool T. 0023590.

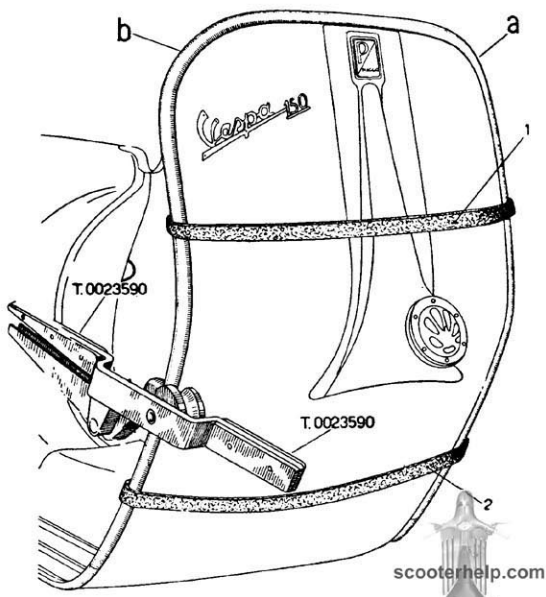



**Fig. 100.** Replacement of shield protector.

Re-assemble the outer channels of the floorboard and the rubber treads; drill the protector in the point where it covers the hole on the shield, mount and rivet the end caps of the channels.

## 18. FUEL CONSUMPTION TEST ON ROAD

### 18a Premise

(a) Check that the tyres are inflated to the prescribed pressure (see page 27)

(b) During the test the scooter must be ridden by the driver alone; he should not be less than 1·60 m tall (6 ft. 3 in.) and sit sit upright when driving.

(c) Carry out the test with the top gear engaged.

(d) The test should take place on 50 Km (25 Km to and 25 Km from), corresponding to 31 miles of dry, flat highway in windless weather (max. wind speed : 2m/sec.). Temperature should be + 5° to + 25° C. (41 - 77° F.).

**The fuel to be used is a 2% mixture of petrol and ESSO SAE 30 Two-Stroke Oil (20 c.c. of oil per litre of petrol or ¼ pint per 1½ gallons respectively).**

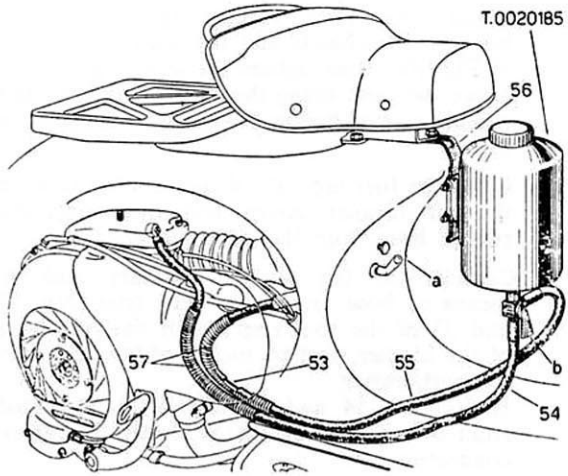



**Fig. 105.** Fuel tank for consumption test

**18b Preparing the scooter**

Use the auxiliary tank T. 0020185 completed with parts No. 53 to 57, as follows :

(a) Clamp the tank bracket (part No. 56) between the chassis and the saddle as shown in Fig. 105, then tighten the screw again.
Move the tank along the bracket until its tap reaches a level higher than that of the scooter tap.

(b) Close the fuel tap "a" of the scooter, remove the air cleaner cover and disconnect the rubber hose from the carburettor.

(c) Connect the tap of the auxiliary tank by means of hose and union pipe (part No. 55 and 53 of the tool resp.) with the fuel hose of the scooter, and by means of hose 54 with the carburettor.
Both hoses 54 and 55 should be insulated from cylinder by means of sheath 57 before connection.

(d) Re-assemble the air cleaner cover and the engine cowling.

(e) Rotate the lever of the tap "b" to the position "all off" (oblique upwards) and fill auxiliary tank up to the hole on the baffle fitted just below the filler cap.

**18c Road test**

(a) Set the lever of tap "b" of the auxiliary tank horizontally, the carburettor being fed by the scooter tank, and ride tc the road section for the test, adjusting the scooter speed to 50 Km/h (31 m.p.h.).

(b) When entering the test section, quickly turn the lever of the tap "b" of the auxiliary tank vertically downwards (carburettor fed by the auxiliary tank). The speed of 50 Km/h (31 m.p.h.) should be maintained as constant as possible for the whole test.

(c) At the end of the last kilometre of the first half of the test section, quickly turn the lever of the tap "b" horizontally, and stop the scooter after about 300 m (330 yards).

(d) Invert the riding direction, and regulate the speed again to 50 Km/h and, at the beginning of the first kilometre, repeat the operation indicated at point (b). At the end of the section, quickly turn the lever of tap "b" to horizontal position.

**18d Calculating fuel consumption**

(a) Close the tap "a" of the fuel tank of the scooter.

(b) Take some fuel mixture from a graduated burette (not from the two tanks on the scooter), and top up the auxiliary tank to the original level (see paragraph "14b", letter "e"). The amount "C" (in c.c.) added is obviously equal to the amount of fuel used for the test.

(c) The distance "P", expressed in Km/litre of fuel is given by the following formula :

$$P = \frac{50{,}000}{C}$$

The value "P" must be multiplied by 2·36 or 2·84 for obtaining m.p.g. figures (U.S.A. or imp. gal. respectively).

## (C) FAULT FINDING AND REMEDIES

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | NOTES |
|---|---|---|---|
| **HARD STARTING** | | | |
| **1 Fuel system** | | | |
| Fuel tank empty | | Refuel | |
| No fuel at carburettor | | | |
| (a) Fuel tap body | Clogged | Remove and blow clean | (1) Avoid use of any abrasive materials or wires |
| (b) Hose between carburettor and tap | Broken or clogged | Replace. Blow clear | |
| (c) Filter on carburettor | Dirty | Remove and wash with petrol, blow dry | |
| (d) Float hinge or tapering valve on the fuel line | Sticking in their seatings | Remove and blow clean (1) | (2) Suggested procedures : |
| (e) Jets and air vents | Clogged | Remove and blow clean (1) or replace | (a) push-start the scooter; |
| (f) Carburettor body | Clogged | Dismantle the carburettor. Clean carefully with petrol and blow dry | (b) close fuel tap, unscrew sparkplug and rotate the engine in order to expel the excess fuel; replace the sparkplug and proceed as for normal start |
| **2 Carburation** | | | |
| Neat fuel coming out from exhaust pipe | Engine flooding (2) | | |
| Float | Perforated | Replace | |
| | Tapering valve not properly fitting into its seating | Clean or replace | |
| Air cleaner | Choked, dirty | Wash in petrol and blow dry; dip in a 30% oil-petrol bath | |
| Choke flap | Sticking in position "closed" | Release | |

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | NOTES |
|---|---|---|---|
| **3 Ignition** | | Disconnect the sparkplug lead. Check if sparking occurs between lead and crankcase when the footstarter is operated | |
| Sparkplug | Dirty | Clean. Correct gap to 0·6 mm (0·023 in.) (3) | |
| | Cracks in insulation | Replace the plug | |
| Switch | Push-button sticking in "cut-out" position | Release. If necessary, dismantle and inspect the switch | |
| Case or cover of external ignition coil | Cracked, causing short circuit | Replace | |
| Cables to the ignition coil | Loose on the clamps or broken | Tighten or replace | (3) Inspect by means of feeler gauge 0016741 |
| Earth cable | Insulation damaged causing short circuit | Replace the cable<br>Disconnect the lead tag from the L.T. terminal; if the ignition works again, the trouble is located in the lead portions inside the frame | (4) Replace the rotor cam if its surface is scratched (see page 71) |
| Moving arm of contact breaker | Bearing surface worn (4) | Re-time (see page 82); replace the breaker, if abnormally worn | |
| | Lubrication felt dry or broken | Lubricate or replace | |
| | Faulty | Replace | |
| Condenser | Broken or disconnected | Replace or re-solder | |
| Sparkplug lead | from ignition coil | | |
| Breaker points | Dirty | Clean with suitable file or very fine emery paper | |
| | Gap incorrect | Re-time (see page ); correct gap to 0·3 - 0·5 mm (0·011 - 0·019") and inspect with feeler gauge 0016741 | |
| | Worn out or pitted | Replace<br>**N.B.** See directions on page 133 for checking ignition timing | |

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | NOTES |
|---|---|---|---|
| Woodruff key for flywheel | Broken | Remove the flywheel and replace the key (5). If the key-way is worn out, replace the crankshaft | |
| **4 Clutch** | | | |
| The engine will not revolve when the footstarter is depressed | Clutch slipping | Inspect and replace the clutch plates and springs (see page 85) | |
| **5 Starter assembly** | | | |
| Starter pinion | Not meshing | Check the thrust blades of the starter pinion and the side teeth of the same and of multiple gear | |
| Kickstarter | Too short stroke due to wrong positioning | Correct kickstarter position (see page 127) | (5) Firmly tighten the nut retaining the flywheel to ensure that the trouble does not reoccur |
| **INCORRECT RUNNING** | | | |
| **6 Lack of power** | | | |
| Silencer | Carbonised | Clean | |
| Exhaust port | Partially closed by carbon deposits | Decarbonise cylinder, piston and cylinder head | |
| Cylinder base gasket | Not tight | Replace | |
| **7 Poor compression** | | | |
| Sparkplug | Not well screwed down in cylinder head | Tighten | |
| Cylinder and cylinder head | The head does not fit properly into spigot on top of cylinder | Set the head properly and tighten nuts carefully, after deburring the spigot, if necessary | |

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | NOTES |
|---|---|---|---|
| Piston rings | Gummed up | Replace piston rings and clear piston grooves | |
| **8 Explosions at silencer and carburettor** | | | |
| Sparkplug | Excessive electrode gap | Correct gap to 0·6 mm (0·023 in.) | |
| | Carbon coated | Replace or clean (6) and check the gap | |
| | Carbon pearls on insulation | Clean with a suitable wire brush or by sand-blast | |
| | | Check oil-petrol percentage in fuel mixture | (6) Clean with a wire brush or, better, a scraper |
| | Pre-ignition | Replace the sparkplug | |
| | | Check ignition timing (see page 133) | |
| Condenser | Loose | Tighten the screw securing it | |
| | Faulty | Replace | |
| Contact breaker | Loose tip (7) | Replace | (7) When the breaker point is loose, if the lights are turned on while the engine is idling, the latter should stop, or at least misfire |
| Carburettor | Not enough mixture | See "Hard starting," paragraph 1 | |
| **9 Clutch troubles** | | | |
| Clutch snatches | | Check total axial play of plates (see page 85) | |
| (a) Plates (driving) with cork lining | Gummed together | Wash with paraffin | |
| (b) Driven plates | Become flat | Replace. Make sure that the new driven plates are curved to fit on a cylindrical surface | |
| (c) Gear pinions | Not lubricated | Top up oil level (see "Lubrication Chart", page 25) | |
| Clutch slips | | Check the transmissible statical moment (see page 86) | |
| (a) Springs | Feeble | Replace | |

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | NOTES |
|---|---|---|---|
| (b) Plates with cork lining | Worn out or burnt | Replace | |
| (c) Control cable | Out of adjustment | Adjust (see page 86) | |
| Clutch does not disengage completely | | | |
| Control cable | Excessive play | Adjust | |
| **10 Gear pinions disengage of own accord** | | | |
| Gear change control cables | Out of adjustment | Adjust (see page 87) | |
| Pin for gear shifter stirrup | Loose | Tighten firmly. Spot-punch the edge of the shifter casing on the slot of the pin | |
| Spring for stirrup | Broken, missing or feeble | Replace | |
| Selector | Chamfered arms | Replace | |
| | Guide bush or selector stem wrongly assembled | Rectify | |
| Gear pinions | Chipped or worn dogs | Replace | |
| **11 Starter assembly not engaging.** | | | |
| Gear sector | Not meshing properly | Check, clean or replace if the side teeth are worn out | |
| Starter pinion | Not meshing properly with the gear sector and with multiple gear | (1) Inspect the pawl of the starter pinion<br>(2) Inspect and, if necessary, replace the thrust blades on crankcase (the longer blade should press on the pinion)<br>(3) Inspect the side teeth on the starter pinion and on gear cluster. Replace these parts if such teeth are damage | |

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | NOTES |
|---|---|---|---|
| Return spring | Broken | Replace | |
| Kickstarter | Wrongly assembled | See page 127 | |
| **12 High fuel consumption** | | | |
| Fuel level in carburettor too high | | | |
| (a) Float | Perforated | Replace | |
| (b) Tapering valve | Not properly fitting into its seating | Clean or replace | |
| Air cleaner | Choked or dirty | Clean (8) | |
| Choke valve flap (9) | Sticking in closed or partially closed position | Release. Lubricate the cable | (8) Swirl in a 30% petrol - oil bath |
| Jets and air vents in the carburettor | Diameter of orifice increased | Replace (see page 12) | |
| Ignition | Retarded | Re-time (see page 133) | (9) Once the engine is started, push back the choke control knob |
| Compression (sparkplug, cylinder and cylinder head assembly, piston rings) | Poor | See page 114 | |
| **13 Controls not operating properly** | | | (10) This trouble may lessen riding stability |
| Hard controls | | | |
| Inner cable | Rusty | Lubricate, or, if necessary, replace | |
| | Unravelled | Replace and lubricate | |
| Excessive play | | | |
| Inner cable | Loose | Operate on respective adjusting screws | |
| **14 Steering column becomes stiff** | | | |
| Upper race of top ball bearing | Too tight | Adjust | |
| Ball races | Pitted (10) | Replace | |

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | NOTES |
|---|---|---|---|
| **15 Excessive play in steering column** | | | |
| Upper race of top ball bearing | Loose | Adjust | |
| **16 Poor braking** | | | |
| Control pedal or lever | Stroke too long | Adjust and lubricate cables | |
| Rear brake jaws | Lining worn down | Replace linings | |
| | Lining oily | Wash with petrol, dry and slightly rub, if necessary, the braking surface with emery paper | |
| Brake drums and linings | Scratched | Replace brake linings and drums | |
| **17 Inefficiency of front suspension** | | | |
| Noisiness | | | |
| (a) Nut securing the spring | Slack | Tighten | |
| (b) Spring | Interference with welded support bracket | Move the bracket side away from the upper coils of spring | |
| (c) Anchorage trunnion | Stiff on its spindle | Dismantle the unit, lubricate and reassemble; if necessary, replace the worn parts (see "Lubrication Chart", page 25). Screw down the nut firmly | |
| (d) Swinging hub | Axial play | Tighten the nut securing the hub on bottom end of steering column | |
| Riding instability | | | |
| (a) Spring | Broken or feeble | Replace | |
| (b) Spindle of swinging hub | Radial play | Replace the spindle or the rollers or bushes, as the case may be | |
| (c) Hydraulic damper | Inefficient | Overhaul (see instructions at page 104) | |
| Difficult rotation of wheel spindle | | | |
| (a) Bearings | Ball races pitted for lack of lubrication | Replace and lubricate generously | |

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | NOTES |
|---|---|---|---|
| (b) Speedometer drive pinion | Seized | Replace and lubricate | |
| **18 Inefficiency of rear suspension** | | | |
| Noisiness | | | |
| (a) Spring | Broken | Replace | |
| (b) Top rubber bush for hydraulic damper | Slack or damaged | Tighten or replace | |
| (c) Hydraulic damper | Loose on supports | Tighten | |
| (d) Attachment of engine to frame | Side or rotational play | Replace the rubber bushes | |
| Inefficiency | | | (11) See permissible tolerances, pages 67-70 |
| (a) Spring | Broken or feeble | Replace | |
| (b) Hydraulic damper | Lack of oil or internal components worn out | Overhaul (see page 166) | |
| | Stem rod loose on top anchorage pin | Tighten | (12) If the edges of the key-ways are damaged, the crankshaft should be replaced |
| **19 Engine noisy** | | | |
| Piston-cylinder-head assembly | Excessive play | Replace or re-grind the cylinder (11) Replace both piston and rings | |
| Connecting rod | Play between wrist pin and small end needle cage | Replace the needle cage and, if scratched, the wrist pin as well | |
| | Play between crankpin and con. rod big end | Replace the crankshaft (11) | |
| Crankshaft | Friction against the walls of the pre-compression chamber | Inspect the crankshaft (see page 129) and replace, if necessary | |
| Main bearings | Races pitted | Replace the bearings | |
| Flywheel magneto<br>Clutch assembly | Loose on crankshaft | Replace the woodruff key and tighten with wrenches supplied (12) | |

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | NOTES |
|---|---|---|---|
| Cush drive | Broken springs | Replace | |
| Gear pinions | Excessive axial play | Assemble an oversize shoulder ring see permissible tolerances at page 70) | |
| Clutch pinion | Whining | (a) Replace clutch pinion or<br>(b) Replace both clutch pinion and outer helical pinion of cush drive | |
| Fan | Slack screws | Tighten or replace the screws and lock edge of tab washers | |
| Silencer | Inside baffles detached | Replace the muffler | |
| **20 Faulty electric wiring** | | | |
| Tags at L.T. terminal | Disconnected | Re-connect or replace the screws | |
| | Slack | Tighten central screw | |
| Leads | Interrupted or naked | Repair or replace | |
| | Wrong connection on L.T. terminal, ignition coil and switch | Rectifier (see diagram on page 22) | |
| Switch | Clampboard faulty | Replace | |
| | Spring of dimmer switch lever feeble | Replace | |
| | Poor contact due to slackening of the clamp screws | Tighten | |
| Horn | Leads loose from their clamps | Re-connect and replace the screws if necessary | |
| Headlamp | Bulb filament fused | Replace the bulb | |
| | Poor earthing | Repair or replace the earthing cable | |
| | | Make sure that the ends of the cable connecting the bulb socket with the clamp in the L.T. terminal and with | |

| LOCATING SOURCE OF TROUBLE | CAUSE OF TROUBLE | REMEDY | |
|---|---|---|---|
| | | clamp "1" of the external ignition coil, where the earth cable from the flywheel magneto is also connected, make good contact (see diagram, page 21) | |
| | Surface of reflector mat or yellow | Replace the reflector | |
| | Wrong positioning of headlamp | Rectify (see page 27) | |
| | Inverted positioning of bulb | | |
| Tail lamp | Bulb filaments fused | Replace the bulb | (13) In such a case, the d.c. circuit will not work when the engine is turned off |
| | Poor earthing | Replace the contact washers under the wing-nuts securing the tail lamp on frame | |
| | Wrong connection of lead with funnel shaped terminal | The cable terminal must be clamped between the bulb and the lug of the insulated carrier | |
| | Wrong positioning of terminal | | |
| Town light | Wrong connection of the cable in the switch | Re-connect according to diagram on page 22 | |
| Rectifier-fuse-battery unit | Fuse broken or interrupted (13) | Replace | |
| | Rectifier damaged through shocks, etc. | Inspect and, if necessary, replace | |
| | | **IMPORTANT**<br>Make sure that the positive (+) and negative (—) poles of the battery are connected with the red and black cables respectively (see electric wiring diagram, page 22) | |

# 5.
# RE-ASSEMBLY

# RE-ASSEMBLY

This section illustrates the sequence to be followed for complete re-assembly of the scooter and its units.
When not otherwise specified at page foot, the succession of operations in each figure is indicated by the alphabetical order of letters, which are marked in correspondence of the parts to be re-assembled.
Tools are shown with their drawing numbers, whilst open-ended wrenches, box wrenches and screwdrivers are indicated with respective symbols

and hexagon dimensions.
When no tool is pointed out, the operation can be carried out by hand.

Use of monkey wrenches, hammers, chisels and emergency tools of any kind is strictly to be avoided. Only by means of the tools listed in the proper section of this manual and by using them to do the job they have been designed for, can any operation be quickly and successfully carried out on the scooter without damaging the parts involved. Before re-assembling, see that all parts are clean and, if necessary, wash them and wipe them dry according to instructions issued at page 39.
Smear with mineral oil all revolving and sliding parts of engine.
Should the assembly of engine or of other units be postponed for a while, keep all loose parts protected from dust.
**Use new packing and split pins for re-assembly.**

## NOTICE

Following figures illustrate the re-assembling operations calling for particular procedures and tools.
Directions for re-assembling components of flywheel magneto, clutch, cush drive, gear sector of starter assembly, parts for attachment of the engine to the frame and shield protector are given in the section " Overhauls."

Retailers should read the section mentioned above also for what may concern adjustment of controls, inspection, permissible tolerances, and particular test of the machine or of its main units.
For all re-assembling operations not illustrated here, follow a procedure reverse of that explained on the figures in the section "Dismantling".

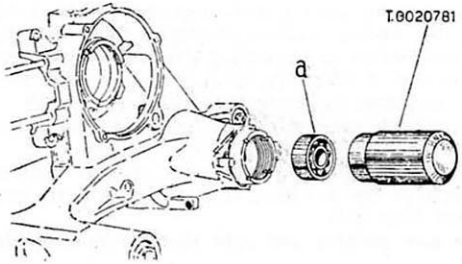



Fig. 106

Mainshaft ball bearing.

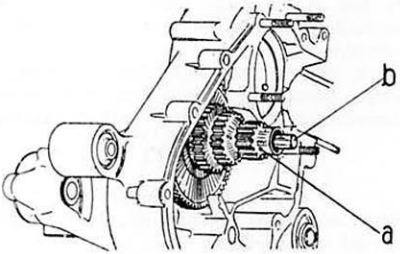



Fig. 107

(a) Cush gear with layshaft and needle rollers (secure the 23 rollers on their track by means of a layer of grease).
(b) Insert the layshaft with rollers through the central hole and screw down the nut on the other end.

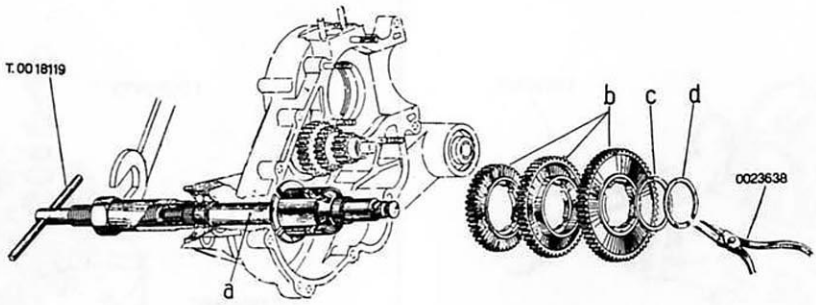



**Fig. 108**

(a) Mainshaft (with selector and stem). (b) Gear pinions.

**N.B.** The 2nd and 3rd gear pinions are to be positioned with their collars turned outwards; the 1st gear pinion (largest diameter) is to be mounted so that its collar with more pronounced relief is turned towards the crankcase half, clutch side.

(c) Shoulder washer. (d) Circlip.

**N.B.** For assembling the shoulder washer see table at page 70. Axial play is to be checked with feeler gauge 0.18094.

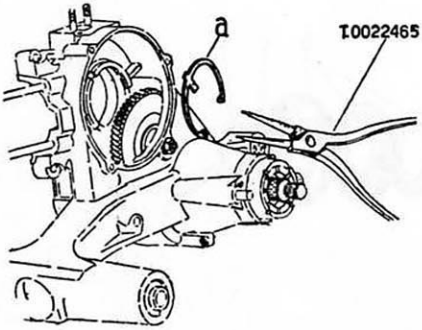



**Fig. 109**

Circlip retaining crankshaft oil seal (fit top end of the centralising lug into its seating on crankcase).

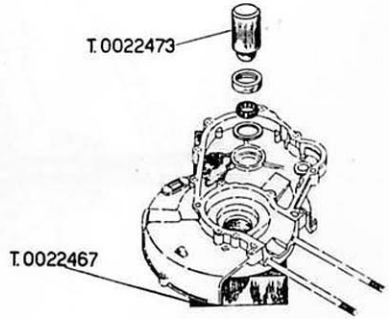



**Fig. 110**

Mainshaft roller bearing.

**N.B.** Smear with grease the bearing cage, then mount the 14 rollers.

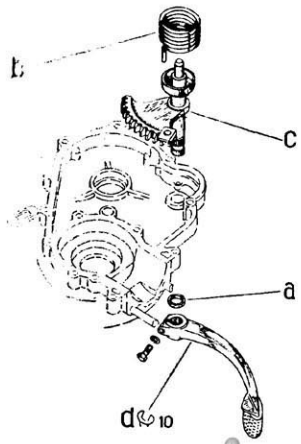



**Fig. 111**

Starter Assembly

(a) Kickstarter packing. (b) Return spring (the spring end bent inwards is to be secured in the slot of the boss on the sector axle). (c) Axle with gear sector and return spring (anchor the free end of spring in the hole of the crankcase). (d) Kickstarter.

**N.B.** Correct position of kickstarter is to be found practically with engine assembled on scooter; mate the kickstarter to the sector axle so that it can travel the entire stroke for starting the engine without interference with the engine cowling.

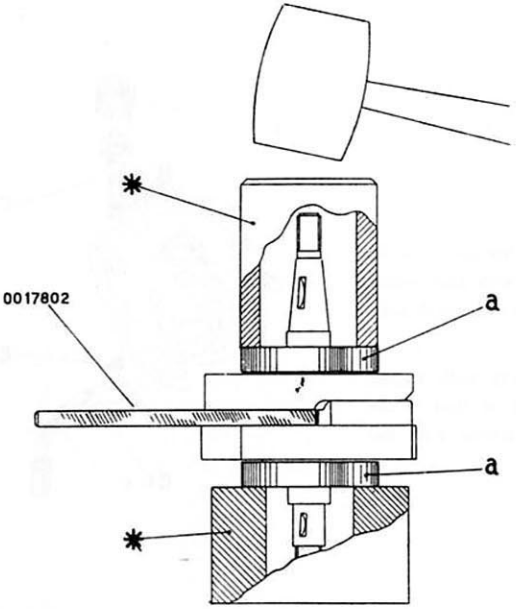



**Fig. 112**

Main bearings.

Dip the main bearings for about 6 minutes into oil at 100° C (212° F) and mount them on the crankshaft, placing the wedge 0017802 between the crankwebs. The two bearings should be mounted contemporarily with the aid of a hand press, if available (see figure). The tube and the drilled plate, marked by an asterisk, can be prepared by the Retailers themselves.

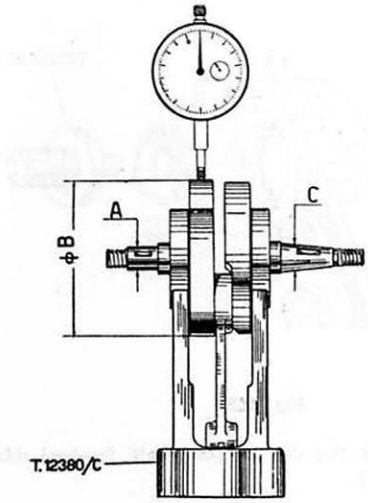



**Fig. 113**

Inspection of crankshaft before fitting into crankcase.
Rotate the crankshaft (complete with ball bearings) on the fixture T. 12380/C. The eccentricity of diameter "A" in respect to "C" and to "B" should not exceed 0·015 mm (6/10 thou) and 0·005 mm (2/10 thou) respectively; the max. permissible stroke of the dial gauge should consequently be 0·03 mm (·0011") and 0·01 mm (·0003") respectively.

**N.B.** Do not hammer the crankshaft nor try to straighten it up. The consequent deformations would cause running troubles.

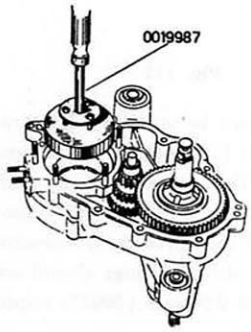



**Fig. 114**

Heat to about 80° C (176° F) the crankcase bush, clutch side, where main bearing and oil seal will be housed.

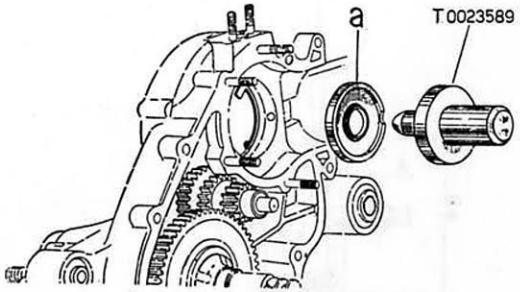



**Fig. 115**

Crankshaft oil seal. For the crankcase half, flywheel side, use tool T. 0021071.

**N.B.** Make sure that the slotted portion of the seal tallies with the crankcase hole, in order to ensure a correct lubrication of the bearings.

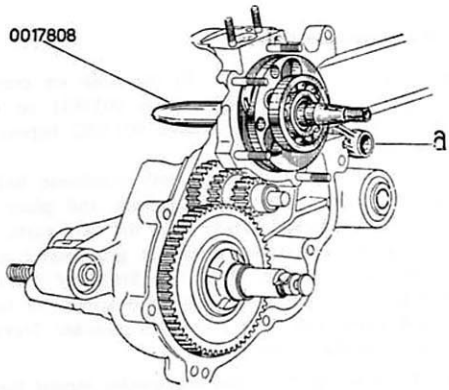



Fig. 116

Crankshaft into the crankcase half, clutch side.

(a) Fit pilot sleeve 0017808 on crankshaft end.

(b) Mount the shaft complete with ball bearings, into the crankcase, clutch side. This should be done immediately after assembling the oil seal, when the crankcase bush is still very warm (see Figs. 114 and 115).

**Assembly of starter unit**

(1) Assemble the starter pinion on the gear cluster of the cush gear, being sure that the side teeth of the pinion mesh with the corresponding set of teeth on the cluster.

(2) Replace the two rubber buffers for the starter sector if they are damaged, and make sure they don't stand out beyond the joining surface of crankcase halves.

(3) If the thrust blades for the starter pinion must be replaced, secure them to the crankcase half, flywheel side, by means of suitable rivets and pad (see the list of spare parts); make sure the longer blade is assembled on the shorter.

(4) Re-assemble the plug on the hole for the layshaft (crankcase half, flywheel side) seeing that the convex side of the plug is turned towards the assembler.

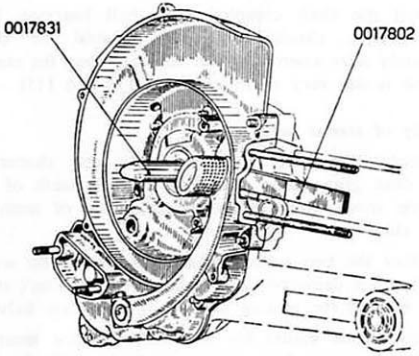



Fig. 117

**Joining the crankcase halves**

(a) Heat to about 80° C (176° F) the bush on crankcase half, flywheel side; fit pilot sleeve 0017831 on crankshaft end, then place the wedge 0017802 between the crankwebs.
Clean the joining surfaces of both crankcase halves, smear the paper gasket with shellack and place it on one of the crankcase halves; join the two parts, while depressing the kickstarter until the gear sector meshes with the starter pinion. A perfect fitting of the crankcase halves on each other can be obtained by tapping on the flywheel side with a wooden hammer. Never tap on the crankshaft end.

(b) Pull off the wedge from the crankwebs, mount the four central bolts with washer, and tighten the nuts diagonally and evenly.

**It is essential that the crankshaft rotates freely, without grazing the crankcase.**

**Timing the engine**

Remove the sparkplug and screw timing gauge T. 0016205 (Fig. 119) into cylinder head. One of the two clamps of tool T. 0023278, the test circuit of which consists of an electromagnetic vibrator and a 6V-1W bulb, is to be connected with the engine earth (for ex: the cylinder fins), the other with the flywheel earthing cable. Connect the cables "1" (green) and "2" (red) of the tool with a 4V d.c. source (for ex: just two cells of a Vespa battery, as shown in the figure).

Bring the piston to the t.d.c., then let the zero mark of the outer sleeve of the gauge T. 0016205 coincide with the line on the inner rod. Rotate the flywheel through 90° in an anti-clockwise direction.

Turn switch "3" on (see note on page 83), thus starting the vibrator, then rotate the flywheel in a clockwise direction: breaker points should clear, and consequently bulb "4" go on, exactly 28° before the t.d.c. If the ignition is advanced (more than 28°) or retarded (less than 28°), remove the flywheel, slacken the three screws and rotate the stator on a clockwise or anti-clockwise direction respectively.

Tighten the screws retaining the stator on the crankcase.

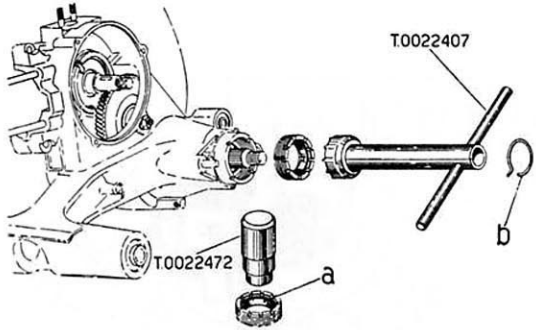



**Fig. 118**

(a) Mainshaft oil seal. (b) Circlip.

**Notice.** For re-assembling the other units, not illustrated in this section, follow a procedure reverse of that explained in the section "Dismantling". See also section "Overhauls".

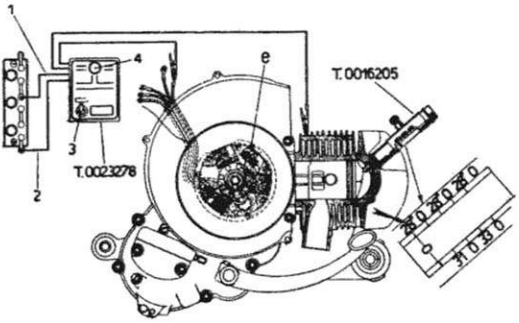
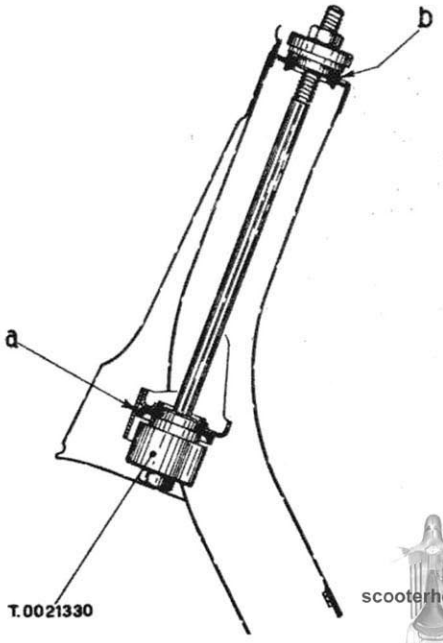



**Fig. 119**

**Fig. 120** (right)

(a) Top race of bottom bearing. (b) Bottom race of top bearing.





# ASSEMBLY OF STEERING COLUMN

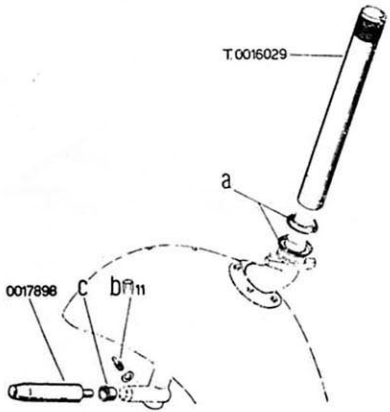



**Fig. 121**

(a) Bottom race of bottom ball bearing and dust cover (for the tool T 0016029 see note "e", page 33). (b) Grease nipple. (c) Liners for wheel spindle.

**N.B.** See on Fig. 98 and page 100 the directions for checking steering column alignment. Axial play between front wheel hub and stub axle of steering column must be 0·2-0·4 mm (0·007-0·015"): see the Parts List, page 33, note " h "

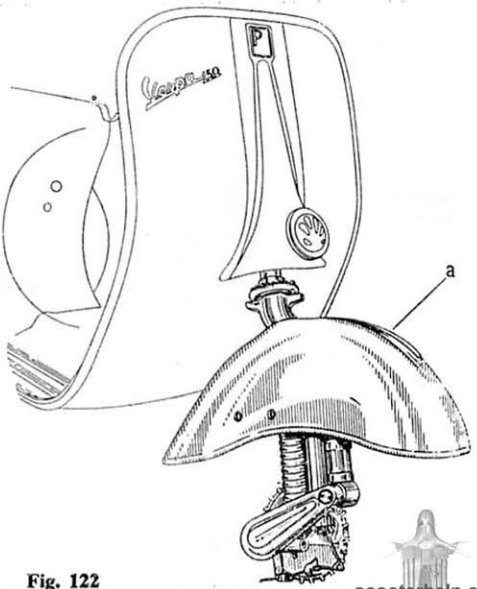



**Fig. 122**

Steering column unit on the scooter (hold the 19 balls of bottom in position by means of a layer of grease).

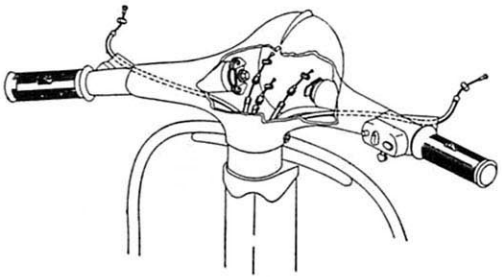


Fig. 123

Handlebars (be sure that the nipples are soldered on the cables).

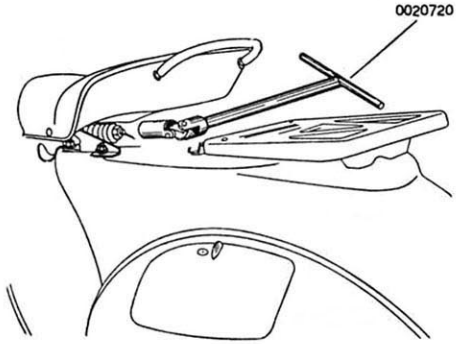



Fig. 124

Saddle adjustment (the spring is adjustable according to driver's weight).

# ASSEMBLY OF SPEEDOMETER

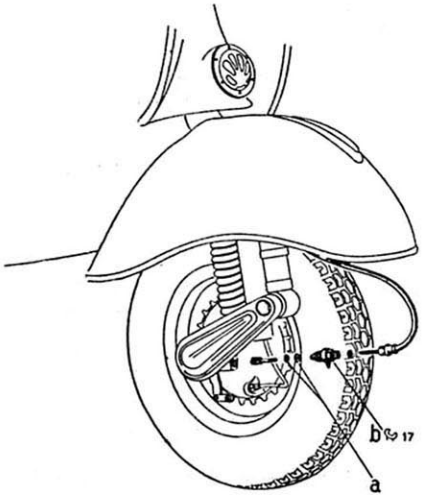



**Fig. 125**

Speedometer drive pinion and flex drive.

**N.B.** When mounting the speedometer, check that axial play of drive pinion is between 0·25 - 0·8 mm (0·01 - 0·03″) and, if necessary, mount one or two shim washers. part No. S. 13863.

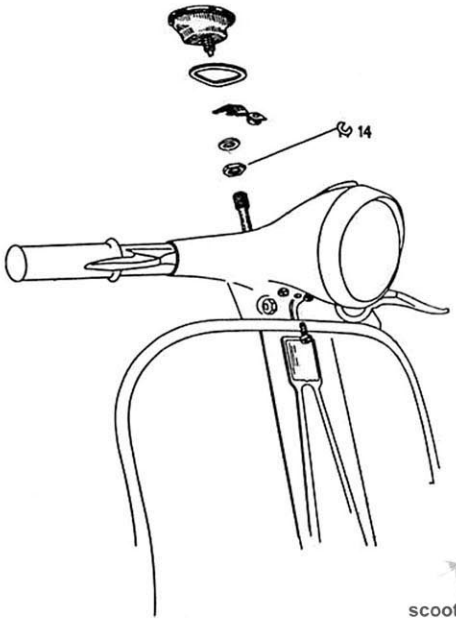



**Fig. 126** Speedometer

## BEFORE STARTING OPERATION OF THE SCOOTER

After completing the overhaul of the engine or other units and, when required, testing engine and flywheel magneto on the test stands, inspect as indicated hereunder before returning the scooter to the owner.

1. Make sure that nuts and bolts are tight.
2. Oil level in gear box: the scooter standing upright, oil should just be about to flow out.
3. Efficiency of shock absorbers.
4. No leaks of either oil or fuel mixture.
5. Tyre pressure. See page 29.
6. Check assembly position of kickstarter (see N.B. at Fig. 111).
7. Efficiency of electric wiring.
8. Carburation (see pages 13 and 112).
9. Brake efficiency.
10. Adjustment of clutch and gear change control cables (see pages 86 and 87).
11. Road holding with hands off.
12. Efficiency of security lock (never lubricate).
13. Cleaning the scooter; use paraffin for the engine outside; wash the painted parts with water and wipe dry with chamois leather. Wipe off dust from the reflector with a very soft feather and keep fingers off its surface.

**Notice.** Such an inspection should be made by the Retailers also on a new scooter after unpacking, before they are handed over to the customer.

# ALPHABETICAL INDEX

| NAME OF PARTS OR SUB-ASSEMBLIES | PAGE | | |
|---|---|---|---|
| | Dismantling | Re-assembling | Overhauls and other |
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# 6.
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# 4.

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