SERVICE MANUAL
STIHL 009, 010, 011

SPECIAL TOOL MANUAL

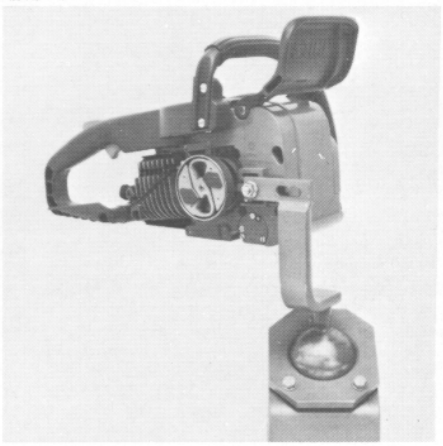
FOREWORD

This Service Manual covers model 010 chain saws up to machine number 7 900 000 as well as later machines unless technical information bulletins have been issued in the meantime with updated repair procedures.

Models 009 and 011 have substantially the same constructional features as model 010 chain saws. This Service Manual can therefore be used for the 009 and 011 chain saws as well.

In the event of faults it is quite possible that a single fault may have several causes. It is therefore advisable to consult the "Troubleshooting Chart" in each chapter when tracing faults. We also recommend that you make use of the exploded views in the illustrated parts lists when carrying out repair work.

This service manual and all technical information bulletins are intended exclusively for the use of STIHL servicing dealers and staff and must not be passed on to third parties.



Repair work is made considerably easier if the chain saw is mounted on assembly stand 5910 850 3100. The saw is easily secured to the stand by means of the bar mounting stud and collar nut.

While on the assembly stand the chain saw can be swivelled into any required position within a certain range to suit the repair in question. This not only has the advantage of keeping the component in the most convenient position for the repair but also leaves both hands free for the work and thus effects a considerable time saving.

Our special tool manual illustrates and lists the part numbers of ail available machine-related tools as well as general purpose tools for all machines.

The special tool manual is available in several languages and can be ordered by quoting the appropriate part number listed hereunder.

German	0455 901 0023
English	0455 901 0123
French	0455 901 0223
Spanish	0455 901 0323
Yugoslav	0455 901 0423
Swedish	0455 901 0523
Italian	0455 901 0723
Portuguese	0455 901 1223

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CONTENTS

1. SPECIFICATIONS

1.1 Engine

Single cylinder two-stroke engine with specially processed cylinder bore

Displacement 009, 010:	37 cm³ (2.26 cu. in)
Bore 009, 010:	36 mm (1.42 in)
Displacement 011:	41 cm³ (2.50 cu. in)
Bore 011:	38 mm (1.50 in)
Stroke:	36 mm (1.42 in)
Compression ratio:	9.8:1
Max. torque:	1.8 Nm (1.3 lbf. ft) at 4500 r.p.m.
Rated speed, off load with bar and chain:	9500 - 9800 r.p.m.
Mean idle speed:	2200 - 2400 r.p.m.
Crankshaft:	Drop forged
Crankshaft bearings:	2 needle sleeves
Crankpin:	13 mm (0.51 in) dia.
Big-end bearing:	Cylindrical rollers without cage
Piston pin:	9 mm (0.35 in) dia.
Small-end bearing:	Needle sleeve
Rewind starter:	Pawl engagement with automatic starter rope rewind mechanism
Starter rope:	3.5 mm (0.14 in) dia., 960 mm (38 in) long
Clutch:	Centrifugal clutch without linings, 64 mm (2.5 in) dia.
Clutch engages at:	3200 - 3300 r.p.m.
Crankcase leakage test with overpressure:	0.5 bar (7.1 lbf/in²)
with vacuum:	0.5 bar (7.1 lbf/in²)

1.2 Fuel System

Carburetor:	All-position diaphragm carburetor with integral fuel pump
Adjustment:	
High-speed adjustment screw H:	Open 1 turn
Low-speed adjustment screw L:	Open 1 turn (basic setting starting with screws lightly against their seats)
Carburetor leakage test with overpressure:	0.4 bar (5.7 lbf/in²)
Fuel capacity:	0.26 L (0.55 US pt)

	Fuel mixture:	Regular grade gasoline and branded two-cycle engine oil Mix ratio 1:40 with STIHL two-cycle engine oil: 1:25 with other branded two-cycle engine oils
	Air filter:	Large area felt mat

1.3	**Ignition System**	Type:	Breaker-controlled magneto ignition
		Magneto edge gap:	5 mm (0.2 in)
		Ari gap:	0.2 mm (0.008 in)
		Ignition timing:	1.8-2.1 mm before T D.C.
		Ignition advance angle:	23°-24°
		Breaker point gap:	0.3-0.4 mm (0.012-0.016 in)
		Condenser:	Capacitance 0.17 µF
		Ignition armature:	Coil winding resistance Primary Secondary 0.8-1.3 Ω 7.2-8.8 kΩ
		Spark plug (suppressed):	Bosch WSR 6 F or Champion RCJ 6 Y Heat range 200 Electrode gap 0.5 mm (0.02 in)
		Spark plug thread:	M 14x1.25; 9.5 mm (0.37 in) long

1.4	**Tightening Torques**	Crankshaft nut (ignition side) M 8x1:	30 Nm (22.1 lbf. ft)
		Clutch (sprocket side):	30 Nm (22.1 lbf. ft)
		M 6 socket head screws:	10 Nm (74 lbf. ft)
		M 5 pan head screws:	5 Nm (3.7 lbf. ft)
		M 4 pan head screws:	2.5 Nm (1.8 lbf. ft)
		M 5 nuts:	5 Nm (3.7 lbf. ft)
		Spark plug:	25 Nm (18.4 lbf. ft)

1.5 **Cutting Attachment**	Guide bars:	STIHL Standard guide bars without stellite-tipped nose STIHL Duromatic guide bars with stellite-tipped nose STIHL Rollomatic guide bars with sprocket nose All types with corrosion-resistant finish and induction hardened rails	
	Bar lengths:	Duromatic 30 and 35 cm (12 and 14 in) Rollomatic 30, 35 and 40 cm (12, 14 and 16 in)	
	Chain:	9.32 mm (3/8")-Oilomatic-Picco	
	Chain sprocket:	6-tooth for 3/8" Picco pitch	
	Chain speed:	13 m/s (42.6 ft/sec) at 7000 r.p.m.	
	Chain lubrication:	Speed-controlled oil pump with Diaphragm	
	Oil delivery rate:	6-12 cm^3/min (0.37-0.74 cu. in/min) at 7000 r.p.m.	
	Oil tank capacity:	0.28 L (0.59 US pt)	

1.6 **Weights**	Model:	009	010 AV	011 AV
	Dry powerhead with 30 cm bar and chain:	4.3 kg (9.51 b)	4.6 kg (10.1lb)	4.7 kg (10.4lb)

1.7 **Special Accessories**	STIHL repair kit 009, 010, 011	1120 900 5000
	Set of gaskets 009, 010, 011	1120 007 1050

2. CLUTCH, CHAIN DRIVE AND CHAIN BRAKE

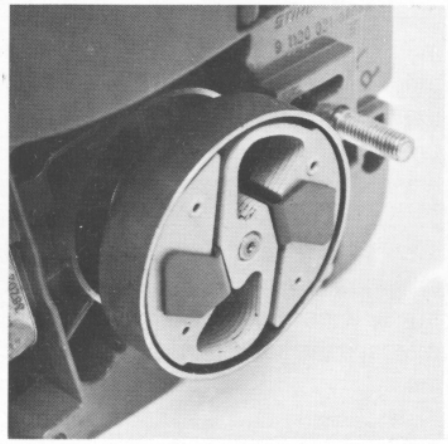
2.1 Construction and Operation

2.1.1 Clutch and Chain Sprocket

The transmission of power from the engine to the saw chain is effected via a centrifugal clutch which has no linings.

The clutch consists of a laminate block made up of seven separate metal sheets which are riveted together. The laminate block is screwed to the crankshaft. A cranked U-plate is fitted between the laminate block and the clutch drum and acts as a guard which prevents parts of the clutch coming adrift in the event of breakage.

Clutch with cranked U-plate in position

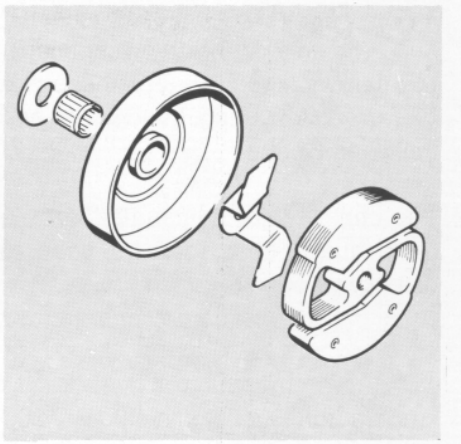


While the engine is running at idle speed there is no change in the shape of the clutch, i.e. its outside diameter remains constant because the rigidity of the laminate block's smallest cross section is greater than the centrifugal force applied. As engine speed increases the outer diameter of the clutch becomes larger when the centrifugal force overcomes the rigidity of the laminate block. This causes the clutch to be pressed against the clutch drum and thus transmit engine torque positively via the clutch drum and the chain sprocket to the saw chain.

The rigidity of the clutch is designed so that the clutch begins to make contact with the clutch drum at an engine speed of approx. 3200 r.p.m.

The clutch engages fully above this speed. It is therefore very important to set the carburetor to the correct idle speed in order to insure that the clutch engagement speed (3200 r.p.m.) is not reached when the engine is idling.

Component parts of clutch



The construction of the clutch is identical on both models of the saw (with and without chain brake).

2.1.2 **Chain Brake**

The chain brake is a spring-loaded band brake without any friction linings. Its main components are the brake band, tension spring, hand guard and the lever system.

The chain brake is actuated via the hand guard which can be used to disengage or engage the brake.

The **chain brake is disengaged** by pulling the hand guard back toward the handlebar. This movement is transmitted via a lever system which preloads the tension spring and releases the brake band.

The actuating lever, which is attached to the hand guard, remains locked in the idle position after the operator releases the hand guard.

The **chain brake is engaged** by moving the hand guard toward the bar nose. This movement unlatches the locked brake lever and causes the brake band to be clamped around the clutch drum by the force of the preloaded tension spring. The cluch drum and saw chain are brought to a standstill in a split second.

2.2 **Troubleshooting Chart**

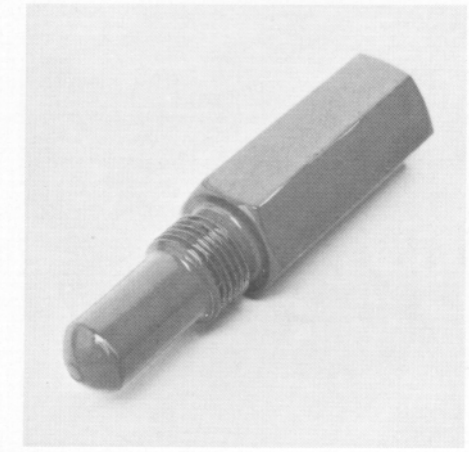
Condition	Cause	Remedy
Saw chain turns at idle speed	Engine idle speed too high	Readjust at idle speed adjusting screw
	Clutch broken	Fit new clutch
Excessive chain sprocket wear	Incorrect chain tension	Tension chain correctly
Saw chain does not stop immediately when chain brake is actuated	Tension spring broken	Fit new tension spring

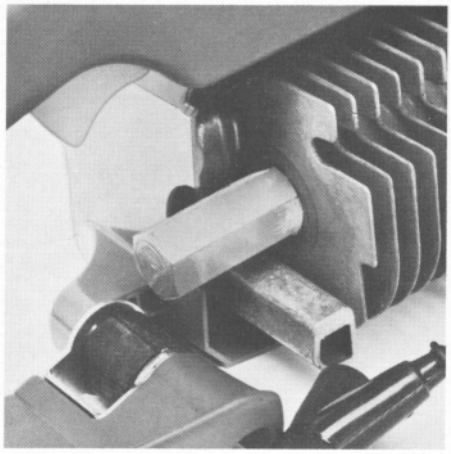
2.3 Repair

2.3.1 Disassembly and Assembly of Clutch

Top:
Locking screw 1107 191 1200

Bottom:
Locking screw in position



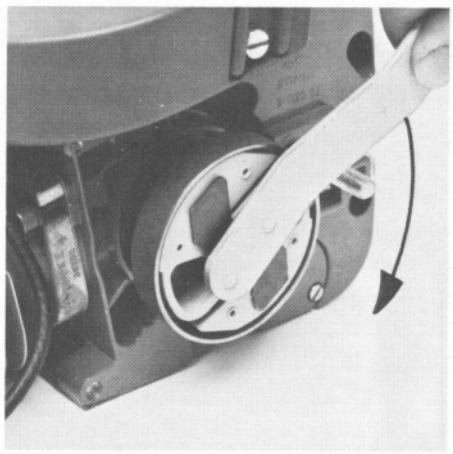


First remove the chain sprocket cover and the cutting attachment. On Quick-stop models it is necessary to disengage the chain brake so that the brake band releases the clutch drum.

Take out the spark plug and fit the locking screw in its place. Use the special wrench to turn the clutch and the crankshaft clockwise until the piston head butts against the locking screw. Now use wrench to unscrew the clutch.

Top:
Wrench 1113 890 3600

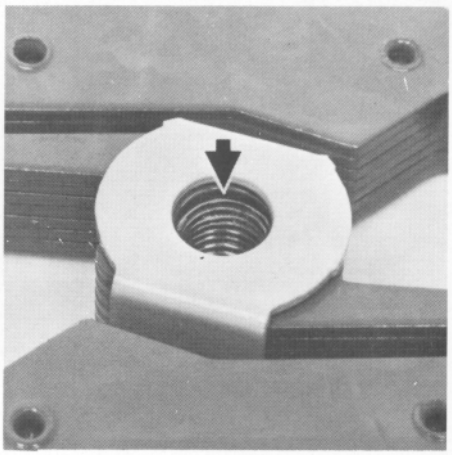
Bottom:
Unscrewing the clutch



Caution: The clutch has a lefthand thread - unscrew it clockwise!

After unscrewing the clutch, remove the chain sprocket, needle cage and thrust washer from the crankshaft. Examine clutch for signs of cracks or breaks. If hairline cracks are found in the sprung part of the clutch, fit a new clutch. The cranked U-plate should also be inspected for hairline cracks. If any are found, fit a new Cranked U-plate. Wash needle cage, thrust

Counterbored side of clutch

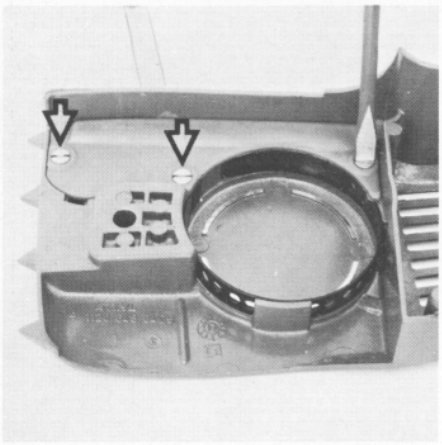


washer and stub of crankshaft with clean gasoline. Replace needle cage if it is faulty.

Lubricate needle cage, thrust washer and stub of crankshaft with antifriction bearing grease before assembly. When refitting the clutch make sure that the side on which the thread is counterbored to a depth of about 2 mm (0.08 in) faces the crankcase. Tighten down clutch with the wrench to a torque load of 30 Nm (3.0 kpm).

2.3.2 Disassembly of Chain Brake

Removing plastic cover



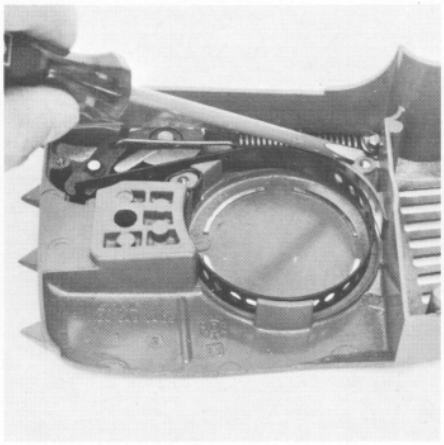
The chain brake components are integrated in the chain sprocket cover. It is therefore necessary to remove the sprocket cover to gain access to the brake components. After removing the sprocket cover, engage the chain brake, unscrew the plastic cover and detach the tension spring from the pin in the housing. Remove retaining washer from brake lever pivot pin and then prise brake lever together with the brake band and the tension spring out of their seats in the cover. The relay lever and actuating lever cannot be disassembled. If either one of these levers is faulty the complete chain sprocket cover (1120 640 1740) must be replaced.

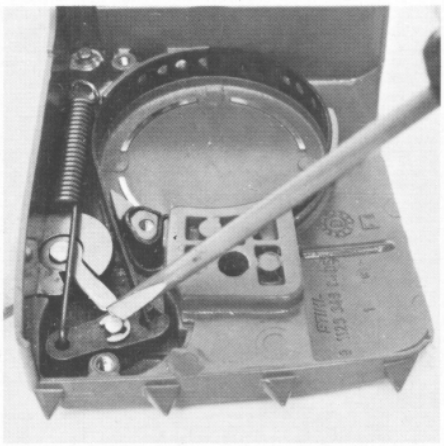
Check levers and brake band for signs of wear. Renew damaged parts and apply a little grease to the pivot points before reassembly.

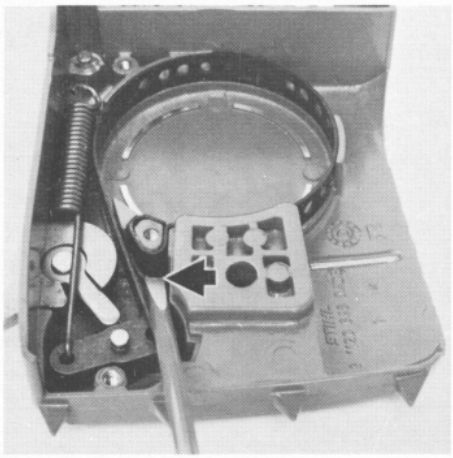
Top:
Detaching tension spring

Center:
Removing retaining washer

Bottom:
Removing brake band



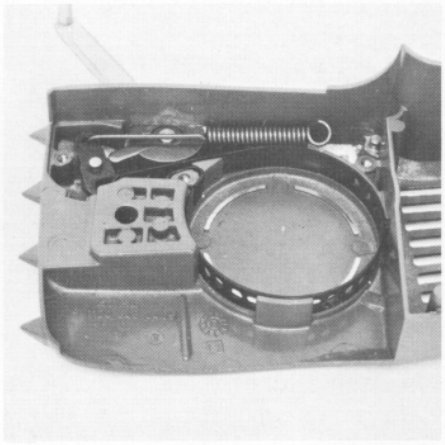


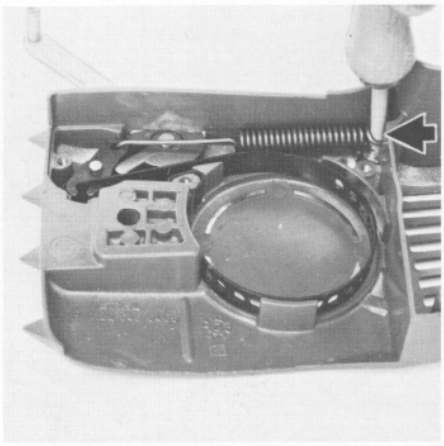


2.3.2.1 Disassembly of Chain Brake

Top:
Brake band, brake lever and tension spring in position

Bottom:
Fitting tension spring with installing tool 1117 890 0900





First engage brake band in the brake lever. Then attach the tension spring to the brake lever and install the pre-assembled parts in the chain sprocket cover.

Fit the retaining washer and use installing tool to attach tension spring to the retaining pin. Finish off by securing the plastic cover.

3. ENGINE

3.1 Construction

Series 010 chain saws are powered by an air-cooled, single cylinder two-stroke engine.

The crankcase is a two-part pressure die casting made of a magnesium alloy. The drop-forged crankshaft is supported in two needle sleeves. Two oil seals, one for each half of the crankcase, hermetically seal the crank chamber.

The connecting rod is supported by cylindrical rollers, i. e. without a bearing cage, on the crankpin and a needle sleeve on the piston pin.

The cylinder and piston are made of an aluminium alloy. The cylinder bore is coated in a special process.

3.2 Troubleshooting Chart

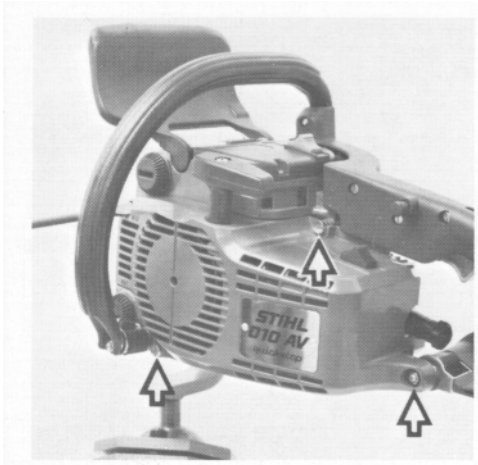
Check fuel system, carburetor, air filter and ignition system before looking for faults in the engine.

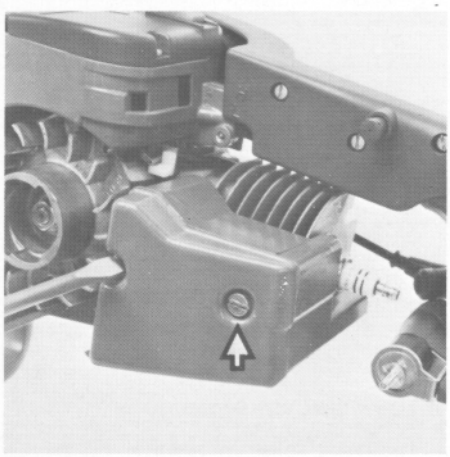
Condition	Cause	Remedy
Engine does not start easily, stalls at idle speed, but runs normally at full throttle	Oil seals in crankcase leaking	Replace oil seals
	Carburetor flange leaking, cracked	Fit new carburetor flange
	Crankcase damaged (cracks)	Replace crankcase
Engine does not deliver full power or runs erratically	Secondary air seepage into engine because of faulty carburetor flange	Fit new carburetor flange
	Piston ring leaking or broken	Replace piston ring
Engine overheats	Insufficient cylinder cooling. Air inlets in fan housing blocked or cylinder cooling fins clogged with dirt	Thoroughly clean all cooling air openings

3.3 Exposing the Cylinder

Top:
Unscrewing the fan housing

Bottom:
Unscrew the muffler screws





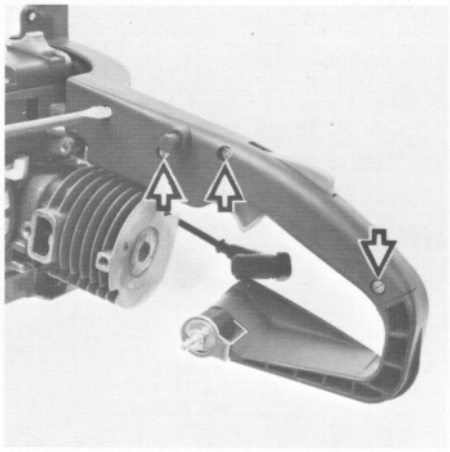
Unscrew the collar nut and take off the chain sprocket cover. Remove flat head screw from rear vibration damper. Unscrew the fan housing and pull off the spark plug terminal.

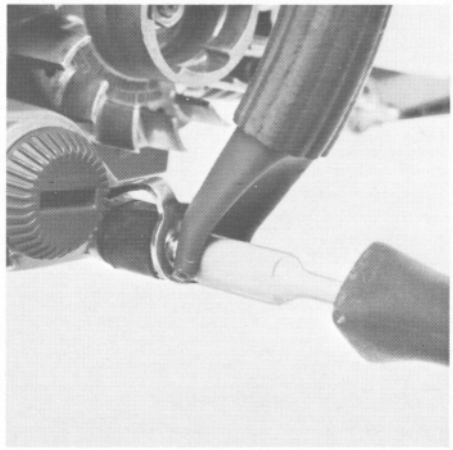
Once the muffler is removed the cooling fins of the cylinder are easily accessible. They should be thoroughly cleaned and examined for signs of damage (cracks, broken cooling fins etc.).

3.4 Disassembly of Cylinder and Piston

Top:
Removing the handle moulding

Bottom:
Removing hexagon nut from handlebar



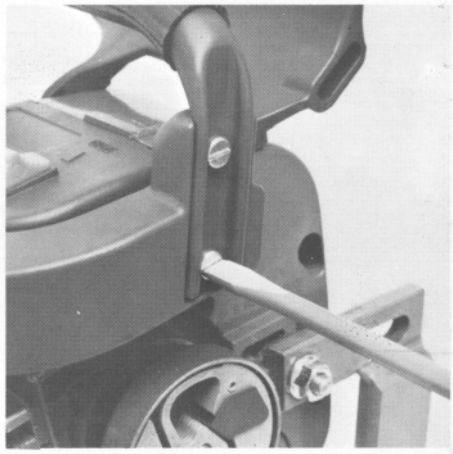


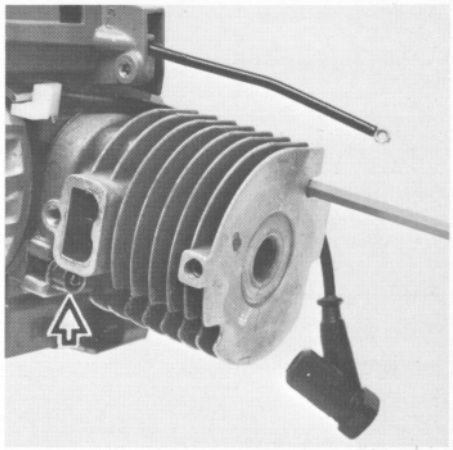
First drain the fuel and oil tanks and remove the spark plug. Unscrew the four self-tapping screws from the handle moulding, take off the moulding and disconnect throttle cable from throttle trigger. Push the handle moulding back into position to prevent the throttle trigger and flat spring dropping out.

Now take off the rear handle together with the handlebar. To do this, unscrew the M 5 hexagon nut and flat

Top:
Removing flat head screw

Bottom:
Removing cylinder base





head screw from the front vibration damper.

Unscrew the two cylinder base screws - which secure the cylinder to the crankcase - and then pull the cylinder off the piston.

Top:
Clamp 1120 893 9100

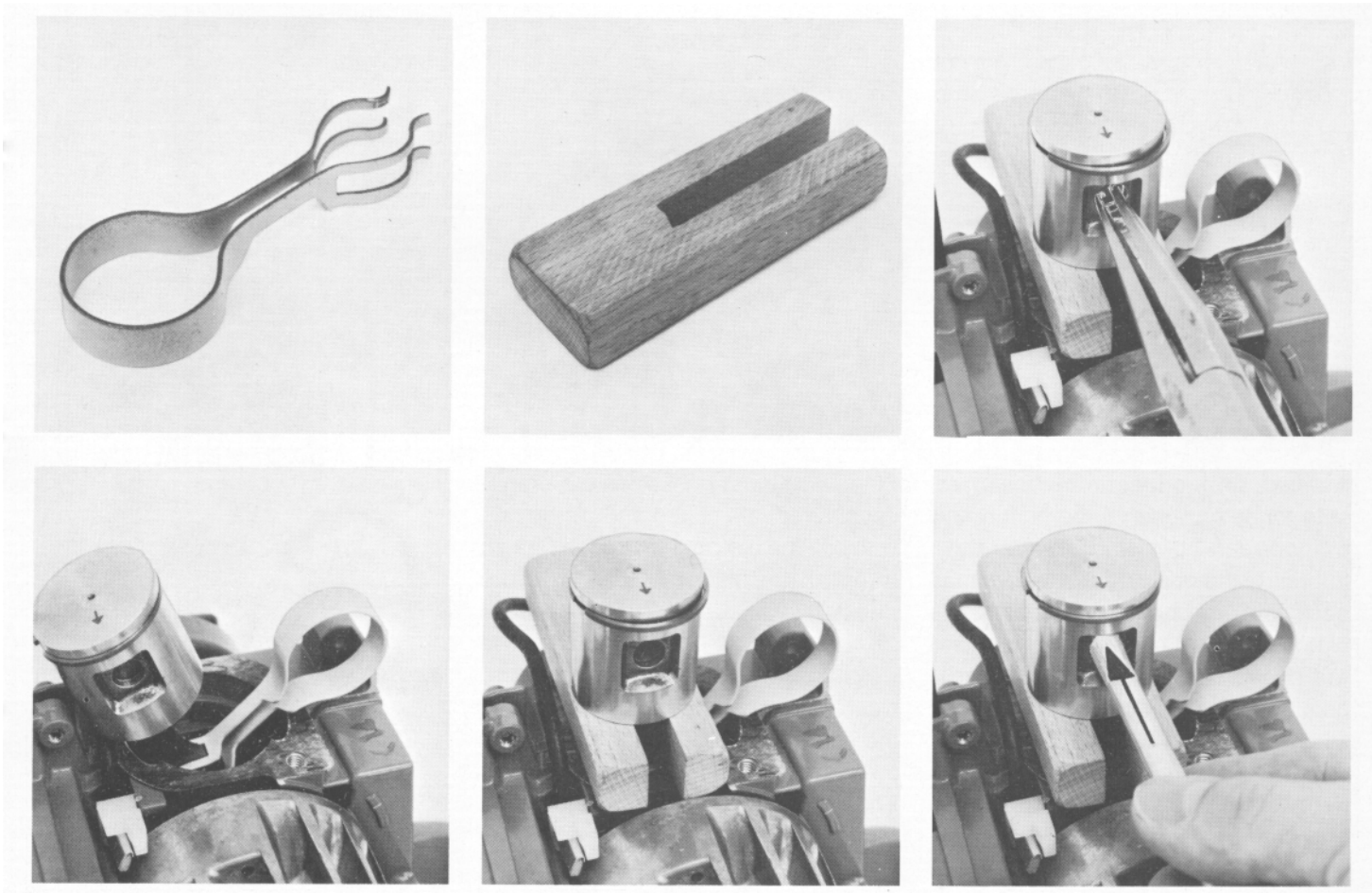
Bottom:
Clamp in position

Top:
Wooden assembly block 1108 893 4800

Bottom:
Assembly block fitted between crankcase and piston

Top:
Removing wire retainer

Bottom:
Pressing out piston pin with drift 1114 893 4700



Caution: The cylindrical rollers in the big end are not held in a bearing cage. The special clamp must therefore be pushed over the big end immediately after taking off the cylinder in order to prevent the cylindrical rollers dropping into the crankcase if the connecting rod shifts sideways.

Before removing the piston it must be decided whether or not the crankshaft is to be removed as well, i. e. the wooden block which is used to lock the crankshaft to facilitate removal of the flywheel and clutch must then be fitted between the crankcase and the piston.

To remove the piston, first take out the two wire retainers which secure the piston pin and use the drift to press the piston pin out of the needle cage.

If the piston pin is stuck as a result of carbonization, tap it out lightly with a hammer and the drift. It is essential to counterhold the piston to insure that no jolts are transmitted to the connecting rod.

3.5 Assembly of Piston and Cylinder

Arrow must point toward flywheel

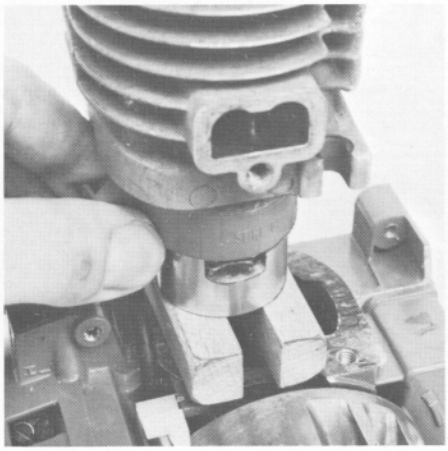
As there are no longer any matching categories to observe the piston and cylinder can be replaced separately. Lubricate the needle cage in the small end with oil before installing the piston. Position piston on connecting rod so that stamped marking (arrow) points toward the flywheel.

Now fit piston pin in piston and connecting rod. To do this, push assembly drift through piston bore and connecting rod (needle cage) to line the bores concentrically. Push piston pin into the piston. Move piston to and from to ease insertion of the piston pin.

The piston pin must move freely in its bore. Never use force during assembly.

Now insert the two wire retainers and make sure they are properly seated. They must fit snugly in the grooves.

Fitting the cylinder



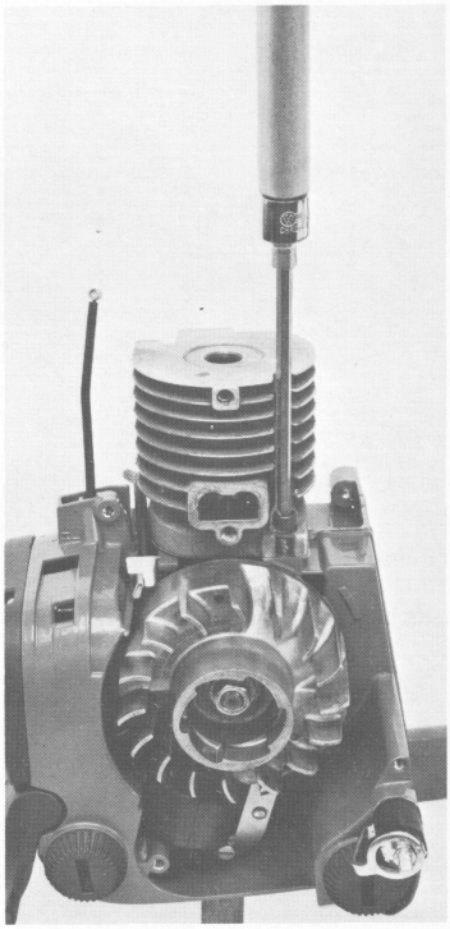
Fit new cylinder gasket on the crankcase. Lubricate piston and piston ring with oil. The piston ring groove has no fixing pin; the piston ring can therefore be fitted in any position.

Use the clamping strap to compress the piston ring around the piston and then push the cylinder over the piston. The cylinder`s exhaust port must face toward the flywheel.

Align cylinder, insert cylinder base screws and preload them initially to a torque of 6-7 Nm (0.6-0.7 kpm). Then finally tighten to a torque of 9.5-12 Nm (1.0-1.2 kpm).

Now reassemble the spark plug, ignition lead terminal, muffler, fan housing, rear handle and handlebar, throttle cable and handle moulding and the chain sprocket cover.

Tightening cylinder base screws with torque wrench



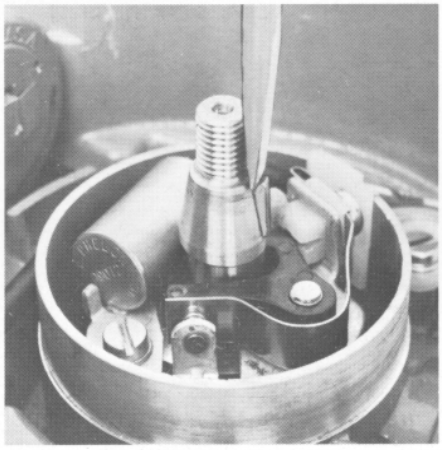
Use a new muffler gasket when refitting the muffler.

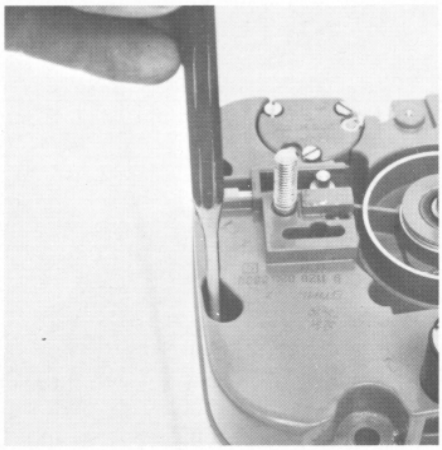
3.6 Disassembly of Crankcase - Removal of Crankshaft

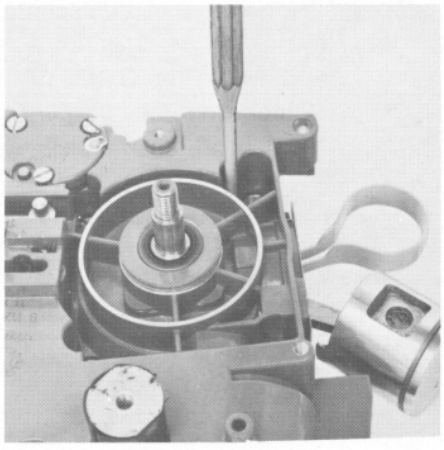
Removing the hand guard

Top:
Removing key

Center and bottom:
Knocking back cylindrical pins

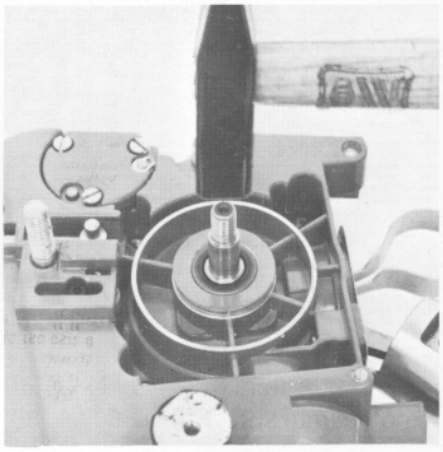


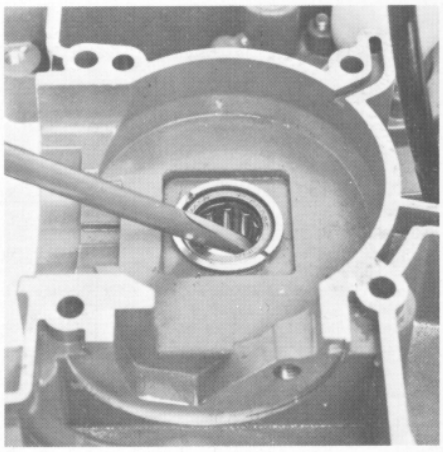




Top:
Driving out the crankshaft

Bottom:
Knocking out oil seal





To remove the crankshaft, first drain the fuel and oil tanks. Then disassemble the rear handle and handlebar, fan housing, muffler (3.4), the clutch (2.3.1), flywheel (4.4.4), carburetor (8.4) and hand guard. Remove cylinder and gasket and fit the special clamp in position (3.4).

Remove key from crankshaft stub at ignition side. Knock the two cylindrical pins back into the ignition side of the crankcase and then unscrew the seven flat head screws at the sprocket side. The two halves of the crankcase can now be split by tapping the sprocket end of the crankshaft with a soft-nosed hammer. The crankshaft should now slide out of the bearing when thumb pressure is applied.

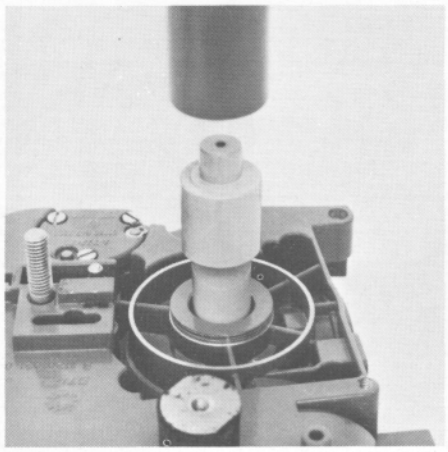
The sprocket side of the crankcase still contains the oil pump (7.4), the chain tensioner, a vibration damper, a needle sleeve and the oil seal.

The ignition side of the crankcase still contains the ignition, a vibration damper, fuel line with pickup body as well as a needle sleeve and the oil seal.

Use a screwdriver to knock the oil seals out of their seats from the inside to the outside, but remove the contact set first.

3.7 Installation of Crankshaft - Assembly of Crankcase

Driving out needle sleeve
with press arbor 1120 893 7200



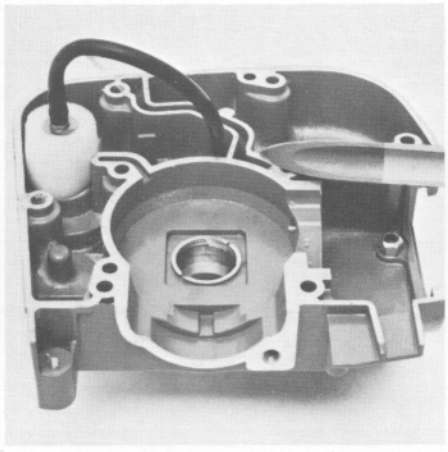
Use the press arbor to drive the needle sleeves out of the crankcase, from the outside to the inside in each case.

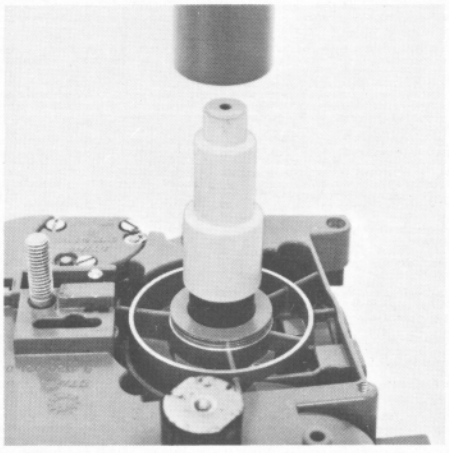
If the crankcase is damaged in any way it must be replaced as a complete unit (both halves). Always install new needle sleeves and oil seals in such a case. All other parts which are still serviceable can then be transferred from the old to the new crankcase.

Top:
Cleaning sealing faces

Center:
Needle sleeve correctly positioned

Bottom:
Pressing in needle sleeve





If the old crankcase is used again, carefully clean the sealing faces. Use a scraper or similar suitable tool to clean off gasket residue before fitting the new gasket.

The crankshaft bearings (needle sleeves) should be pressed into the crankcase halves from the inside to the outside. Do not heat the crankcase for this purpose.

The needle sleeves will only be correctly seated in the crankcase if the press arbor is used.

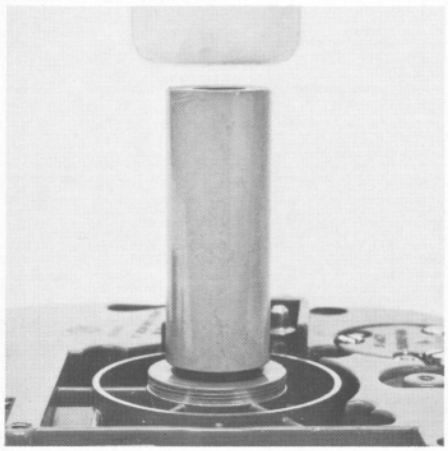
Important: The needle sleeves must be positioned on the press arbor so that the arbor's large diameter butts against the reinforced rim of the needle sleeve.

The needle sleeves are then placed in the crankcase and pressed home until the arbor butts against the crankcase.

Then use press sleeve to press in the oil seals from the outside to the inside.

Top:
Press sleeve 1120 893 2400

Bottom:
Pressing oil seal into position

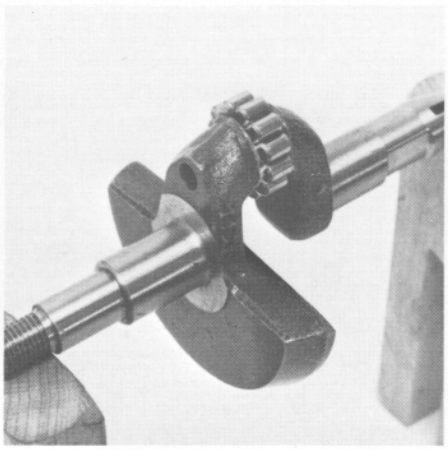


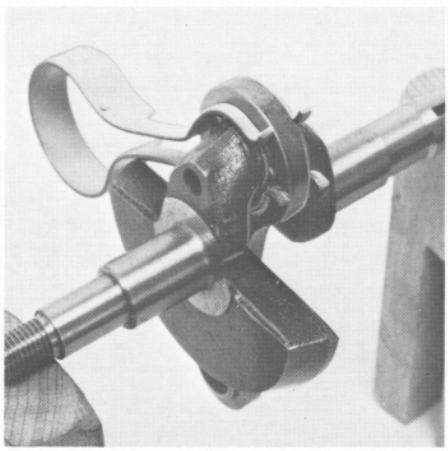
The oil seals should be perfectly flush with the crankcase faces. Lightly grease the sealing lips of the oil seals and the needle sleeves after installation. Use grease 0781 120 1109 for this purpose.

If the oil seals are replaced without removing the crankshaft, use the press sleeve to install them.

Top:
Cylindrical rollers held in position by grease

Bottom:
Clamp 1120 893 9100 in position

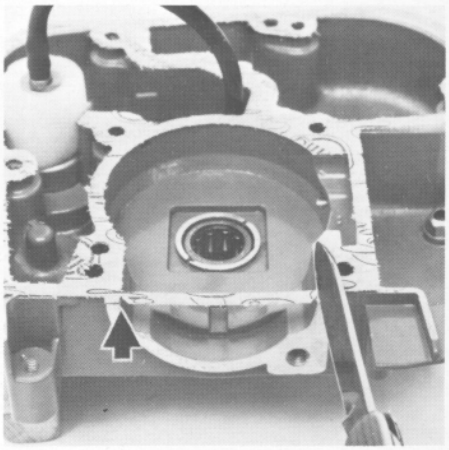




If a new crankshaft is being fitted, first fit 12 new cylindrical rollers in the crankshaft groove by coating the groove with grease (0781 389 3138) and then sticking the cylindrical rollers one by one to the grease. Hold the crankshaft horizontally and carefully fit the connecting rod over the cylindrical rollers.

Now fit the special clamp over the connecting rod to prevent the connecting rod slipping out of position during assembly and the cylindrical rollers dropping out of the crankshaft groove.

Cutting away gasket web at cylinder opening



Coat the mating faces of the two crankcase halves with sealing paste (0783 810 1101) and place the gasket on the clutch half of the crankcase, but first cut away the gasket web across the cylinder opening.

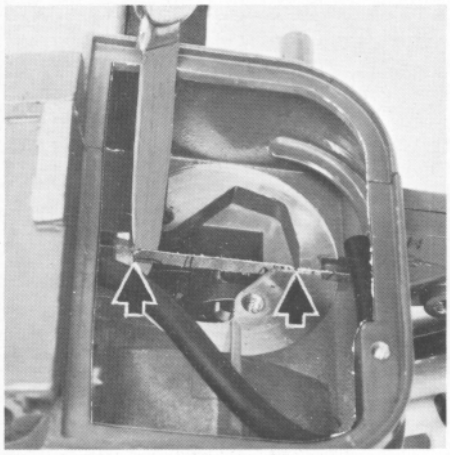
Fit thrust washer in recess on clutch half of crankcase and insert crankshaft, short stub first, into the crankcase until is butts against the thrust washer. Fit the ignition half of crankcase over the other crankshaft stub (do not forget the thrust washer), align the two crankcase halves and then knock in the two cylindrical pins.

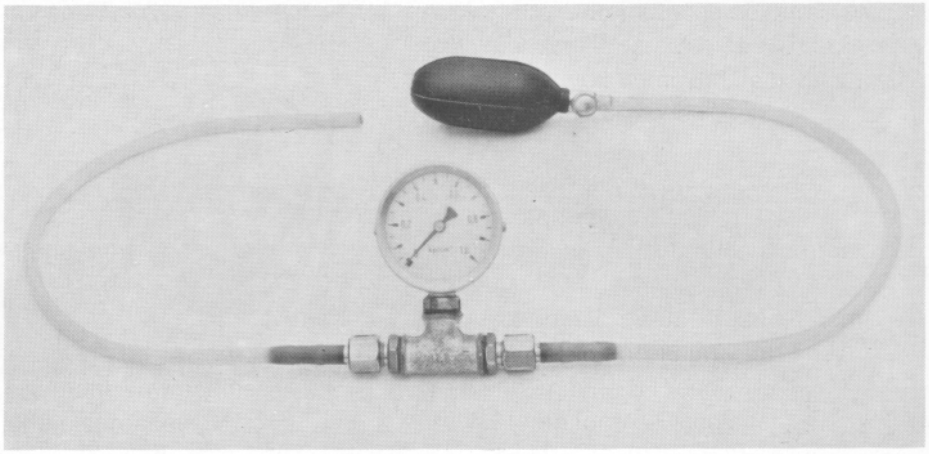
3.8 Leakage Testing the Crankcase

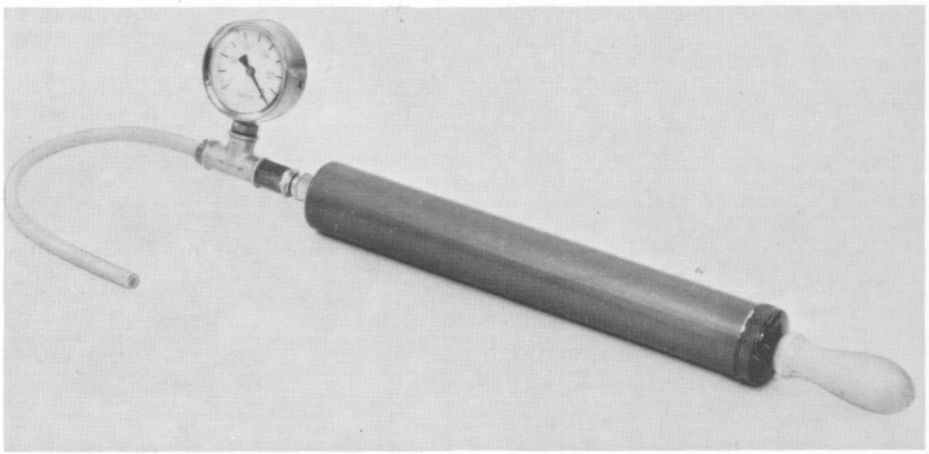
Top:
Carburetor and crankcase tester 1106 850 2900

Bottom:
Vacuum pump 0000 850 3500

Removing gasket web at inlet port







Then insert and tighten down the flat head screws to a torque of 4 - 5 Nm (0.4 - 0.5 kpm).

Reassemble all remaining parts by reversing the disassembly sequence. Carry out crankcase leakage test (3.8) and check ignition timing (4.5.2) before final assembly.

Important: The web of the crankcase gasket across the inlet port must becut away before fitting the diaphragm.

Defective oil seals and gaskets or accucracks in castings are the usual causes of leaks. Such faults allow supplementary air to enter the engine and upset the fuel-air mixture.

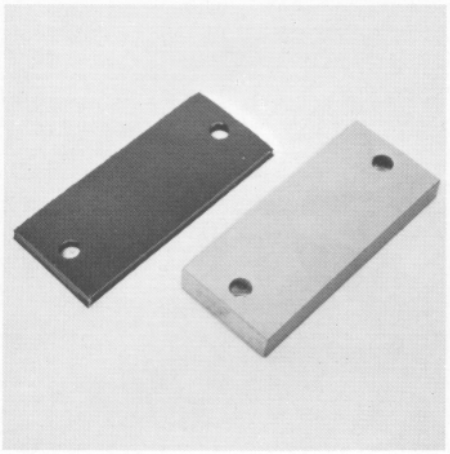
This makes adjustment of the prescribed idle speed difficult or even impossible. Moreover, the transition from idle speed to part or full throttle is not smooth.

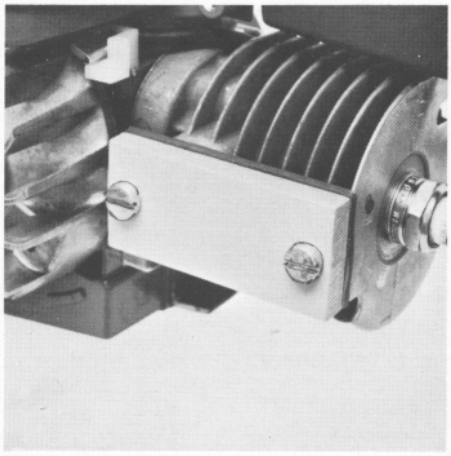
The crankcase can be checked rately for leaks with the carburetor/ crankcase tester and the vacuum pump.

3.8.1 **Pressure Test**

Top:
Sealing plate 1120 855 8100 and test flange 1120 855 4200

Bottom:
Exhaust port sealed





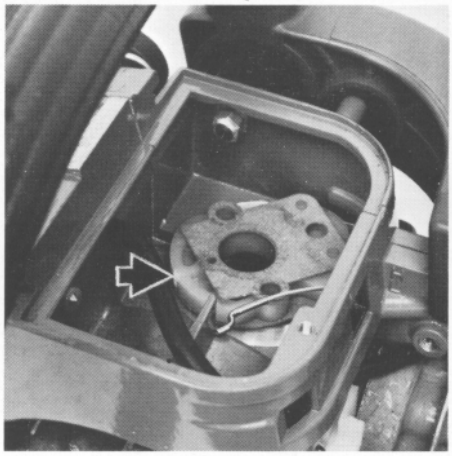
Remove the carburetor and muffler as well as the muffler gasket.

Seal the cylinder exhaust port with the sealing plate and test flange by means of two M 5x18 flat head screws.

Also remove the diaphragm and the two gaskets.

Top:
Test flange 1120 855 4215 in position

Bottom:
Test flange 1118 850 4210 secured in position



Now fit test flange 1120 850 4210 together with two new gaskets (1120 129 0500 and 1120 129 0505) on the crankcase.

Secure test flange 1118 850 4210 by means of two M 5x50 screws in place of carburetor.

Sealing plate 1120 855 8105 installed

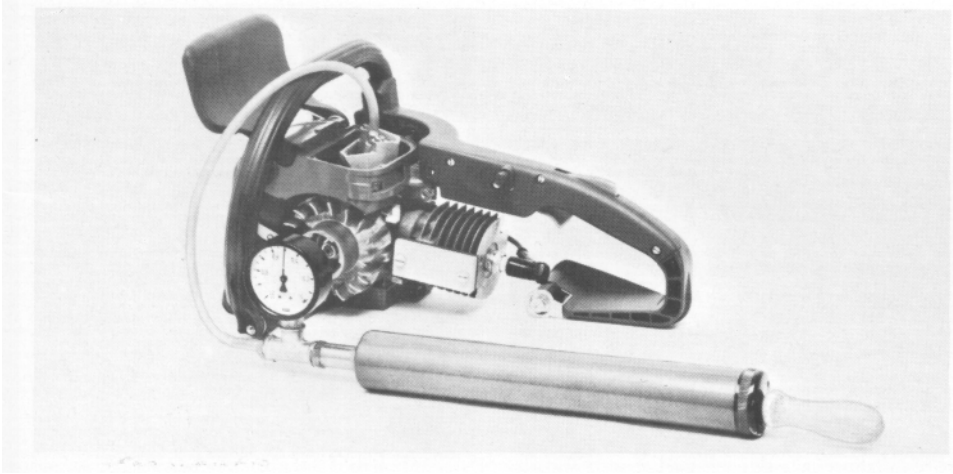
Unscrew the three pan head screws from the oil pump, take complete oil pump out of crankcase and disconnect hose. Use a screwdriver to prise off the circlip and then remove the pump cover. Place sealing plate on flange face - to seal pulse hole - and screw oil pump cover on top of it with the three M 4x16 pan head screws.

Turn piston to top dead center (T D.C.) and check that spark plug is properly tightened down.

Connect tester's pressure hose to the nipple of the test flange. Close bleed screw on rubber bulb and pump air into crankcase until pressure gauge shows a reading of 0.5 bar. If this pressure remains constant, the crankcase is airtight. However, if the pressure reading drops the leak must be found and the faulty part replaced.

3.8.2 Vacuum Test

Leakage test with vacuum pump



Oils seals tend to fail when they are subjected to a vacuum. During the piston's induction stroke the sealing lip lifts off the crankshaft owing to the lack of internal counterpressure.

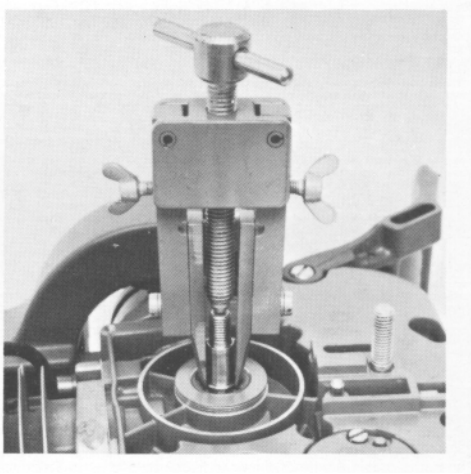
An additional test can be performed with the vacuum pump to detect this fault. The preparations for this test are the same as described for the pressure test (3.8.1).

Connect suction hose of vacuum pump to nipple of test flange. Then pull out pump handle until the pressure gauge indicates a vacuum of 0.5 bar. When you release the pump handle the non-return valve automatically seals the suction hose.

If the vacuum reading remains constant or drops no further than 0.3 bar, the oil seals are in good condition. However, if the vacuum continues to drop (down to 0 bar), the oil seals must be replaced even if no leaks were found in the previous pressure test.

3.8.3 Replacing the Oil Seals

Puller 0000 890 4400 in position



The oil seals can be replaced without disassembling the crankcase. To do this, first remove the clutch (2.3.1), flywheel (4.4.4) and the contact set (4.4.7).The primary lead can be left on the contact set.

Both oil seals, on the ignition and clutch sides, can be pulled out of their seats with puller 0000 890 4400.

Screw the No. 5 jaws to the puller and push the jaws into the oil seal by pressing them down lightly and turning at the same time.

Open up the jaws by turning the wing nuts and then screw down the spindle to pull the oil seal out of its seat.

Installation of the new oil seals is described under 3.7.

4. IGNITION SYSTEM

4.1 Construction

The 010 is equipped with a breaker-controlled magneto ignition system which requires neither a battery nor a generator.

The Phelon ignition system is of component-type construction (ignition armature and control unit are arranged separately) and consists of three main parts - the flywheel (magnet wheel), ignition armature and the control unit.

The flywheel carries the permanent magnet with a north and south pole and is located on the crankshaft stub. The ignition armature is mounted in the crankcase on the periphery of the flywheel and can be adjusted within certain close limits by means of slots in the iron core.

The ignition's control unit, i. e. the contact set with condenser, is screwed to the crankcase behind the flywheel.

4.2 Description of Operation

Every magneto ignition system operates on the principle of magnetic induction. On the breaker-controlled ignition system (and transistorized ignitions) this involves only "dynamic induction".

In **dynamic induction** the electric current is generated in a conductor by moving the conductor through the flux lines of a magnetic field. The magnitude of the induced voltage is basically dependent on the strength of the magnetic field and the speed of the flux change. This in turn is influenced mainly by the intensity of the movement.

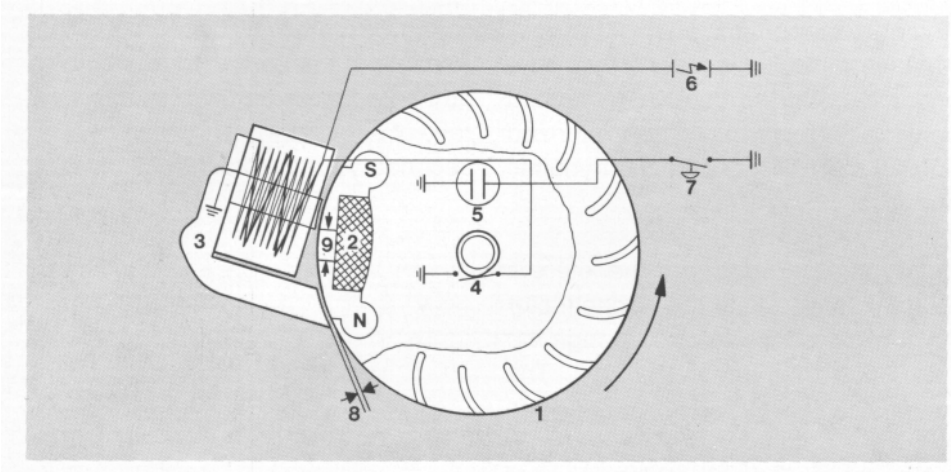
In terms of the magneto ignition system this means: As the flywheel rotates the flux lines flowing between the poles of the permanent magnet, from north pole to south pole, create a magnetic flux in the iron core of the coils. The flux lines of this magnetic field cut through the wire windings of the respective coil and induce a low tension current. The magnitude of the voltage is, therefore, basically depen dent on the rotational speed of the flywheel.

In the case of **static induction** on the other hand, the voltage is created in a conductor by a magnetic field chang ing its strength or flow direction, the conductor being situated in the mag netic field which is produced by an electric current (transformer prin ciple). The magnitude of the induced voltage is principally depended on the strength of the primary current which generates the magnetic field and the ratio of turns between the primary and secondary coils (transformation ratio).

4.2.1 Breaker-Controlled Magneto Ignition

Diagram of ignition system:

1 Flywheel
2 Permanent magnet with north and south poles and pole shoes
3 Ignition armature with primary and secondary windings
4 Contact breaker
5 Condenser
6 Spark plug
7 Ignition stop switch
8 Air gap
9 Edge gap



A condenser is wired in parallel with the contact breaker in the primary circuit in order to prevent excessive sparking (arcing) between the breaker points while they are opening and insure there is no loss of energy or premature corrosion of the points.

The primary circuit is permanently closed by means of the ignition stop switch. This suppresses the abrupt change in direction of the magnetic flux so that no further high-tension pulse can be induced.

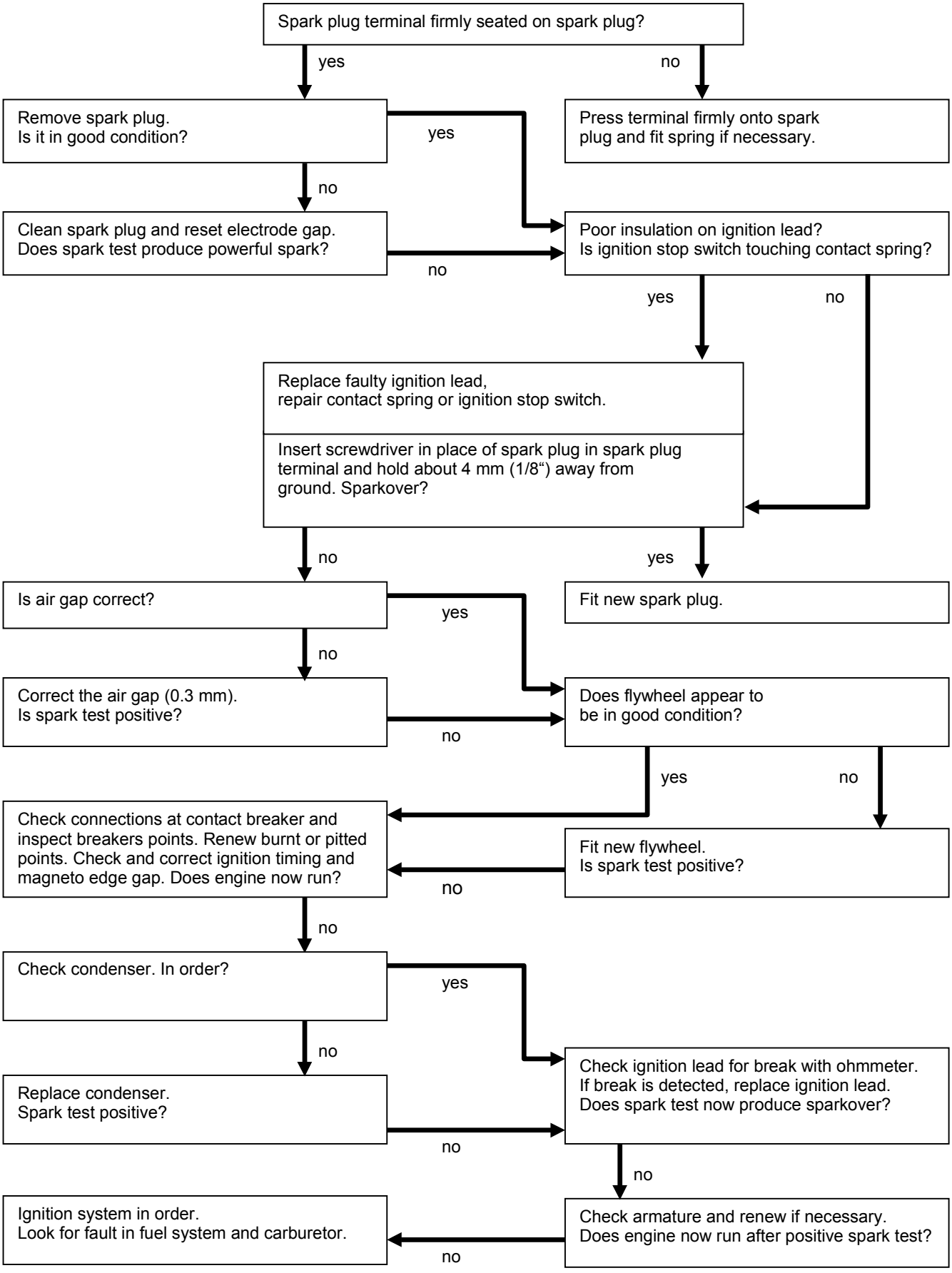
When the magnet poles of the flywheel pass the iron core of the armature coils a low-tension voltage is induced in the coils as a result of the magnetic flux.

Without any form of control the magnetic flux would rise and fall like a sine-wave and finally change direction. The same applies for the electric voltage. However, the magnitude of a voltage pulse generated in this way would not be sufficient to produce a sparkover.

This means that the voltage curve must be controlled. In this ignition system the mechanical contact breaker performs the control function. It is opened by the cam lobe ground on the hub of the flywheel and closed by spring action. At the moment of maximum flux the contact breaker, and also the primary circuit, is closed. The induced voltage thus allows a current to flow in the primary winding which builds up a magnetic field (armature field) around the coil. This is opposed to the inducing magnetic field (exciter field) and counteracts its tendency to change the flux direction. The further the flywheel rotates, the greater the tendency of the exciter field to change the flux direction. The opposing armature field and thus the primary current must also increase accordingly. When the current finally reaches its maximum value the contact breaker opens the primary circuit - this instant is called "magnet breakdown". This causes the magnetic field in the armature core to suddenly change direction and induce a high-tension pulse in the armature's secondary winding which is proportional to the high number of turns in that winding.

This pulse is fed via the hightension ignition lead to the spark plug and is discharged as a sparkover from the center to the ground electrode and thus ignites the fuel-air mixture.

4.3 **Troubleshooting Chart**



4.4 Function and Repair of Components

4.4.1 Spark Plug

The high-tension pulse generated in ignition system is fed to the spark plug and discharge as a sparkover between the center and ground electrodes.

When the spark plug is in good condition and the electrode gap is correct, the spark ignites the fuel-air mixture.

The appearance of the spark plug'sinsulator nose gives valuable information with regard to the effects of various operating conditions:

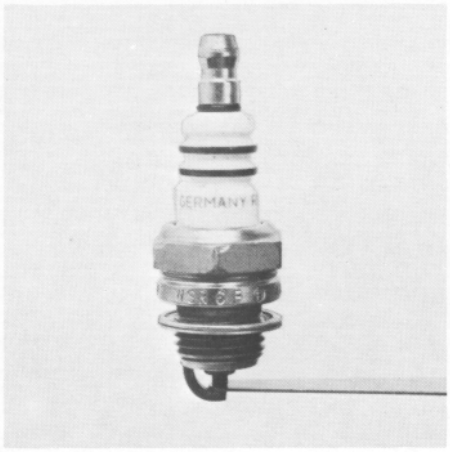
Troubleshooting on the ignition system should always begin at the spark plug.

In the event of starting difficulties, low engine power or misfiring etc., unscrew the spark plug and check whether it is one of the types approved by STIHL.The Champion RCJ 6Y suppressed spark plug is an approved alternative to the standard Bosch the WSR 6 F (formerly WKA 200 TR 6). These spark plugs cover a wide thermal range and have better operating characteristics under severe conditions.

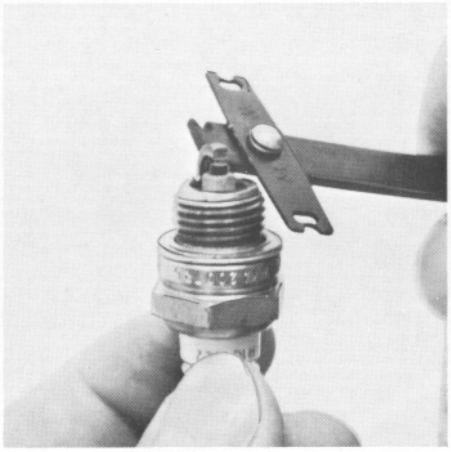
Appearance of insulator nose		Some conditions associated with appearance
Normal:	grey/yellow to brown, dry	Engine in order; spark plug heat range is correct
Sooted:	velvelt-like, dull black coating of soot	Mixture too rich, lack of air (dirty air filter, choke valve partly closed), electrode gap too wide, heat range too high
Smeared with oil:	coating of damp oil carbon and soot	Too much oil in fuel mix
Overheated:	welding beads on insulator nose, eroded electrodes	Mixture too lean, spark plug loose, heat range too low

4.4.2 Ignition Lead

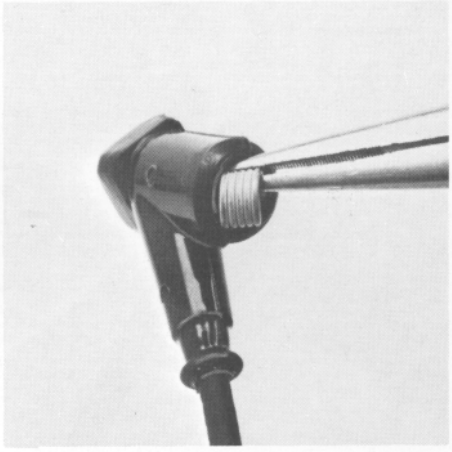
Checking electrode gap with feeler gauge



Resetting electrode gap with Bosch spark plug gauge



Pulling out leg spring



Never use a steel wire brush for cleaning a sooted or carbonized spark plug. Always use a brass wire brush for this purpose and then blow out the plug with compressed air. If the spark plug is smeared with oil, wash the insulator nose with a grease solvent and blow out with compressed air.

As the electrode gap becomes wider as a result of normal erosion the gap must be checked with a feeler gauge at regular intervals and reset as necessary. The specified gap is **0.5 mm** and can be restored by bending the ground electrode. However, always fit a new spark plug if the electrodes are badly eroded.

Accurate checking of the spark plug is possible only with a special spark plug tester. A provisional check can be carried out by fitting the clean spark plug in the ignition lead terminal and holding it against ground. There should be a powerful sparkover at the electrodes when the engine is cranked by pulling the rewind starter.

If there is no sparkover although the spark plug is in good condition, first check the lead connections. Chafed insulation on the ignition or ground leads will cause a short-circuit to ground. If this is the case the engine will either not start or only run erratically.

Before refitting the spark plug in the cylinder, clean the spark plug seat and make sure the sealing ring is in good condition. Tighten down the spark plug to a torque of 25 Nm (2.5 kpm).

The ignition lead feeds the high-tension pulse generated in the armature to the spark plug. If its insulation is brittle or damaged in any way a sparkover to ground can occur and thus interrupt the ignition process.

The ignition lead must be renewed in such a case.

To remove the ignition lead, disassemble the flywheel (4.4.4) and ignition armature (4.4.5.3). Unscrew the ignition lead from the wood screw on the high-tension output of the armature. Take off the rubber boot and then pull out the ignition lead through the cable clamp and crankcase. Use a suitable pair of pliers to grip and pull the leg spring out of the ignition lead terminal. Then pull ignition lead out of the terminal.

4.4.3 **Ground Lead Contact**

Screwing ignition lead onto armature

Top:
Ignition lead inserted through terminal

Bottom:
Fitting leg spring

Top:
Spring strip of ignition stop switch pushed out of slot

Bottom:
Removing ignition stop switch

The new ignition lead must have a length of 370 mm.

Slip the rubber boot over one end of the lead and screw the lead firmly onto the wood screw in the armature - this is much easier if a hole is made in the center of the lead with a pointed tool.

Fit the armature and thread the other end of the ignition lead between the crankcase and cable clamp. Coat the free end of the lead with a little oil. Push the terminal over the end of the lead and use a suitable pair of pliers to grip and pull the lead out through the terminal. Pinch the hook of the leg spring into the center of the lead about 15 mm from the end of the lead. Pull lead back so that the leg spring locates in the terminal. Take out locking screw and refit spark plug. Push terminal onto spark plug and reassemble all other parts. Readjust air gap (4.4.5.3).

The ignition stop switch short circuits the ignition and thus stops the engine. The switch is installed in the fan housing and makes ground contact when in the "STOP" position.

The ignition stop switch is simply located in the housing slot. To remove it, push the spring strip out of the slot and pull the complete switch upward and out of the housing opening.