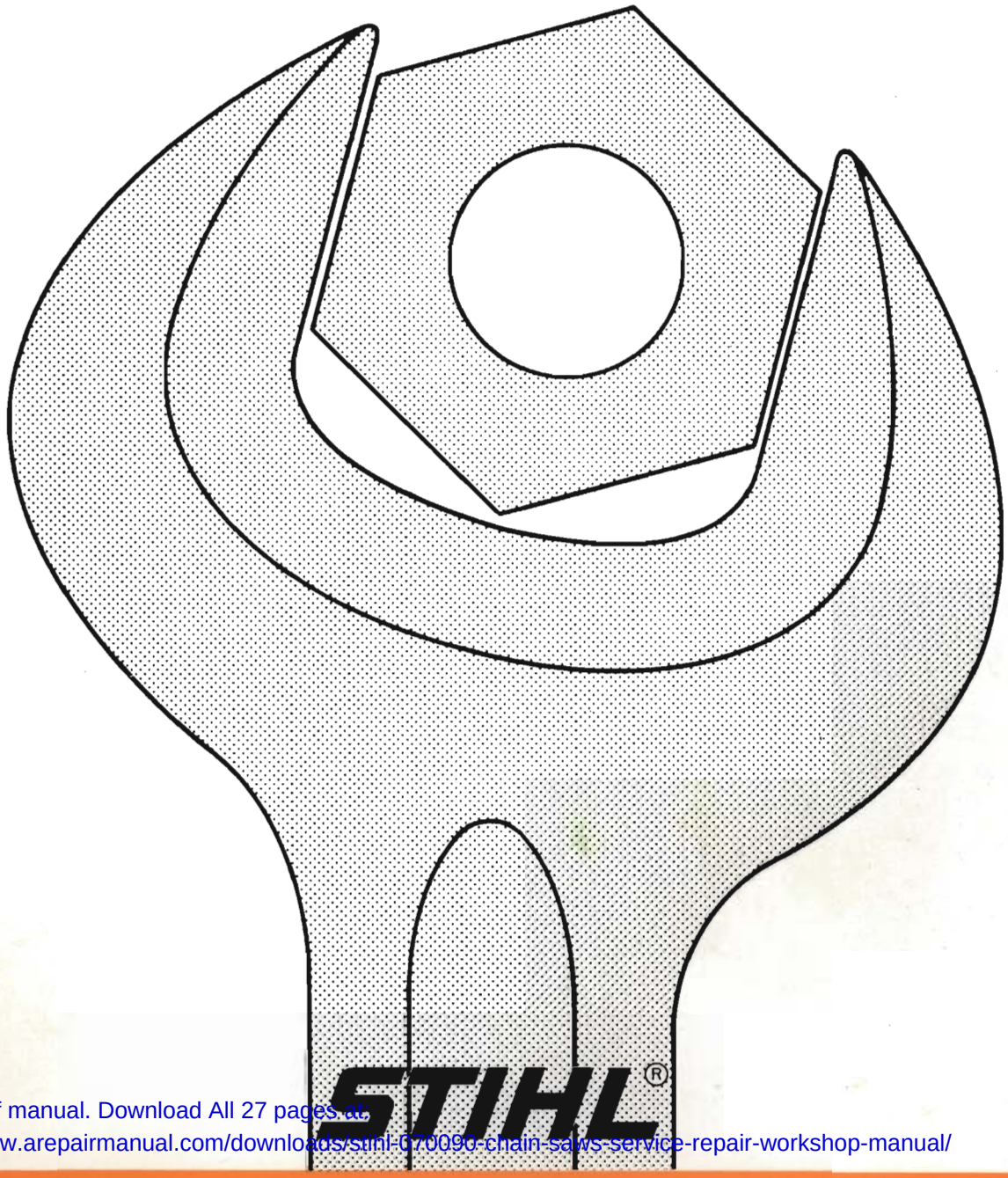
# STIHL 070, 090



# Power Chain Saw
# Stihl 070, 070 AV, 090, 090 AV, 090 G
# Models 1106, 1109
# Chain Saw Service Manual

This Chain Saw Service Manual relates to our models Stihl 070, 070 AV, 090, 090 AV, 090 G beginning with machine number 1 163 000 (070 + 070 AV + 090 + 090 AV) and machine number 1 302 500 (090 G), April 1969. Please refer to our periodically turned out Technical Informations for repairing power saws of same model but of older design and lower machine numbers than mentioned above and for technical modifications made after this manual was printed.

This Guide Book should be used only for the instruction of our dealers and authorized service shops. Handing over or lending this manual to other persons is prohibited.

**Contents**



STIHL®

**Andreas Stihl**
**Postfach 1771**
**D-7050 Waiblingen**

## Specifications

### Engine

STIHL single cylinder, two-stroke engine with specially impregnated cylinder bore

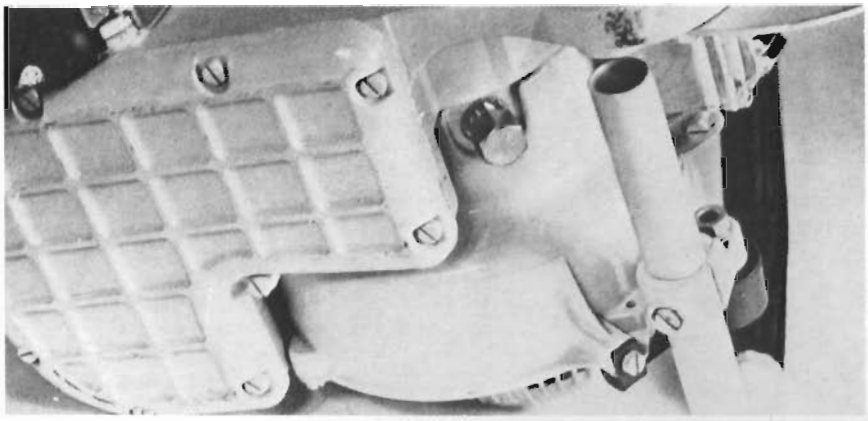
| | |
|---|---|
| Displacement: | 106 $cm^3$ (6.47 cu. in) (070, 070 AV, 090 G) |
| | 137 $cm^3$ (8.36 cu. in) (090, 090 AV) |
| Bore: | 58 mm (2.28 in) (070, 070 AV, 090 G) |
| | 66 mm (2.60 in) (090, 090, AV) |
| Stroke: | 40 mm (1.57 in) |
| Compression ratio: | 9.5:1 |
| Max. torque: | 7,7 Nm (5.7 lbf. ft) on 070, 070 AV, 090 G |
| | 9,5 Nm (7.0 lbf. ft) on 090, 090 AV at n = 5000 r.p.m. |
| Max. engine speed: | 8000 r.p.m. |
| Mean idle speed: | 2000 r.p.m. (070, 070 AV) |
| | 1800 r.p.m. (090, 090 AV, 090 G) |
| Crankshaft: | Two-part, drop forged |
| Crankshaft bearings: | 2 needle bushes |
| Crankpin dia.: | 19,0 mm (0.75 in) |
| Big-end bearing: | Needle cage |
| Piston pin dia.: | 15,0 mm (0.59 in) |
| Small-end bearing: | Needle cage |
| Starter: | Pawl system (070, 070 AV) |
| | Friction shoe system (090, 090 AV, 090 G) |
| | both with automatic starter rope rewind mechanism |
| Starter rope: | 4,5 mm (0.18 in) dia., 1000 mm (40 in) long |
| Clutch: | Centrifugal cluch with lining |
| | 78 mm (3.1 in) dia. (070, 070 AV) |
| | 96 mm (3.8 in) dia. (090, 090 AV, 090 G) |
| Engagement speed: | approx. 2600 r.p.m. (070, 070 AV) |
| | approx. 2500 r.p.m. (090, 090 AV, 090 G) |
| Leakage testing crankcase | |
| with overpressure: | 0,5 bar (7.1 $lbf/in^2$) |
| with vacuum: | 0,5 bar (7.1 $lbf/in^2$) |

### Fuel System

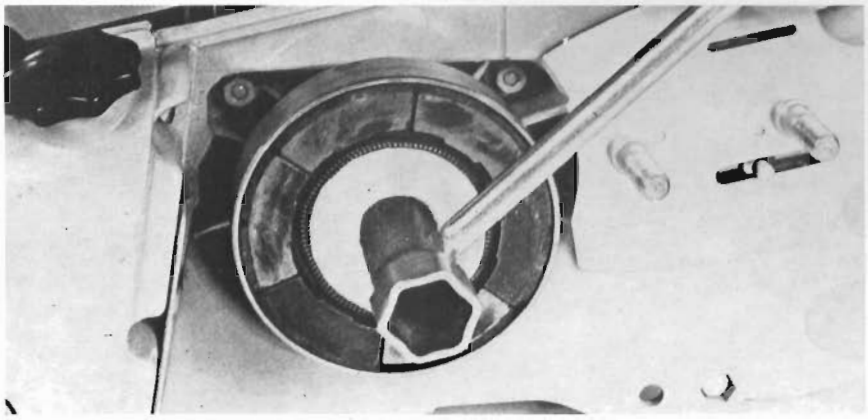
| | |
|---|---|
| Carburetor: | All-position diaphragm carburetor with integral fuel pump |
| Adjustment | |
| High-speed adjustment screw H: | Short with knurled head, open 1 turn |
| Low-speed adjustment screw L: | Long, open 1 turn (basic setting, starting with screws hard against their seats) |

| | | |
|---|---|---|
| | Leakage testing carburetor with overpressure: | 0,4 bar (5.7 lbf/in$^2$) |
| | Fuel capacity: | 0,82 l (1.73 pt) |
| | Fuel mixture: | Mix ratio 1:40 with STIHL engine oil; 1:25 for other branded two-cycle engine oils |
| | Air filter: | Large area flocked wire mesh filter |
| **Ignition System** | Type: | Breaker-controlled magneto ignition system |
| | Magneto edge gap: | 7 . . . 11 mm (0.26 . . . 0.43 in) |
| | Air gap: | 0,2 . . . 0,3 mm (0.008 . . . 0.012 in) |
| | Ignition timing: | 2,8 . . . 3,2 mm (0.11 . . . 0.126 in) before T.D.C. |
| | Spark advance: | 27° . . . 29° |
| | Breaker point gap: | 0,35 . . . 0,45 mm (0.014 . . . 0.018 in) |
| | Condenser: | Capacitance: 0,15 . . . 0,19 $\mu$F |
| | Armature: | Resistance of primary winding: 0,5. . . 0,6 $\Omega$ |
| | Spark plug (suppressed): | Bosch WSR 6 F (earlier designation: WKA 200 TR 6) or Champion RCJ 6 Y<br>Heat range:<br>175 (070, 070 AV, 090 G)<br>225 (090, 090 AV)<br>Electrode gap: 0,5 mm (0.02 in)<br>Spark plug thread: M 14×1,25, 9,5 mm (0.37 in) long |
| **Reduction gear** (090 G only) | Type: | Single-speed spur gear box |
| | Reduction: | 2:1 |
| | Lubrication: | HD SAE 30 engine oil |
| | Oil capacity: | 0,15 l (0.32 pt) |
| **Tightening Torques** | Crankshaft nut (ignition side) M 10×1: | 45 Nm (33.2 lbf.ft) |
| | Crankshaft nut (clutch side) M 10×1 left-hand thread: | 44,1 Nm (32.5 lbf.ft) |
| | M 6 nuts: | 6,9 Nm (5.1 lbf.ft) |
| | M 8 hex. head screws: | 9,8 Nm (7.2 lbf.ft) |
| | M 6 socket-head screws: | 9,8 Nm (7.2 lbf.ft) |
| | M 6 cheese-head screws: | 6,9 Nm (5.1 lbf.ft) |
| | M 5 socket-head screws: | 6,9 Nm (5.1 lbf.ft) |
| | Other M 5 screws: | 4,9 Nm (3.6 lbf.ft) |
| | M 4 screws: | 2,5 Nm (1.8 lbf.ft) |
| | Spark plug: | 24,5 Nm (18.1 lbf.ft) |

| | | |
|---|---|---|
| **Cutting Attachment** | Guide bars: | STIHL Duromatic with stellite tipped nose; STIHL Rollomatic with sprocket nose. Both types with corrosion-resistant finish and induction hardened track |
| | Bar lengths: | Duromatic 53, 63, 75, 80, 90, 105, 120 and 150 cm (21, 25, 30, 32, 35, 41, 47 and 49 in)<br>Rollomatic 75, 90 and 105 cm (30, 35 and 41 in) for 0.404" (10.26 mm) pitch |
| | Chain: | 0.404" (10,26 mm) pitch for 070, 070 AV and 090 AV<br>½" (12,7 mm) pitch for 090 with wrap-around handle and 090 G |
| | Chain sprocket: | 7-tooth for 0.404" (10,26 mm) pitch<br>6-tooth for ½" (12,7 mm) pitch |
| | Chain speed: | 16,7 m/s (54.8 ft/sec) with 0.404" (10,26 mm) chain at 7000 r.p.m.<br>17,8 m/s (58.4 ft/sec) with ½" (12,7 mm) chain at 7000 r.p.m. (070/090)<br>8.9 m/s (29.2 ft/sec) with ½" (12,7 mm) chain at 7000 r.p.m. (090 G) |
| | Chain lubrication: | Speed controlled oil pump, operative only when chain is running<br>Integral hand pump for additional chain lubrication.<br>Supplementary oil feed control by means of adjusting screw |
| | Oil tank capacity: | 0,53 l (1.12 pt) |
| **Weights** | Dry weight without bar and chain | |
| | 070: | 10.7 kg (23.6 lb) |
| | 070 AV: | 11.8 kg (26.0 lb) |
| | 090: | 11.5 kg (25.4 lb) |
| | 090 AV: | 12.3 kg (27.1 lb) |
| | 090 G: | 13.4 kg (29.5 lb) |



*Screwing in crank-shaft locking screw*



*Loosening crank-shaft nut*

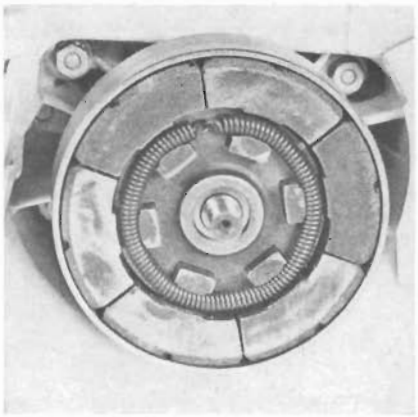
**Chain Drive with clutch**
**Disassembly and repair**

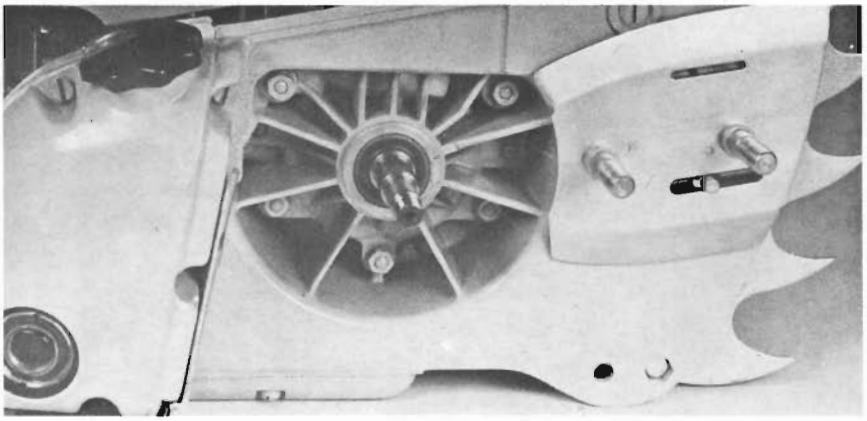
For disassembling the chain drive with clutch remove screw plug in crank-case and screw in crank-shaft locking screw, by hand, which you find in the tools kit. Turn clutch counter-clockwise until web of crank-shaft is stopped by the crank-shaft locking screw. This locks the crank-shaft and the hexagonal crank-shaft nut can now be removed with a 17 SW combination wrench by turning it clockwise. **Note: Left-hand thread!**

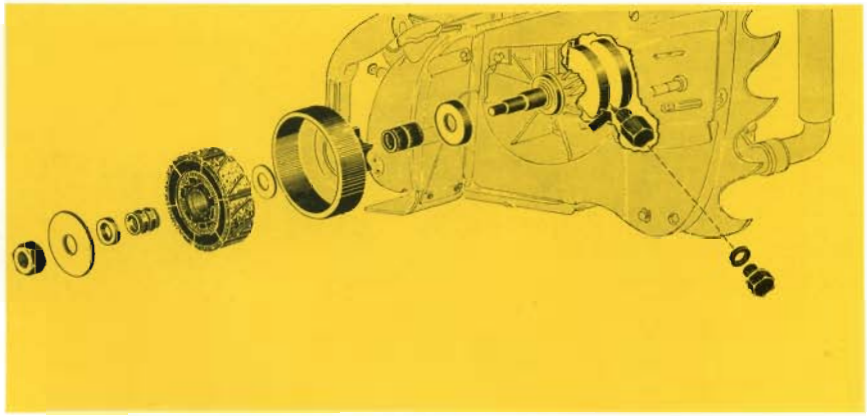
Remove hexagonal nut, washer and ring and then chain sprocket, clutch and spider from crank-shaft. A "Spieth" adapter sleeve is inserted into the spider of the clutch which gets deformed when the hexagonal nut is tightened and this adapter sleeve ensures a tight connection between crank-shaft and spider.

The friction linings of the clutch shoes get worn with the time. If the friction linings are worn so that the clutch shoes must be renewed only the whole set of clutch shoes can be replaced. The same applies to the clutch springs; only the whole set of springs can be replaced if a spring is broken or stretched.

When re-assembling the clutch remove all traces of oil or grease from the friction linings — oil or grease on the friction linings would cause slipping of clutch and would reduce the effectiveness of the clutch.







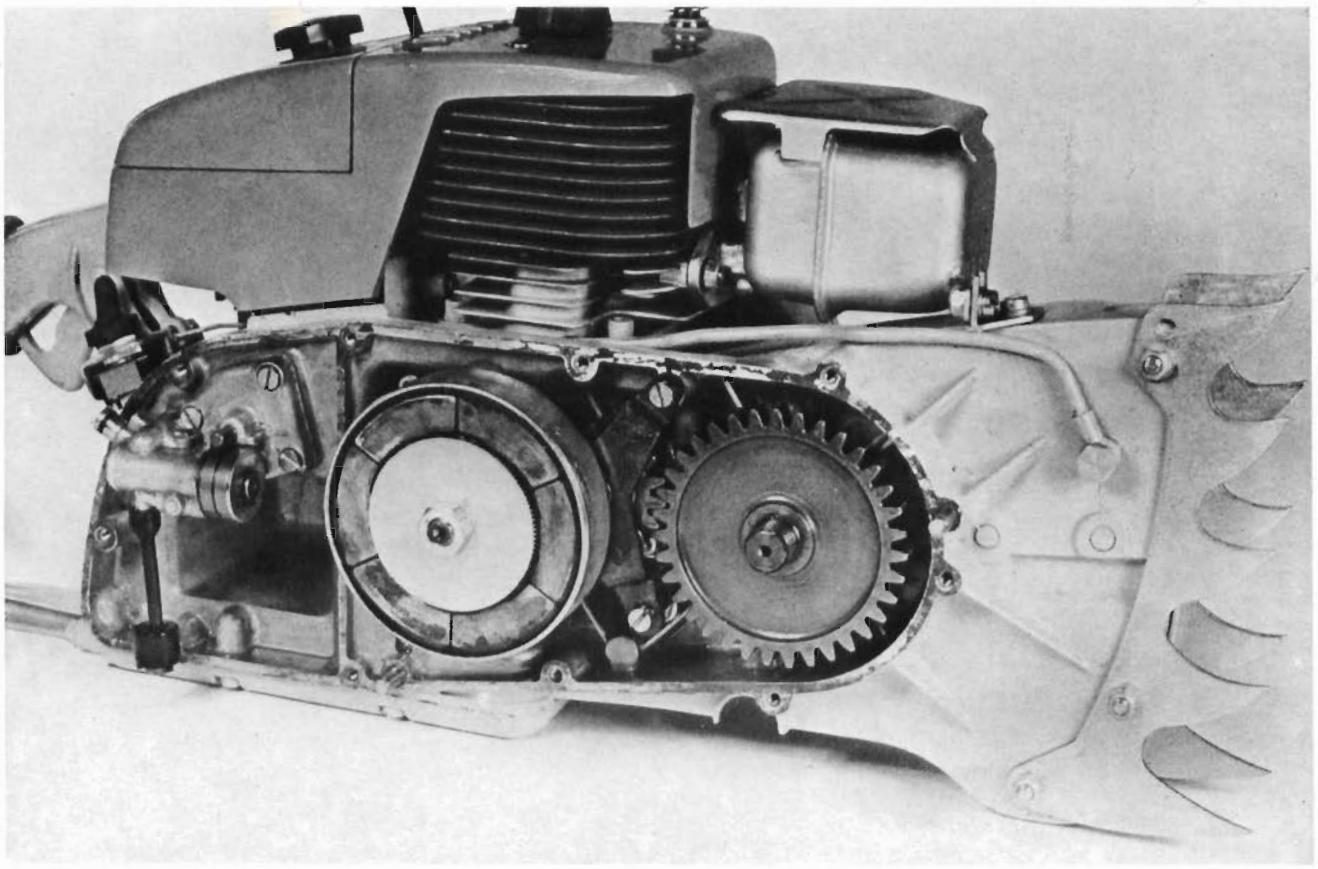
*Exposed clutch*
*End play control of crank-shaft*
*Installation of spring*
*Disassembly of clutch with chain sprocket*

The chain drive sprocket is supported on the crank-shaft by a needle bearing (which should be greased with bearing grease every two months). The chain drive sprocket must be renewed if it has a wear of more than .04″ = 1 mm depth. Moreover, the clutch retainer between chain sprocket and clutch is to be mounted in such a way that the radius, which you find at the centre bore is positioned at the engine side. Mount clutch with absolutely dry "Spieth" adapter sleeve, ring and washer and tighten hexagonal nut with a torque wrench to 32.5 lbf. ft (44,1 Nm).

Contrary to the models 070 and 070 AV, the clutch of the models 090, 090 AV and 090 G is composed of a spider and six clutch shoes. These clutch shoes are held in place by two springs which are positioned laterally in the recesses.

Replacing new clutch shoes

If the set of clutch shoes has to be replaced owing to worn friction linings insert the new clutch shoes into the mounting collar on the spider. Insert mounting bolt and press spring over mounting bolt (see illustration) into the recesses of the clutch shoes. This must be done from both sides.



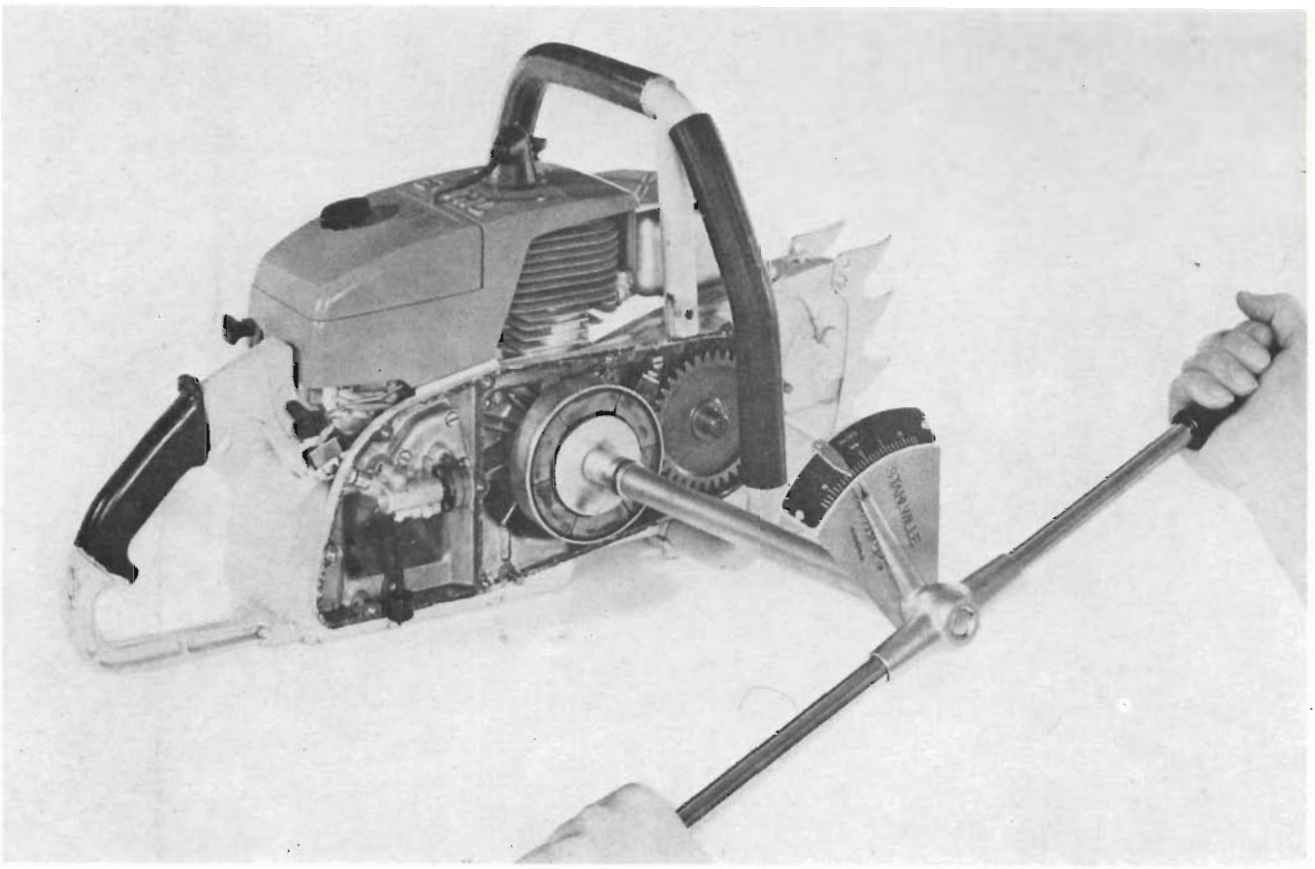
## Transmission 090 G

Contrary to the direct drive models 070, 070 AV, 090 and 090 AV the model 090 G (G = Transmission) is equipped with a spur wheel reduction gear which allows the use of guide bars up to 150 cm (60″) length. The reduction ratio is about 2 : 1, that means the drive gear has 17 and the driven gear 35 teeth. The chain drive is positioned about in the middle of the machine under the muffler.

The model 090 G is equipped with a chain drive sprocket of 1/2″ pitch. Alternatively it can also be equipped with a chain drive sprocket of .404″ pitch. It is pressed onto the drive shaft, secured by a fitting key and fastened by a hexagonal nut. After having removed the hexagonal nut the chain drive sprocket can be pulled off the drive shaft with a puller 1109 890 4401. Before reassembling the chain drive sprocket you must heat it to about 90—100° C (194—212° F). In this way it can be easily put on the drive shaft.

## Disassembly of Transmission

To disassemble transmission of the 090 G, drain gear oil from gear case. Disassemble transmission cover by removing the 11 cylindrical screws and the hex.-head screws at the wrap-around handle. For removing the transmission cover from the two adjusting pins the cover is provided with three lugs. Remove screw plug from crank-case and screw in crank-shaft locking screw by hand.

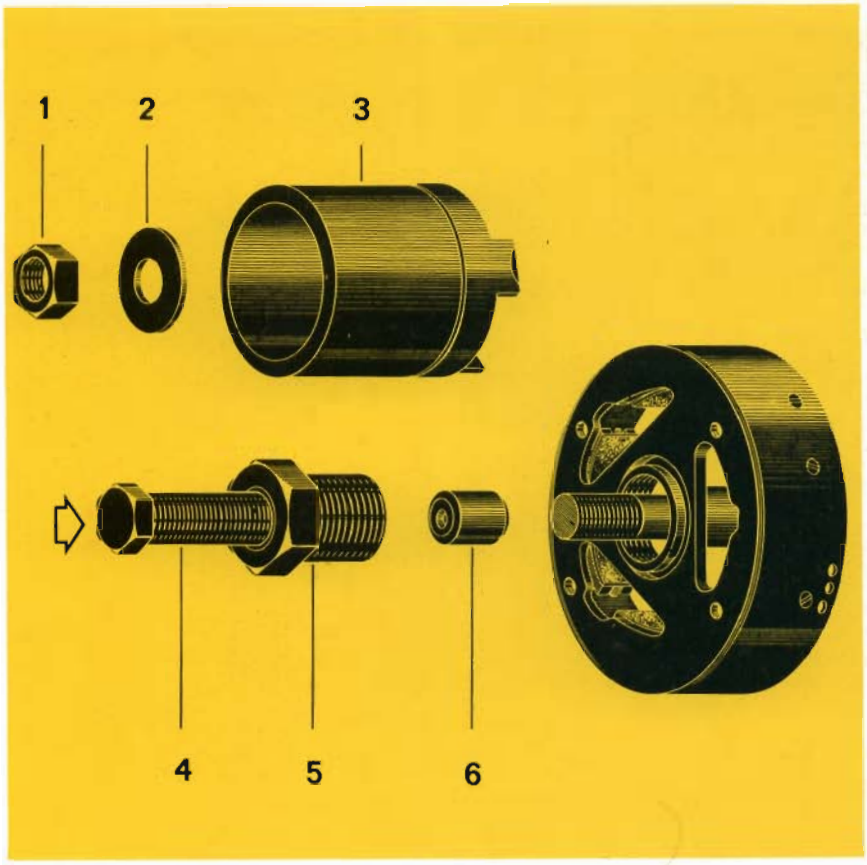


*Tightening crank-shaft nut with torque wrench*

Lever off cap on clutch drum with a screwdriver. This cap protects the clutch against lubricating oil. Loosen hexagonal crank-shaft nut with 17 SW combination wrench by turning it clockwise.
**Note: Left-hand thread!** Then remove washer and ring. Now pull off clutch drum with drive sprocket and clutch with spider from crank-shaft.
Remove bracket over the small spur gear by loosening the two cylindrical screws and remove spur wheel from crank-shaft.
To loosen the hexagonal nut at chain sprocket hold sprocket with a pipe wrench. Then remove washer under sprocket and pull chain sprocket off shaft with puller 1109 890 4401.
Now remove large spur gear with shaft from grooved bearing. Pull spur gear from shaft with a double-claw puller.
Before reassembling the transmission check the oil seal, the grooved bearing in the crank-case, the needle bearing in the gear case cover, the needle bearing of the small spur gear and the needle bearing of the drive gear.
The spur gears can be replaced individually.

**Lubrication**

The transmission has an oil-bath lubrication. The gear oil is SAE 30 oil. The oil quantity amounts to 150 ccm (9.15 cu. inches). Refill oil through oil filler hole and check oil level at oil filler hole. The oil level is correct when the oil reaches the bottom edge of the oil filler hole with horizontally positioned engine.




## Ignition system

The ignition spark is produced by a Bosch fly-wheel magneto which is positioned under the rewind starter or under the fan wheel.

## Exposure and Disassembly of Armature Plate

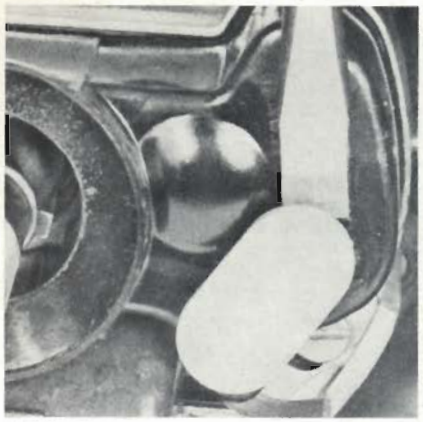
Unscrew the four AM 5 cylindrical screws at the fan cover with rewind starter. Disassemble fan cover. Remove fan wheel which is fastened by four screws. Now lock crank-shaft by removing the screw plug and screwing crank-shaft locking nut into the screw plug hole. The crank-shaft locking screw is included in the tools kit. Then loosen hexagonal crank-shaft nut using a 17 SW combination wrench **by turning the nut counterclockwise.** Remove starter cup. Screw fly-wheel puller with pressure piece onto thread of fly-wheel until snug and turn fly-wheel clockwise until the web of the crank-shaft bottoms on the crank-shaft locking screw. Screw in pressure piece of fly-wheel puller to loosen the fly-wheel from crank-shaft taper and lift it off the crank-shaft. Now the armature plate is accessible. The point set and the condenser are positioned under the dust cap on the armature plate.

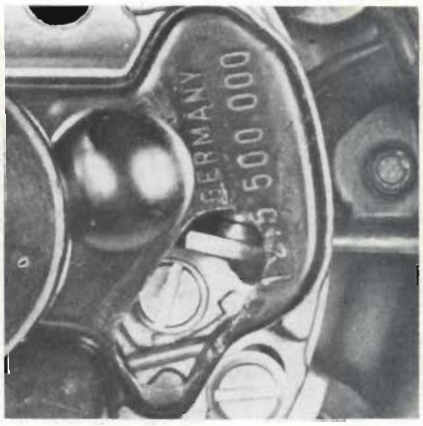
*Illustrations:*

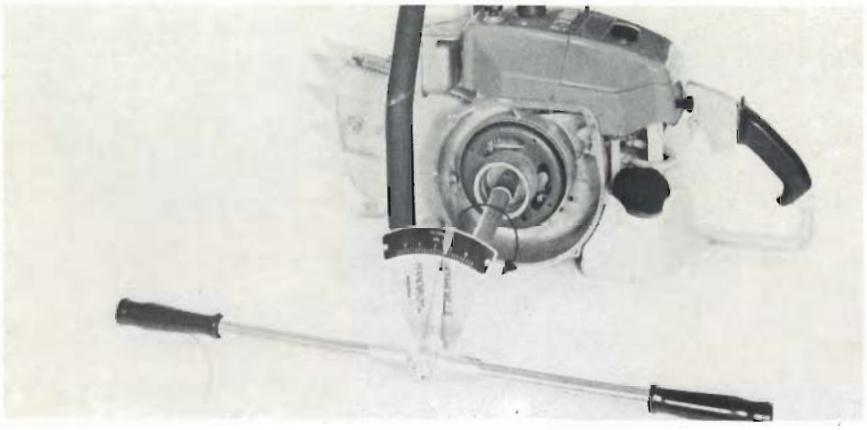
*Exploded view:*
*Removing starter cup and inserting fly-wheel puller*
*1. Hexagonal nut*
*2. Washer*
*3. Starter cup*
*4. Hex.-head screw*
*5. Puller sleeve*
*6. Thrust bolt*
*Disassembly of fan wheel*
*Removing fly-wheel*

## Replacing Point Set

Remove dust cap. Take out screw which holds the breaker point base to the armature plate and remove retaining ring from breaker arm shaft. Then loosen the screw with nut connecting the ground





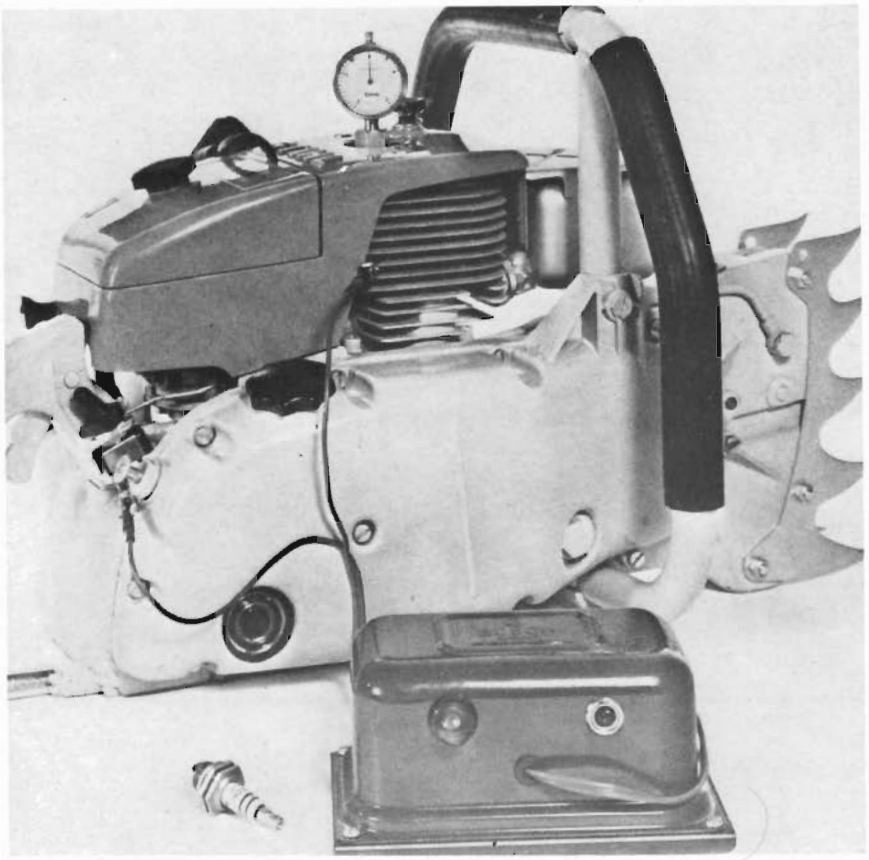
*Removing rubber cap from grommet*
*Breaker points exposed for adjustment*
*Exposed ignition system*
*Torque wrench*
*Tightening hexagonal nut with torque wrench*

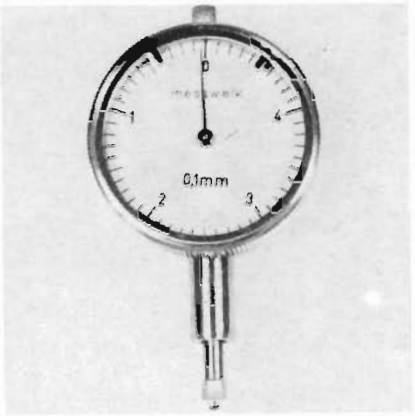
lead and the lead to the ignition coil as well as the spring of the breaker arm. Now remove the point set and replace the whole set.

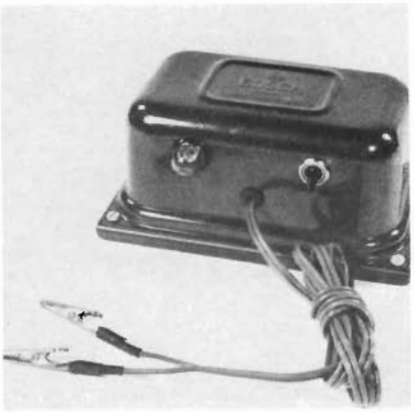
**Checking and Re-adjusting Ignition Timing**

For this purpose reassemble the dust cap and place fly-wheel, starter cup and washer on crank-shaft. Make sure Woodruff key is correctly positioned in the keyway of the crank-shaft and the fly-wheel. The Woodruff key should be absolutely grease free. Tighten hexagonal nut. The correct torque of the crank-shaft nut is 33.2 lbf. ft (45 Nm) and should be checked with a torque wrench. Remove crank-shaft locking screw from crank-case and screw screw plug into the screw plug hole. Turn fly-wheel and check to be sure that there is no metal to metal contact between magneto and fly-wheel. Now remove rubber cap from dust cap and adjust breaker point gap to 0.4 mm (.016″). The adjustment of the breaker point gap should be made in the following way: Screw timing dial gauge into spark plug hole and turn fly-wheel in direction of engine rotation until piston is at top dead centre. Now adjust timing dial gauge to "0" position. In this position the breaker point gap should be 0.4 mm (.016″). Check to be sure that the breaker points face each other correctly and that they lift in parallel position.

Connect one terminal of ignition timing device with the ground lead and the other terminal with the ground. Now lower piston to





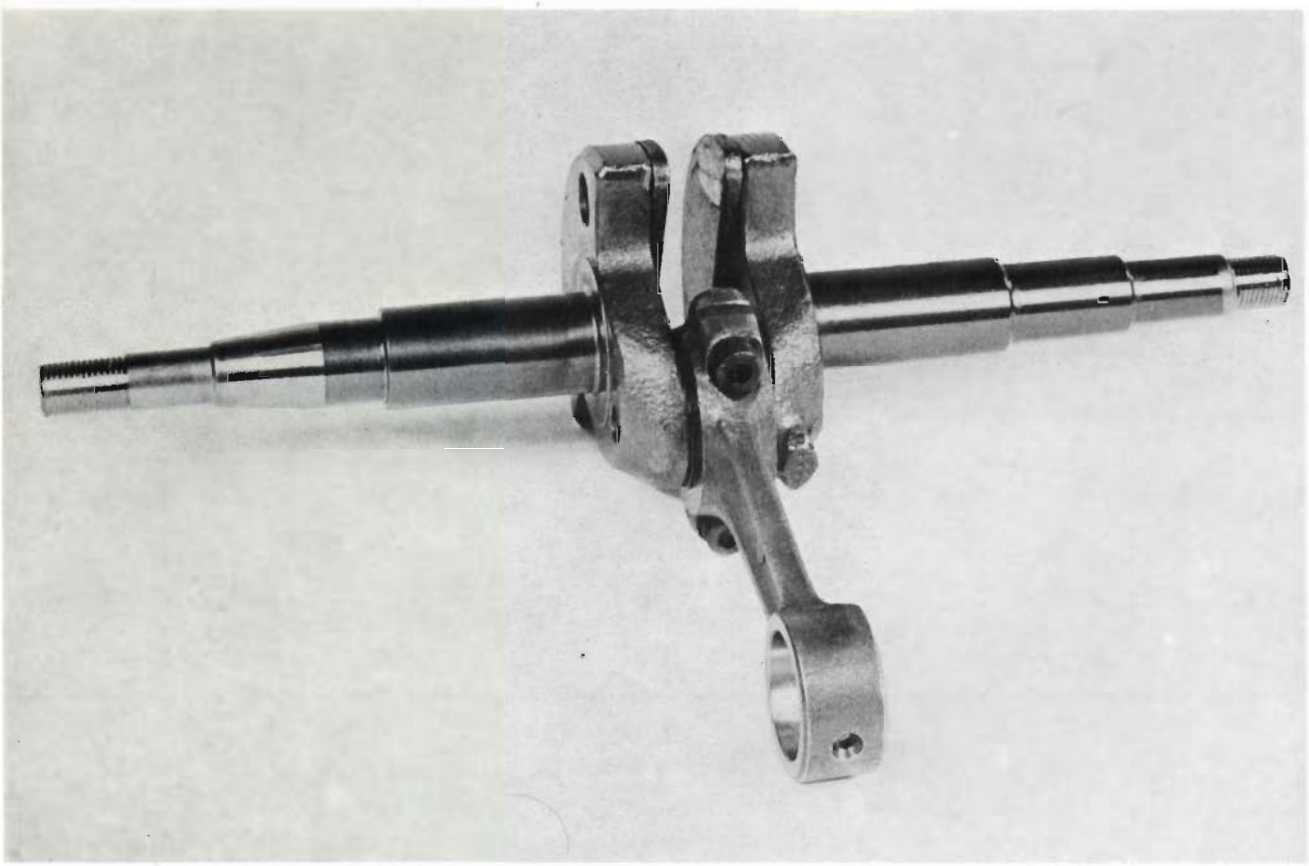
*Connecting ignition dial gauge and ignition timing device*
*Ignition dial gauge*
*Ignition timing device*

3.0 mm (0.12″) before top dead centre by turning the fly-wheel in reverse direction of engine rotation (clockwise). Loosen the screws retaining the armature plate through opening in the fly-wheel and turn armature plate counterclockwise if ignition timing is too much advanced, or clockwise if ignition timing is not enough advanced until pilot lamp of ignition timing device will indicate when the breaker points open. Re-tighten the retaining screws of armature plate. Re-check timing to be sure adjustment is correct. When turning the fly-wheel in direction of engine rotation the pilot lamp should light up when piston is at 3.0 mm (0.12″) before top dead centre. Use only a correct spark plug (Bosch WSR 6 F) with a correct spark gap.

**Looking for malfunction**

Frayed or worn insulation of the breaker point base, the breaker points and the ground lead or fouled breaker points may cause short circuits in the primary circuit of the ignition system. Therefore, always inspect the ignition system for such shorts when repairing it. Furthermore, check to be sure that the ground lead does not cause a short circuit where it is connected with the breaker point base.

In case of malfunction of the ignition system also check ignition switch, high tension lead and spark plug terminal.



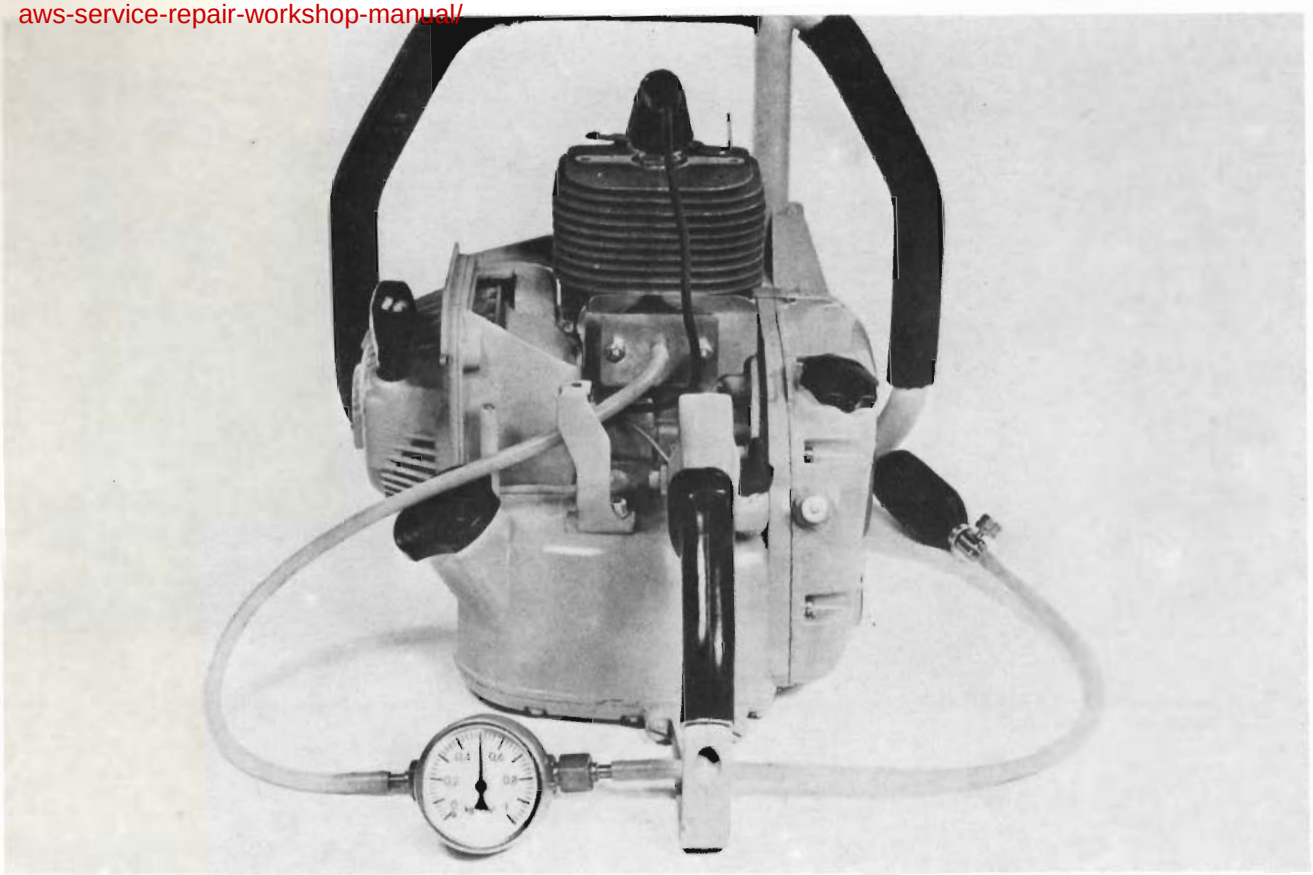
*Crank-shaft*

rollers. The bearing fits at the conrod are classified into two dimension groups:

| | | |
|---|---|---|
| 1. Green dimension group: | Shaft | 17, 996 — 18, 000 |
| | Conrod | 24, 010 — 24, 014 |
| 2. Red dimension group: | Shaft | 18, 001 — 18, 005 |
| | Conrod | 24, 015 — 24, 019 |

The split needle cage can be replaced at will. The radial play of the crank-shaft in the needle cage is 0.010—0.018 mm (0.004—0.0072"). If a worn or damaged needle bearing should necessitate the removal of the crank-shaft from the conrod re-use parts only if bearing surfaces at crank pin and at conrod bearing are in perfect condition. If these surfaces are rough, scarred or worn reject the whole crank-shaft. When installing the needle bearing check to be sure that the bearing surfaces of the conrod are dust and grease free and are matching exactly. Tighten the two screws with inner hexagon head uniformly with torque wrench to 1 mkg (7.233 ft. lbs.).

Don't mix-up crank-shaft main bearings. If you have to replace a needle bearing you must also replace the needle cage which is fitted into the crank-case. To remove the needle cage heat crank-



*Pressure test at crank-case*

case to 90—100° C (194—212° F). The crank-shaft end play of 0.2—0.4 mm (0.008—0.016″) is controlled by two plastic check plates on the crank-shaft. These check plates are available in different thicknesses in order to get the correct end play of 0.2—0.4 mm (0.008 to 0.016″).

Check oil seals which are pressed into the crank-case on proper condition. After longer time of operation the sealing lip of the oil seal gets hard and then it does not seal properly anymore. Such an oil seal must be replaced. Press oil seal into crank-case without twisting or deforming the seal. Always use new oil seals when installing a new crank-shaft.

**Pressure Test at Crank-case**

It is possible to check the driving parts of the engine for leakage due to faulty seals or flange gaskets as well as a porous crank-case. For this test you need a carburetor and crank-shaft testing device. Remove carburetor and muffler. Plug exhaust flange and connect pressure test flange with carburetor adapter. Connect open hose end of pressure testing device to nipple at carburetor adapter. For this test you must leave the spark plug in the cylinder. Raise the piston to top dead centre. If the pressure of 0.5 kp/cm² (7.1 lbf./in.²) remains constant it indicates that the crank-case is not leaking. If the pressure drops you may use oil for finding the leaking spot.