REPAIR MANUAL

for the

MZ MOTOR-CYCLES

TS 125 and TS 150

with 174 illustrations

and 23 drawings of special tools

4th Edition

VEB MOTORRADWERK ZSCHOPAU

Betrieb des IFA-Kombinats Zweiradfahrzeuge

The motor-cycles of types TS 125, TS 150, ES 125/1 and ES 150/1 are products from VEB Motorradwerk Zschopau

This Repair Manual was written by a team of engineers in the employ of VEB Motorradwerk Zschopau

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Preface

In the high latitudes of Finland, in the parching heat of Africa, under the most different operating conditions MZ motor-cycles run to the satisfaction of their owners.

To ensure that the vehicles remain in perfect working order and reliable in service after a long period of operation, involving a certain amount of wear, we issue this Repair Manual to give the necessary instructions to our MZ workshops at home and abroad.

Repair work is a matter of confidence in several respects:

reliability and workmanship of the mechanic; the safety of the driver depends on them.
finding the actual cause of the trouble; this ensures that no material is wasted and labour costs are restricted to a minimum.
from this, three advantages result: no retouching work, short times of inoperation and low repair costs.

A good worksmanship in repairs largely depends on the use of the special tools and means recommended by MZ. Authorised MZ Service-shops may obtain them from the MZ Spare Sales Department, whereas amateur constructors only have the possibility of making them themselves. But to do it yourself you shbuld use the sketches given in the Appendix.

We should like to underline that especially customers of "self-service workshops" and amateur constructors bear this in mind to avoid considerable additional expenditure of labour and material.

We hope this book of reference offers the required information to the staff of the workshops contracted for servicing our products at home and abroad and to the friends of MZ motor-cycles throughout the world, and we wish good success.

VEB MOTORRADWERK ZSCHOPAU
Betrieb des IFA-Kombinats Zweiradfahrzeuge

Service Dept.

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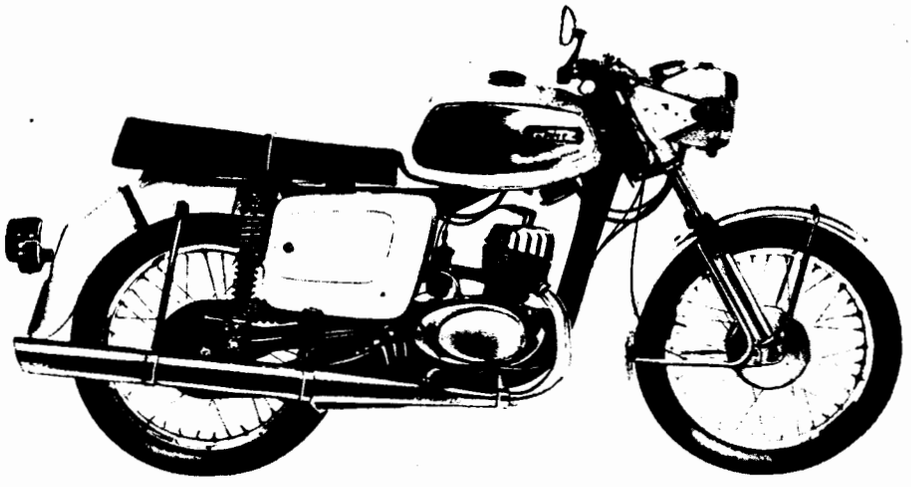

Fig. 1. TS 125 and 150

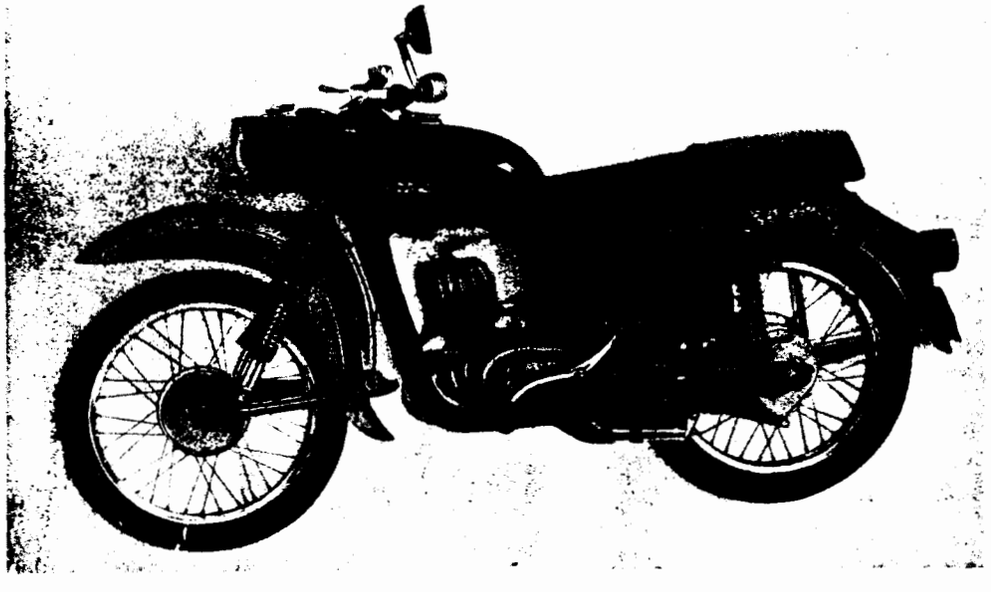

Fig. 2. ES 125/1 and 150/1

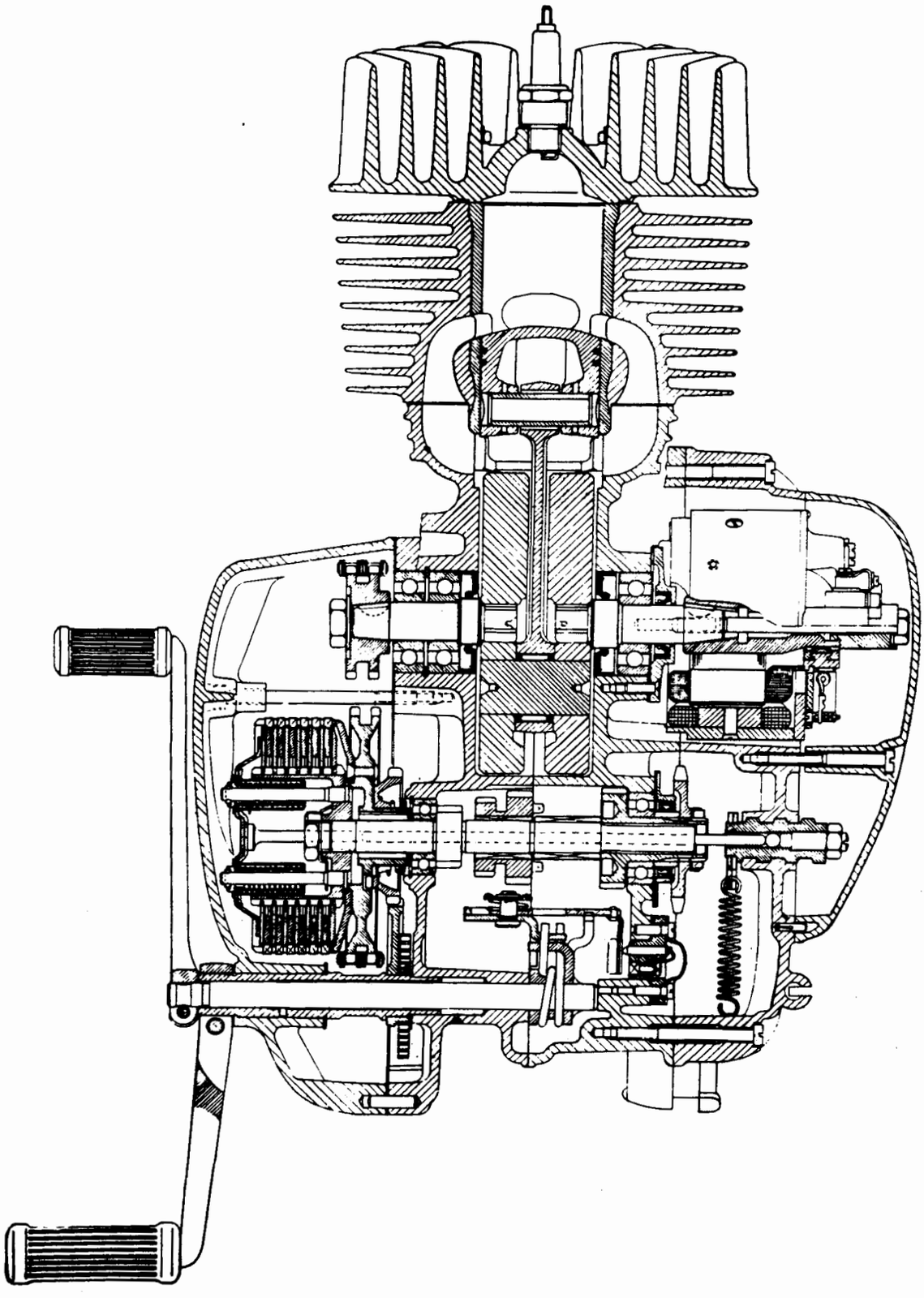

Fig. 3. Sectional view of engine

1. Technical Data

1.1. Engine

	TS 125 and ES 125/1	TS 150 and ES 150/1
Type	MM 125/2	MM 150/2
Stroke/bore	58/52 mm	58/56 mm
Swept volume	123 cm^3	143 cm^3
Maximum output (at 6000 to 6300 rpm)	7.35 kW (10 hp) (11 SAE hp)	8.45 kW (11.5 hp) (12.5 SAE hp)
Maximum torque (at 5000 to 5500 rpm)	12.3 Nm (1.25 kp-m)	14.7 Nm (1.4 kp-m)
Type of carburetter	22 N 1-3	24 N 1-1
Number of cylinders	1	1
Piston mass, complete with two rings, gudgeon pin and locks	160 ± 5 g	200 ± 5 g
Compression volume with the sparking-plug inserted	14.0 cm^3	16.5 cm^3
Cycle	two-stroke reverse scavenging	
Cooling system	air stream produced in driving	
Connecting-rod bearing	bottom, cage-type needle bearing K 25 × 31 × 17 L top, bronze bushing	
Crankshaft main bearing	3 ball bearings 6303 c 3 f (silent, 17 × 47 × 14 mm) lubrication by gear lubricant	
Cylinder	light-alloy, liner of special grey cast-iron onto which the light metal is cast	
Timing in crank degrees		
inlet	150°	
transfer	115°	
outlet	165°	

1.2. Carburetter

	22 N 1-3	24 N 1-1
Transfer port	22 mm	24 mm
Main jet	90	95
Needle jet	65	65
Partial-load needle No.	c 3	c 3
Needle position, from top	2nd to 3rd (3rd for running-in)	3rd to 4th (4th for running-in)
Starter jet	70	75
Slow-running jet	35	40
Slow-running air screw	opened by 2 to 3 turns	opened by 2 to 3 turns
Throttle opening	3 mm	3 mm
Air filter	dry air filter (paper cartridge)	
Float valve seat	15 (1.5 mm)	15 (1.5 mm)

1.3. Electrical Equipment

Ignition		battery ignition
Ignition timing		$3.0_{-0.5}$ mm before T.D.C., fixed setting
Contact breaker points gap		0.3 to 0.4 mm
Sparking-plug		M 14/260
Electrode gap		0.6 mm
Dynamo		direct current 6 V, 60 W, short-time operation 90 W
Charging control light (red)		in speedometer
Regulator		RSC 60/6, under left-hand panelling
Battery		6 V, 12 Ah (flat lead storage battery)
Ignition coil		6 V, under left-hand panelling
Headlamp (asymmetrical)	ES Types	fixed – lamp opening 136 mm
	TS Types	movable – lamp opening 170 mm
Tail lamp	ES Types	lamp opening 95 mm
	TS Types	lamp opening 100 mm
combined with stop light		contact in rear brake

		TS 125 and ES 125/1	TS 150 and ES 150/1
Flashing-light direction indicators	ES Types	2-light system at the handle bar ends	
	TS Types	4-light system	
Flasher unit		in headlamp shell	
Horn		under fuel tank	
By-pass light signal		actuated by push-button arranged below dimmer switch	
Bulbs (data in parantheses apply to TS Types)			
bilux (twin-filament)		6 V, 45/40 W passing beam asymmetric	
parking light		6 V, 4 W, BA 9 s cap	
stop light		6 V, 18 W, S 8.5 cap (6 V, 21 W, BA 15 s cap)	
tail light		6 V, 5 W, S 8 cap (BA 15 s)	
flashing-light indicator		6 V, 18 W, S 8.5 cap (6 V, 21 W, BA 15 s cap)	
charging control light		6 V, 1.2 W	
idling indication		6 V, 1.2 W	
speedometer illumination		6 V, 1.2 W	

1.4. Transmission

Clutch	multiple disk clutch in oil bath
Gear-shift system	foot-operated, left-hand side
Number of speeds	4
Gear ratios	
1st speed	3.05 : 1
2nd speed	1.805 : 1
3rd speed	1.285 : 1
4th speed	1 : 1
Bearing on clutch shaft	6202 (15 × 35 × 11 mm)
Bearing on layshaft	6201 (12 × 32 × 10 mm)
Bearing on shaft gear	6004 (20 × 42 × 12 mm)
Idling indicating light	electric control bulb (green) in speedometer

1.5. Power Train

Transmission engine/gearbox		2.31 : 1 ≙ 37 : 16 teeth	
by sleeve-type chain		A 9.5 × 9.5 ($^3/_8$" × $^3/_8$") 48 links	
or double sleeve-type chain (from 4th quarter of 1973)		2 × 9.525 × 4.77 ($^3/_8$" × $^3/_{16}$") 48 links	
Transmission gearbox/rear wheel		3.2 : 1 ≙ 48 : 15 teeth	3.0 : 1 ≙ 48 : 16 teeth
by roller chain		12.7 × 6.4 × 8.51 ($^1/_2$" × $^1/_4$") 120 rollers	

1.6. Cycle Parts

Frame		continuous pressed-steel, seamed
Steering angle	TS	60°
	ES	61°
Caster	TS	90 mm
	ES	95 mm
Suspension system front	TS	telescopic fork with hydraulic damping, total travel of spring 185 mm

		TS 125 and ES 125/1	TS 150 and ES 150/1
	ES	longitudinal swing	
rear		spring-loaded suspension units with hydraulic damping, total travel of spring 150 mm	
		spring-loaded suspension units with hydraulic damping total travel of spring 105 mm, spring pre-load adjustable	
Wheels		wire spokes	
Rims, front/rear		1.60 × 18 / 1.85 B × 18	
Tyre, front/rear		2.75-18 / 3.00-18	
Tyre inflation pressure when loaded with:			
75 kg front		150 kPa (1.5 kp/cm²)	
rear		190 kPa (1.9 kp/cm²)	
150 kg front		150 kPa (1.5 kp/cm²)	
rear		260 kPa (2.6 kp/cm²)	
Permissible total mass			
front		150 kPa (1.5 kp/cm²)	
rear		270 kPa (2.7 kp/cm²)	
Brake actuation		mechanically, by means of cable controls for both brakes	
Brake diameter/width of lining			
front	TS	160/30 mm	
	ES	150/30 mm	
rear		150/30 mm	

1.7. Dimensions and Masses

Wheel base	TS	1305 mm	
	ES	1270 mm	
Length	TS	2050 mm	
	ES	1990 mm	
Height with/without mirror (flat handlebars)	TS	1115/1035 mm	
Height with/without mirror (elevated handlebars)	TS	1175/1105 mm	
Height with mirror	ES	about 1150 mm	
Width with/without mirror (flat handlebars)	TS	730/620 mm	
Width with/without mirror (elevated handlebars)	TS	865/735 mm	
Width with flashing-light indicators		about 750 mm	
Ground clearance, loaded, at prop stand		140 mm	
Weight unladen, ready for operation with fuel and tools			
	TS	114 kg	
	ES	112 kg	
Permissible total mass		270 kg	

1.8. Capacities

Gearbox	0.45 l of GL 60 gear oil for summer and winter
Fuel tank	12.5 l of petrol-oil mixture
including reserve	about 1.5 l
Telescopic fork	220 cm³ of shock-absorber oil for each unit
Suspensions units, rear	70 cm³ of shock-absorber oil for each unit

1.9. Characteristics and Diagrams

The maximum speed, depending on sitting position, is about

100 km/h for the TS 125 and ES 125/1
105 km/h for the TS 150 and ES 150/1

The maximum speed will only be reached if the required favourable conditions are given (rider stooping so as to be almost "lying", tightly fitting motoring suit, plane road, no headwind).
The engine characteristics, traffic fuel consumption, and acceleration are shown in the following diagrams (Fig. 4 to 9).

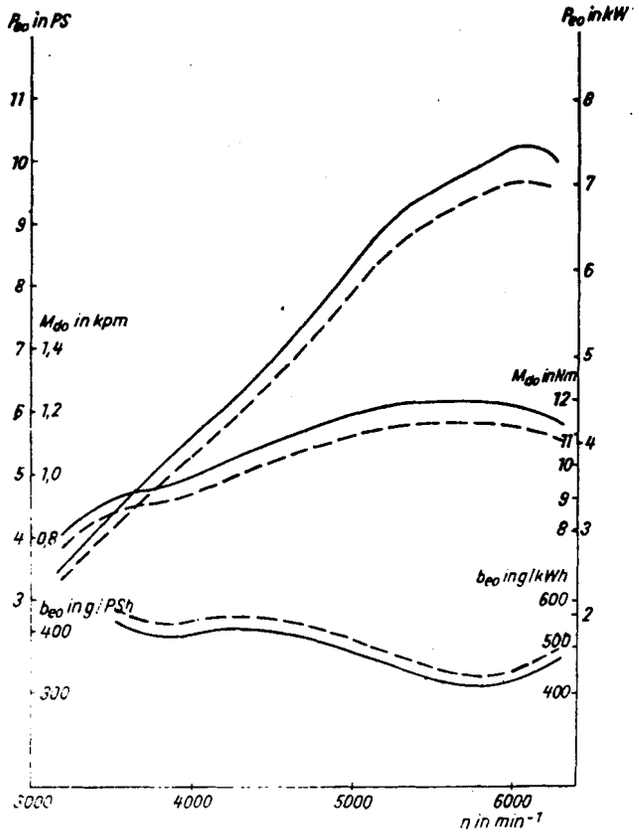

Fig. 4. Full-load characteristics of the engine MM 125/3: max. output, max. torque and specific fuel consumption

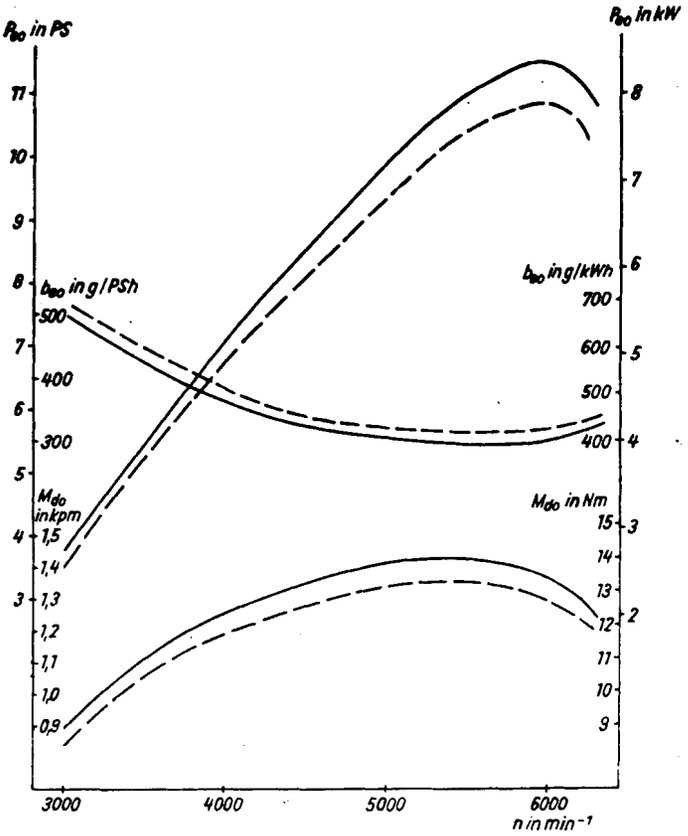

Fig. 5. Full-load characteristics of the engine MM 150/3: max. output, max. torque and specific fuel consumption

Neo [PS] – Neo [hp]
Mdo [kpm] – Mdo [kp-m]
beo [g/PSh] – beo [g/hp-h]
n [U/min] – n [rpm]

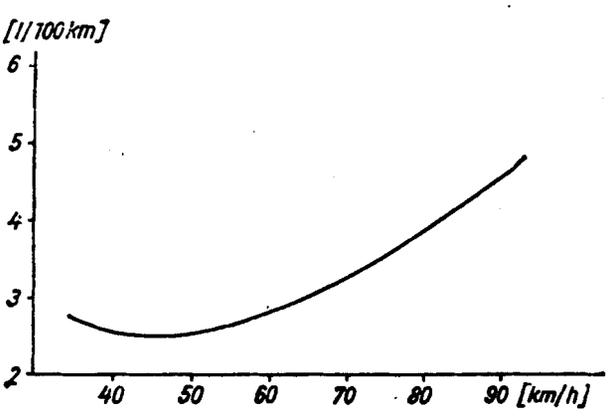

Fig. 6. Basic fuel consumption of the TS 125 and ES 125/1 in top gear (4th)

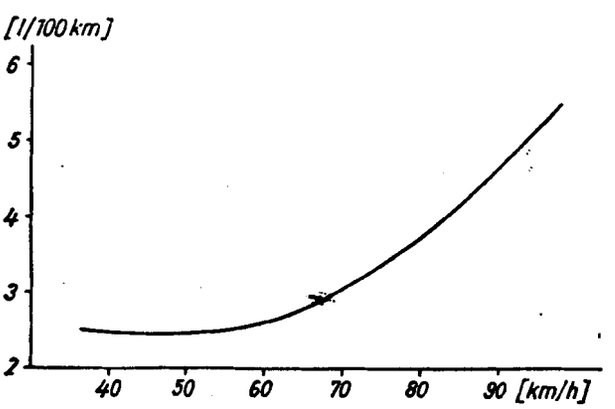

Fig. 7. Basic fuel consumption of the TS 150 and ES 150/1 in top gear (4th)

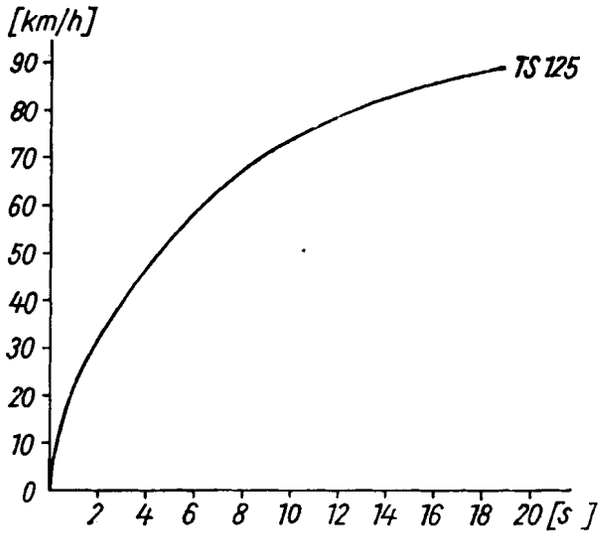

Fig. 8. Maximum acceleration when starting from stationary state (TS 125 and ES 125/1)

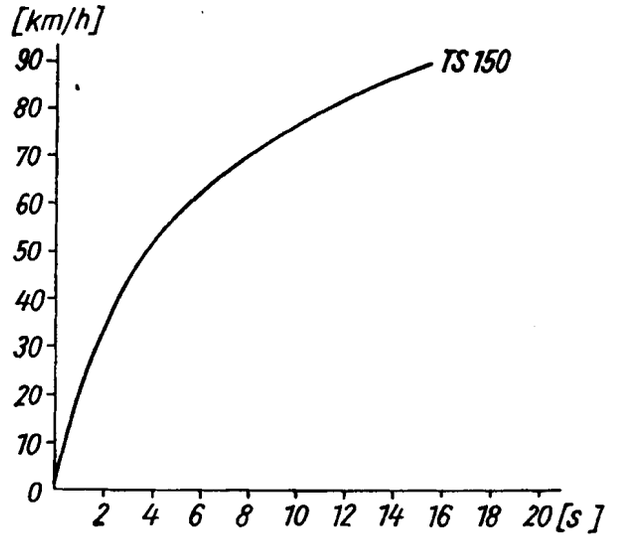

Fig. 9. Maximum acceleration when starting from stationary state (TS 150 and ES 150/1)

2. Fuel, Lubricants and Fluids

2.1. Fuel

According to the design of the engine, a petrol of an octane rating of at least 88 (in the GDR abbreviated as "VK 88") should be used.
In countries other than the GDR, the use of a fuel with a similar rating is recommended.
If fuels of a higher octane number are used, readjustment of the carburetter by resetting the partial-load needle may be necessary.

2.2. Engine Oil

Engine oil is added to petrol in the

ratio of 1:33

(e.g. 0.3 l of engine oil are added to 10 litres of fuel). For other units of measurement we refer to the conversion table (see Section 11.). This mixing ratio also applies to the running-in period.
This simple and reliable system of petroil lubrication supplies oil to the two connecting-rod bearings, cylinder liner, and piston.
Experiences gathered by us in the course of many years have shown that it is advisable to use exclusively

MZ 22 two-stroke engine oil.

This additive-type oil meets the following technical requirements:

viscosity at 50 °C 20 to 25 cSt
pour point maximum −30 °C

It contains additives which effect a high temperature and pressure resistance. Limited tendency to coking, prevention of carbonaceous oil deposits or loosening of them. Wear reducing and corrosion preventing properties. Contains lead separating agents preventing whisker formation in sparking-plugs.

For MZ motor-cycles operated in countries other than the GDR we also recommend exclusive use of two-stroke engine oils which possess these properties (e.g. Shell 2 T, Castrol 2 T, Arol 2 T, Mixol "S", LT-2 T).

2.3. Gear Oil

For gearbox and primary drive, an amount of 450 cm^3 of GL 60 gear oil is required.
This is an additive-type gear oil which is particularly suitable for the lubrication of change-speed gearboxes and axle drives. It is an ageing-resistant refined lubricating oil with additives for an increase of load-bearing capacity and a reduction of wear.

It . as favourable low-temperature properties and meets the following technical requirements:

viscosity at 50 °C	
(corresponds to about 8 °E)	53 to 68 cSt
pour point maximum	−25 °C
flashpoint	180 °C
water content	0.1 %

In countries other than the GDR, a gear oil with similar viscosity values and properties should be used.

2.4. Lubricants for Cycle Parts

The swing arm bearing and the worm for clutch operation must also be lubricated with GL 60 gear oil.

(Oil-filled grease gun: swing arm bearing to be lubricated thoroughly until oil emerges from the lubrication points: worm for clutch actuation to be lubricated by 2 to 3 strokes.)

The following lubricating points of the cycle parts must be lubricated with "Ceritol + k 2" or "Ceritol + k 3" antifriction bearing grease:

steering bearing, wheel bearings, bearing for rear-wheel drive, secondary chain, brake cam, brake shoe bearings, and speedometer drive (the latter only when being mounted or repaired).

This antifriction bearing grease has a pour point of about 130 to 150 °C, can be used for a temperature range from −20 to +100 °C, and is water-resistant at +50 °C.

In countries other than the GDR, an antifriction bearing grease of similar characteristics should be used.

2.5. Shock-absorber Fluid

For the telescopic fork and the spring-loaded suspension units, a shock-absorber fluid of a viscosity of 8 to 11 cSt (corresponds to 1.65 to 1.92 °E) at 50 °C should be used.

The damping characteristics of the telescopic fork and the spring-loaded suspension units are based on this viscosity. Springing and roadability will be impaired if shock-absorber fluids of a different viscosity will be used.

2.6. Contact Breaker Lubrication

For contact breaker lubrication, the special oil for ignition circuit breakers, in the GDR known as "Unterbröl", should be used; it possesses a viscosity of from 700 to 1,300 cSt at 50 °C.

If this special oil is not available, a high-viscosity gear oil of similar viscosity properties can be used.

3. Disassembly of the Engine

Remove the closing plate and the dynamo cover, disconnect the cables from the dynamo (disconnect the plugged connections).

If the identification colours of the various cables are not clearly discernible, it is advisable, especially for amateur constructors, to attach paper slips with markings (D+, DF and frame) to the cables to save the work of measuring them for reassembling.

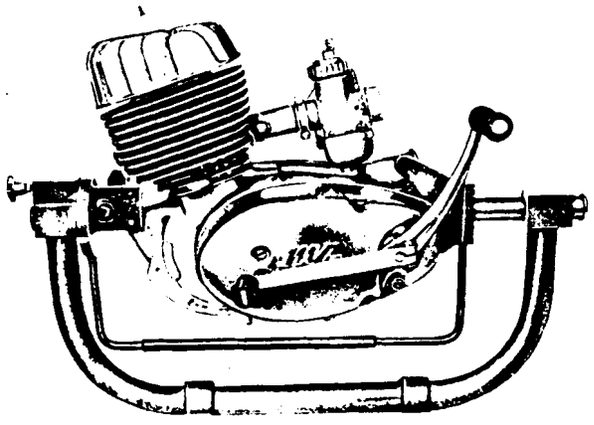

Fig. 10. Placing the engine in the 05-MW 197-0 assembling fixture

Loosen the two fastening screws (see arrows) of the terminal casing and remove the latter (it is mounted on a centring device and locating pin).

Unscrew the armature fastening screw (1) and remove the interrupter cam. Take care not to damage the face of the commutator to ensure that the cam will continue to run properly.

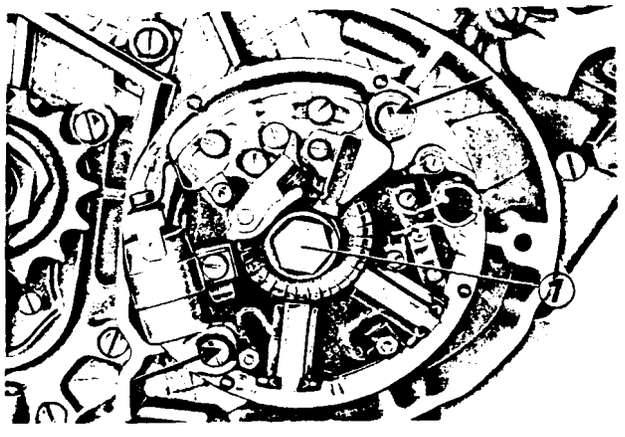

Fig. 11. Removing the pole casing

Use puller 02-MW 39-4 or a screw M 10×100 for removing the armature. By means of other tools, e.g. a claw-type puller, either the winding will be damaged or the segments will be deformed.

Keep the plate disk ("key") in a safe place!

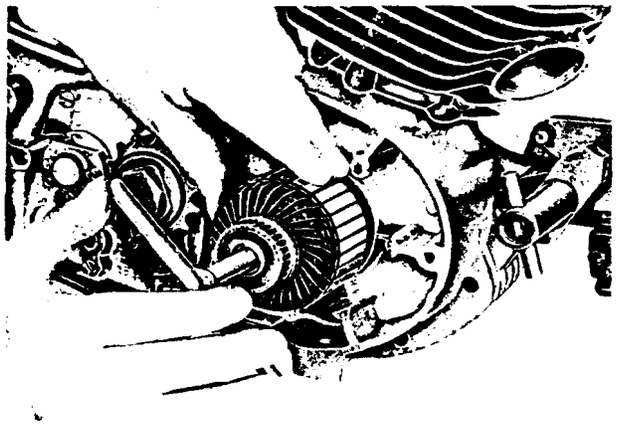

Fig. 12. Pulling off the armature

For loosening the nut of the gearbox sprocket, bend up the lock plate, using the sprocket-holder 05-MW 45-3 to retain the sprocket. (Left-hand thread!) Remove cover plate (1) and sealing cap (2).

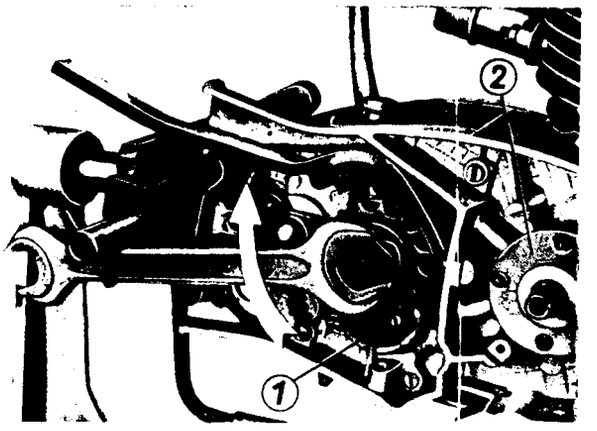

Fig. 13. Removing the gearbox sprocket

Loosen the clamping screw of the kick-starter and that of the gear-shift pedal and remove the two controls. Loosen the clutch cover by tapping against it close by the fitting pins (A), using a rawhide mallet, and remove the cover. Do not use a screw-driver to force off the cover because time-consuming refinishing operations will be necessary to restore the cover to a proper leakproof condition! Press down the spring plates by means of tool 11-MW 15-4 and push out the pins.

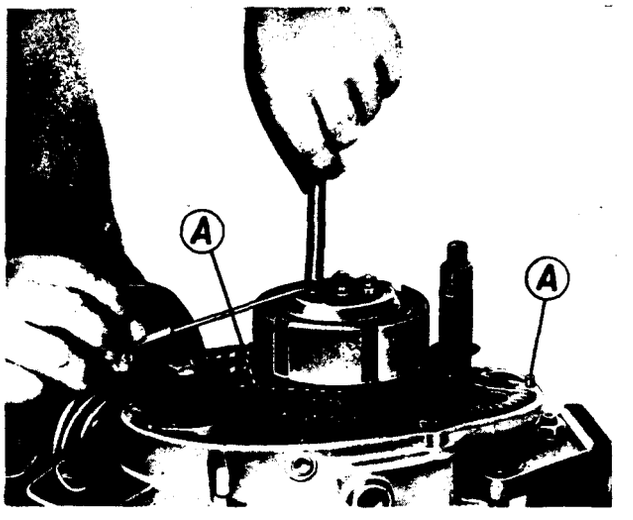

Fig. 14. Dismounting the clutch

Loosen the nut on the clutch shaft (use a spanner with a width over flats 19). (Left-hand thread!). For this purpose use the holders 01-MW 22-4 (1) and 12-MW 5-3 (2). Unscrew the nut (width over flats 19) from the drive pinion (right-hand thread).
An amateur constructor may rivet or weld a round iron bar having a diameter of 10 mm and a length of about 200 mm to an old clutch disk of steel. The tool produced in this way (similar to a signal disk) can be used in the place of the two holders. The internal teeth will retain the clutch driver, the round bar the clutch drum.

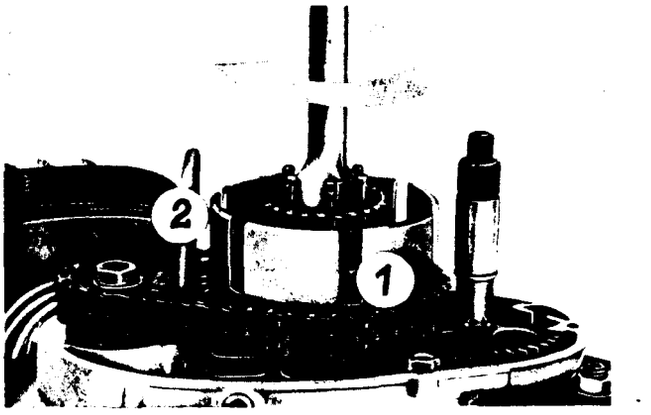

Fig. 15. Dismantling the clutch driver

Remove the driving sprocket by means of puller 12-MW 25-4 (A).
The vent bores at the pinion for the duplex chain are arranged closer together!
Remove pinion with chain and clutch basket.
Keep the plate disk ("key") from the end of the crankshaft carefully so that it cannot be lost!

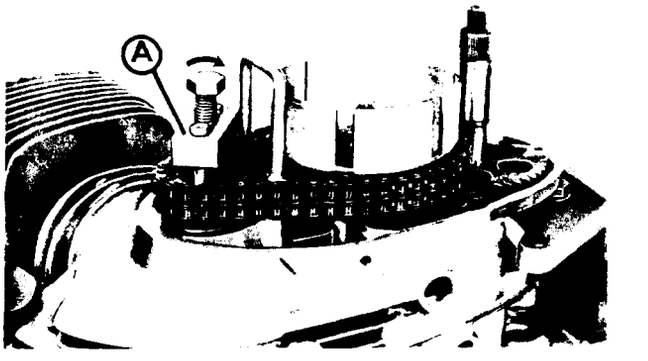

Fig. 16. Removing the primary drive

Dismount cylinder with head (gradually loosen the hexagon nut crosswise) and the piston. Remove the gudgeon pin lock ring by means of a pair of taper-nose pliers and press out the gudgeon pin by means of the drift 22-50.010.

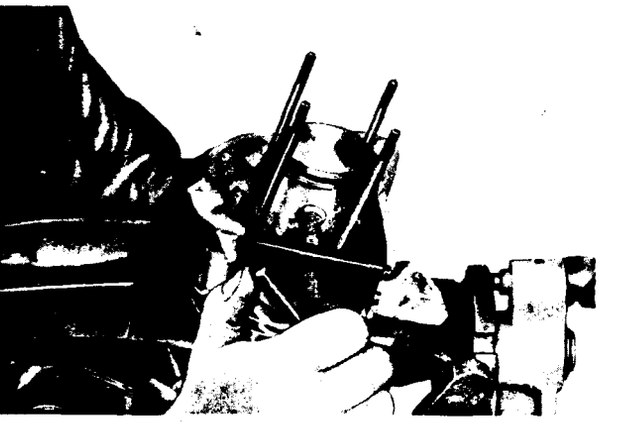

Fig. 17. Driving out the gudgeon pin

Remove all of the 14 casing screws from the right-hand side of the casing.
Force out the fitting sleeves at the front and rear engine mounting by means of the offset drift 11-MW 3-4.

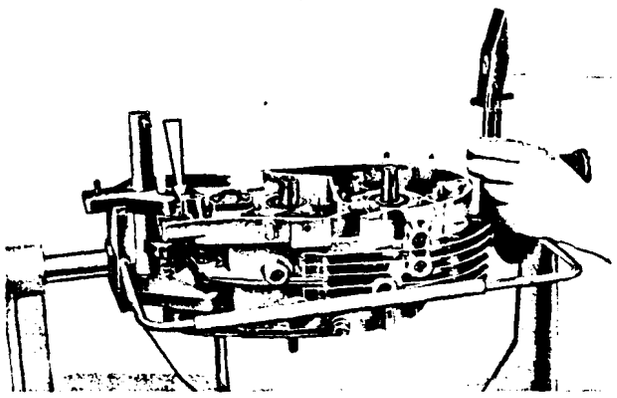

Fig. 18. Driving through the fitting sleeves

Engage the fourth speed of the gearbox. Lift off the right-hand casing half by means of the separating screw 22-50.012.
Facilitate this operating by slightly tapping with a rawhide mallet (see arrows).
Then, proceeding from the bottom, beat out upwards both clutch shaft and layshaft by means of a copper mandrel (screw thread!).
For this purpose, move the gear-shift wheels so that the slotted section easily slides through the gear-shift wheels, otherwise the gear-shift dog will be deformed.

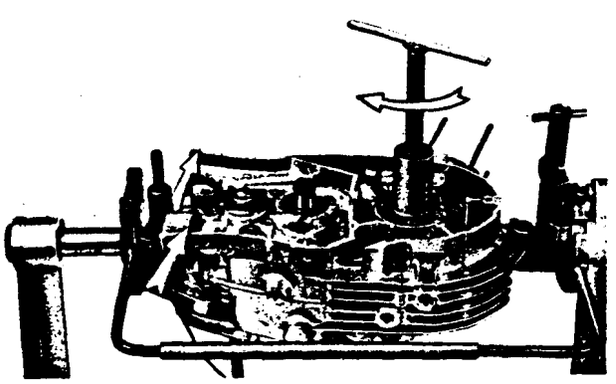

Fig. 19. Pulling off the right-hand casing half

Gear-shift detent shaft (1) must then be screwed out after bending up the lock plate and unscrewing the nut at the clutch side.
Bend up the lock plates for the fastening screws (2) and (3) of the retaining plate with gear-shift segment and loosen the screws.
Now, the complete gear-shift mechanism can be removed.

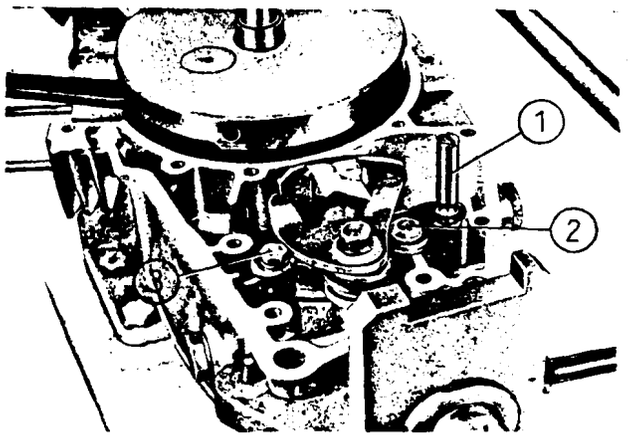

Fig. 20. Dismantling the gear-shift mechanism

Do not beat out – crankshafts whose ends are heavily damaged will not be accepted by repair-shops. If the gearbox bearings have to be replaced by new ones, remove the lock rings (see arrows) by means of a pair of taper-nose pliers.

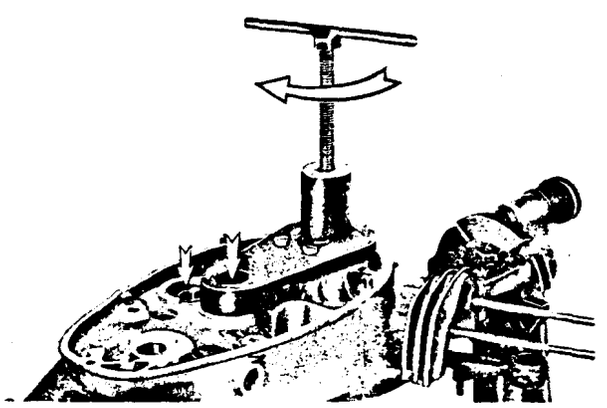

Fig. 21. Pushing out the crankshaft by means of the 22-50.013 pusher

For the removal of the ball bearings, heat the casing halves to a temperature of about 100 °C. This will facilitate dismounting without damaging the bearing seat.
Beat out the bearings for clutch shaft and layshaft from the interior to the outside.
As to the 6303 crankshaft main bearings take into consideration that a lock ring (1) is arranged between these two bearings (see Fig. 3).
First beat out the outer bearing, from the inside of the casing, using a mandrel. Then remove the circlip by means of a pair of taper-nose pliers and push out the inner bearing – together with the packing ring – using drift 11-MW 7-4 and proceeding towards the inside.

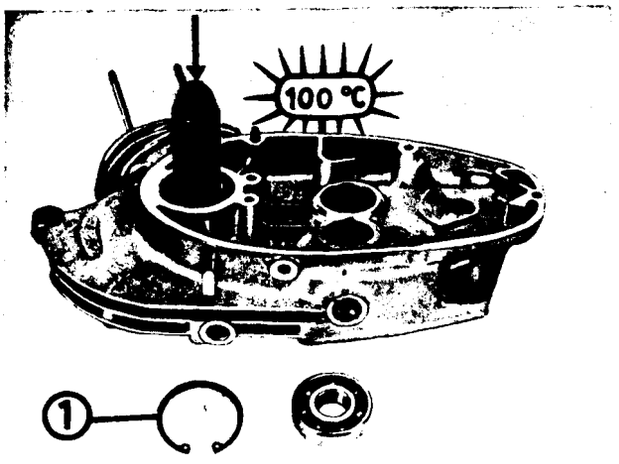

Fig. 22. Dismantling the ball bearing

Push the crankshaft main bearing 6303 with packing ring out of its seat in the heated right-hand casing half, using a suitable drift and proceeding from outside to the inside.
The delivery and return pipes for lubricating the crankshaft bearing at the dynamo side and the layshaft bushing must be cleaned to remove lubricant remains, and then blow compressed air through them (see arrows).
A careful cleaning of all engine parts is indispensable for reliable trouble-shooting. Do not only check and replace those parts which cause functional troubles but check and measure all parts and points subject to wear. This is the only way to avoid another repair after a short time of operation.

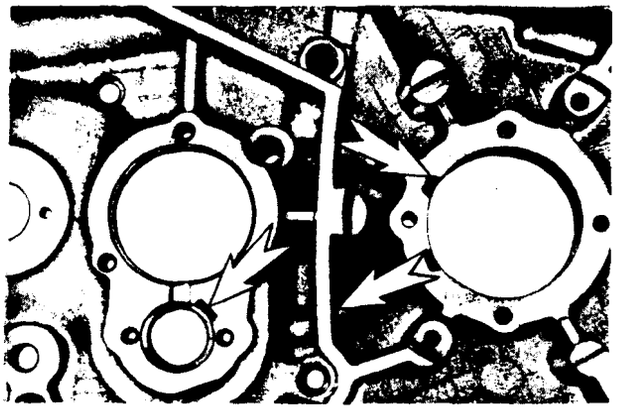

Fig. 23. Oil bore-holes of the right-hand casing half

only then, the engine will become perfectly gastight. If a surface plate is not available, the table of a machine tool, e. g. a column-type drilling machine, will do good service.

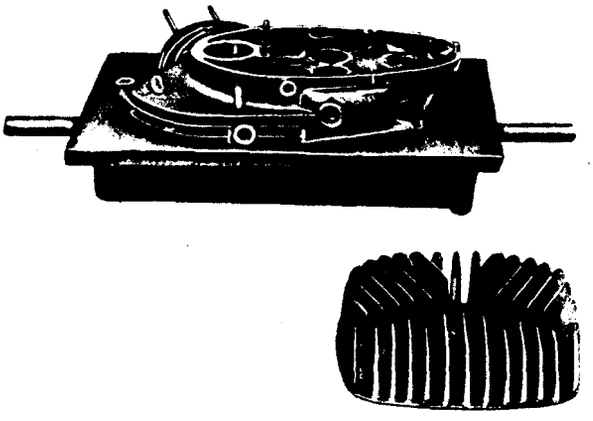

Fig. 24. Re-finishing the sealing surfaces

The next thing to do is to insert the circlips (locking ring) for the crankshaft main bearing and the clutch shaft and layshaft bearings into the left-hand half of the casing, using a pair of taper-nose pliers; the half of the casing must be heated to a temperature of about 100 °C on an electric cooker.
This is necessary to facilitate the insertion of all bearings, especially, to prevent them from being tilted and the casing bore-holes from being damaged (bearing location). On no account use a welding torch for heating – due to local overheating the casing may get distorted.

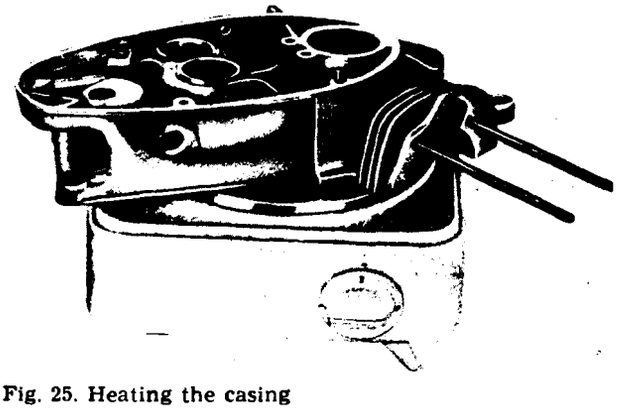

Fig. 25. Heating the casing

4. Assembling the Engine

After having cleaned the engine parts carefully, the first thing to do is to treat the two halves of the casing, the clutch cover and the cylinder head.
The joint faces are checked on a surface plate and touched up, if required (using emery cloth), until all scratches or sealing compound are removed. Then and

Please notice:

Bearing for clutch shaft = closed end of the cage pointing to the gearbox.
Bearing of layshaft = open end of the cage pointing to the gearbox.
For fitting use a bolt or a piece of a tube (must be clean inside!) having a diameter from 35 to 32 mm.

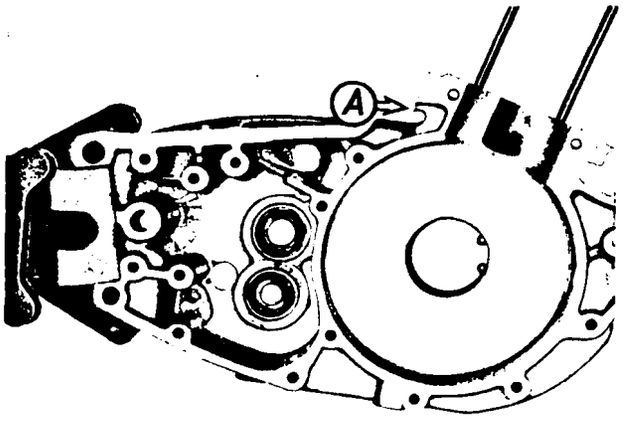

Fig. 26. Mounting the gearbox bearings
(A) Vent of the gearbox casing

For the 6303 crankshaft bearing and for the sealing ring use the 22-50.411 drift – sealing lip points outwards – see Fig. 3. As crankshaft bearings, only use the silent special bearings 6303 c 3 f.
For sealing the casing at the crankshaft, only use the green original sealing rings!
Check that all three bearings properly contact the sealing rings.
Once more heat the casing half shortly until the cold ball bearings have become hot by heat transfer from the hot casing to such a degree that the cold bearing seats of the shafts can move so easily in the heated inner race of he bearing as previously the cold outer races of the bearing in the hot casing.

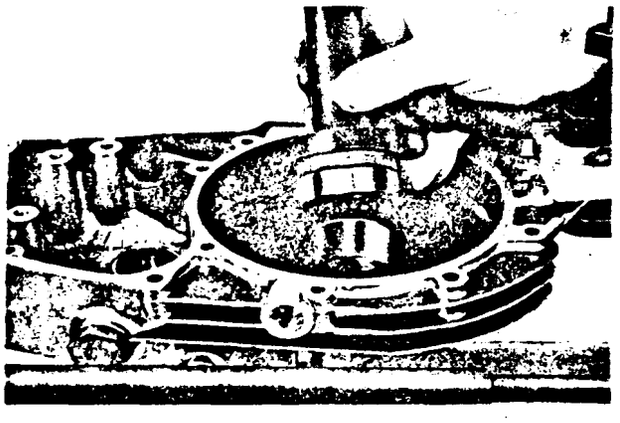

Fig. 27. Inserting the crankshaft bearing at the left-hand side

Note that all operations regarding the mounting of the crankshaft and of the gear-shift mechanism must be finished before the temperature of the casing drops below 70 °C.
Therefore, check all parts to be mounted before fitting them or replace them by new ones, if required, and place them on a clean surface, together with the necessary tools, so that they are ready at hand for mounting.
Every crankshaft, wheter it is a new one or a regenerated one, must be checked for true running before mounting. It may have been distorted during transport or when it was dropped inadvertently. When mounted in this improper condition, premature wear of the crankshaft bearings and poor engine output will be the result because the contact breaker cam fails to raise at the specified point or raises twice.
If there is no test stand for true running available, the checking operations involved may also be performed between the centres of the lathe.
The amount a crankshaft may be out of true at all measuring points is 0.02 mm.

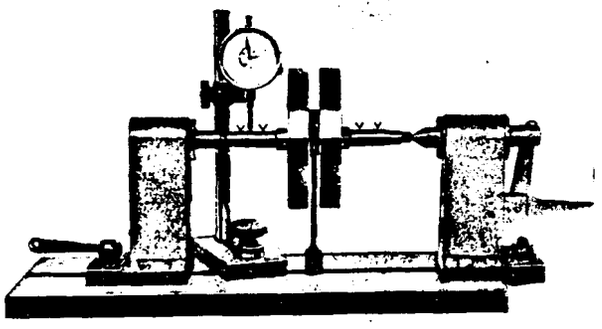

Fig. 28. Checking the crankshaft for true running

The radial play of the connecting-rod provided with needle bearings in new condition must be
0.015 to 0.030 mm

Maximum amount of wear, limit
0.05 mm

The running clearance of the small-end bush, new condition, is
0.020 to 0.030 mm

Amount of wear, limit
0.045 mm

It should be noted that the small-end bushes normally are worn out in such a way that they become oval.

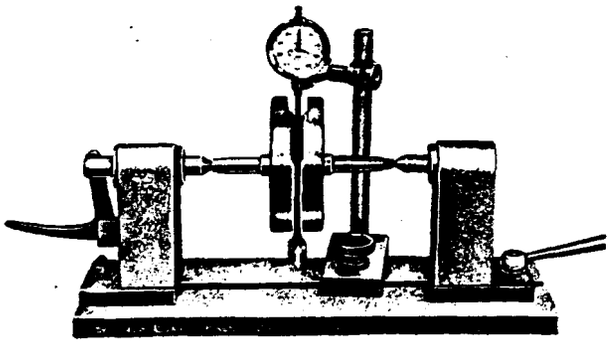

Fig. 29. Checking the connecting-rod bearing

Worn out small-end bushes are replaced by means of the 11-MV 60-3 fitting device. The new small-end bush of final size is put on the device and, when tightening the nut, presses the old bush out of its seat.

Take care that the lubricating holes to be drilled end in the oil catch pockets.
Remove all burr from the holes.
See to it that the fit is not too narrow – the sliding bearing requires a continuous oil film.

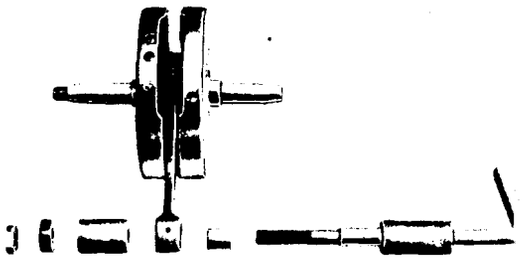

Fig. 30. Replacing the small-end bush

The axial clearance (see double arrow) of the connecting-rod in the crankshaft, in new condition, is
0.25 to 0.40 mm

When the connecting-rod is copper-plated on all sides, this clearance is reduced to
0.13 to 0.36 mm

With an axial clearance of 0.55 mm, the crankshaft is worn out.
The crankshaft (Fig. 31) is used unchanged for the engines of the ES 125/1, TS 125, ES 150/1 and TS 150.

It may happen that the connecting-rod of a new crankshaft was deformed by improper transport or storage. As a distorted or oblique connecting-rod will wear down the small-end bush before long, check the connecting-rod in any case.

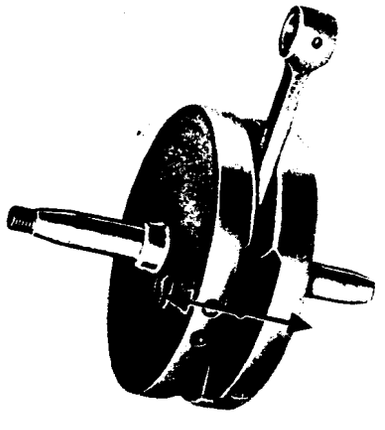

Fig. 31. Crankshaft

Oil the crankshaft end.
At the re-heated casing half, heat the inner race of the crankshaft bearing by means of a heated mandrel (1) in such a manner that the crankshaft slides to the shoulder due to its own weight.

Do not force the crankshaft through a cold bearing because this will render it useless (out of true) before it has run. Then the contact-breaker cam lifts anywhere but not on the cam lobe! Or the primary chain is alternately slack and taut during one revolution.

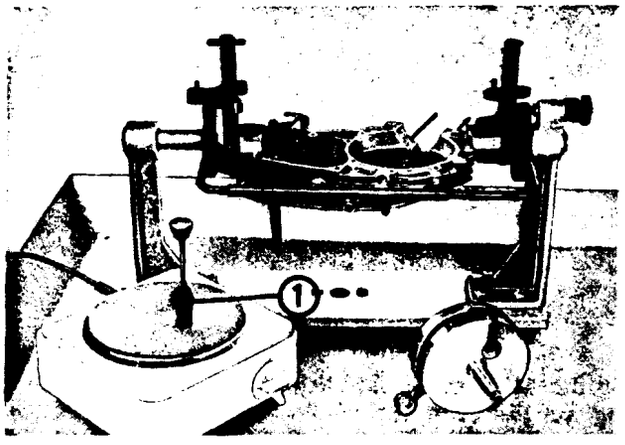

Fig. 32. Mounting the crankshaft

Wear limits at the gear-shift mechanism – causes of gear-shift faults:

(1) Bolt at the retaining plate has a clearance of more than 0.3 mm
(2) Cut-out in the retaining plate worn down more than 0.4 mm (size in new state $20.6^{0}_{0.2}$ mm)
(3) Window in the segment lever and dogs of the gear-shift member heavily worn (round)
(4) Return spring slack
(5) Gear-shift dog worn down more than 0.3 mm or blue discoloration (size in new state $5\ ^{-0.005}_{-0.105}$ mm)
(6) Spring or ball (6.35 mm) jams in the gear-shift fork

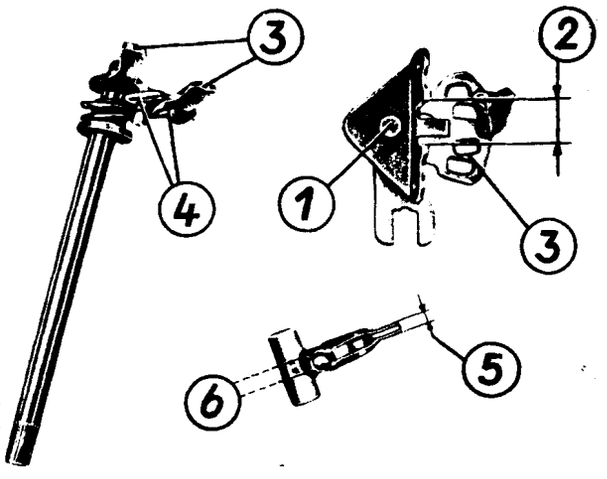

Fig. 33. Gear-shift mechanism

Screw the retaining plate with gear-shift segment in place and fit the lock plates.
Insert gear-shift shaft with gear-shift member; prior to this operation slightly oil the bearing area of the shaft.

Screw the gear-shift detent axle in place and adjust it by means of the setting gauge 11-MI 8-4 (the arrow indicates the references groove).
The check nut (place a lock plate under it) must be tightened before taking measurements, tightening the nut changes the setting.
If the gauge is not available, adjust according to the instructions given in Fig. 38, using a block gauge.

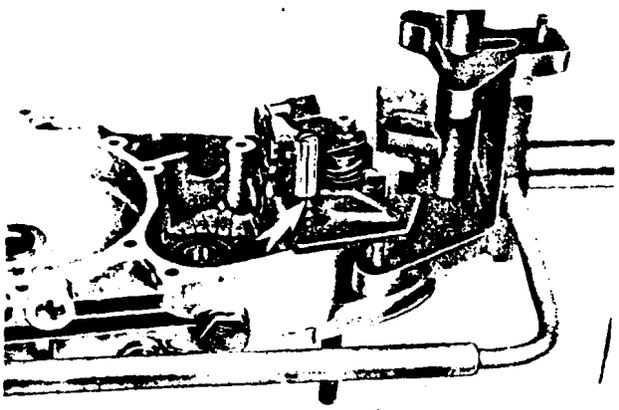

Fig. 34. Setting the gear-shift detent axle

Gear-shift dog to be pushed on the gear-shift detent axle together with compression spring and ball, pressing the ball into the bore-hole by means of a screwdriver.
Put the gear-shift lever in place and shift the gears. During this operation check that the dogs of the gear-shift member properly engage (engagement minimum 1 mm, maximum 3 mm) and that the elastic segment lever does not jam when the gear-shift member returns. If necessary, restraighten the retaining plate.

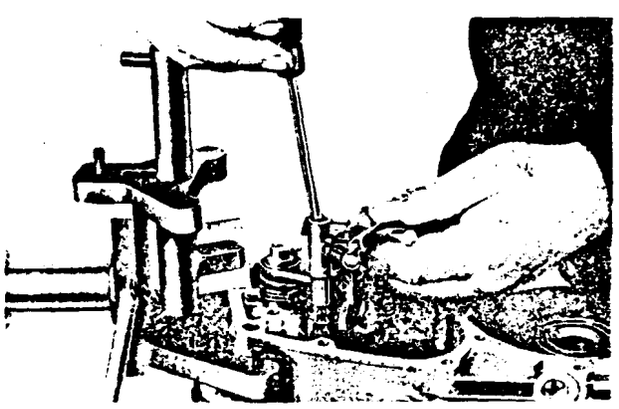

Fig. 35. Inserting the gear-shift pawl

Check all dogs of the gear-shift wheels for wear. The undercut of 5° must bear for at least 3/4, otherwise this part and the gear with which the worn dogs engage must be replaced.
The gears under load are retained in mesh by the undercut but not by the gear-shift mechanism detent device on the axle.

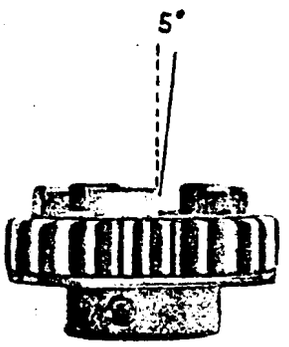

Fig. 36. Gear-shift wheel

If the edges of the keyway in the clutch shaft (1) and layshaft (2) and their gear-shift wheels [2nd and 4th speeds (3)] have become severely rounded or are even broken out, then they must be replaced by new ones.

Check the working surfaces of the bearing collar at the pair of gear-shift wheels for the 1st and 3rd speeds (4) for wear marks. When using new parts take care to see that these parts are properly matched – black colour dot to black and white to white!
Check the gear for the 1st speed (5) that the edges of the window are in a proper state and that there are no cracks.
Check the bush of the shaft wheel (6) for wear.
The amount the clutch shaft may be out of true is

0.05 mm

Realignement should only be effected by pressing but never by beating! It is advisable to check the shaft between the centres of a lathe and then adjust it.

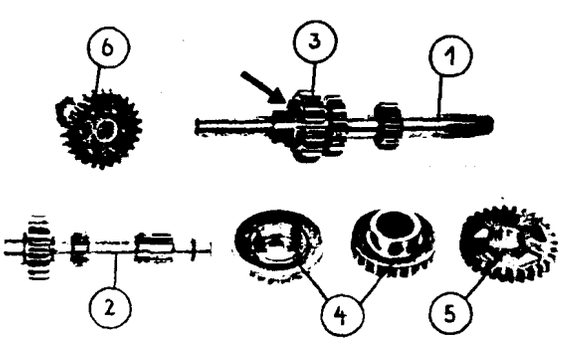

Fig. 37. Causes of faults in the gear-shift set

If the setting gauge shown in Fig. 34 is not available, use a "block gauge" having a height of 13.0 mm; this gauge should be specifically made for this purpose. With the 3rd speed engaged it must be possible to insert this gauge while a slight resistance can just be felt. If this is not the case, readjust with the gear-shift detent axle until the distance is correct.
With the 4th speed engaged, a distance of 0.1 to 0.2 mm is required between gear-shift wheel

of the 4th speed and the shaft wheel – the 6004 shaft wheel bearing must not be exposed to axial pressure!

(See Fig. 38, page 21)

Oil all journals and shafts. Put the gear-shift wheels for the 2nd to the 4th speeds on the clutch shaft and push the latter into the ball bearing. At the same time insert the finger of the gear-shift pawl into the guide grooves of the gear-shift wheels. Use a rawhide hammer to drive the shaft up to the stop. During this operation, the gear-shift pawl is in the 4th speed.
At the layshaft, first fit the gear (provided with a window) for the 1st speed (smooth side pointing upwards), then insert the pair of gear-shift wheels for the 1st to 3rd speeds with the guide collar into the mating wheel and put the layshaft through. At the same time turn sideways until the keyway slides through the gear-shift wheels.
Use a rawhide hammer to drive the layshaft up to the stop.

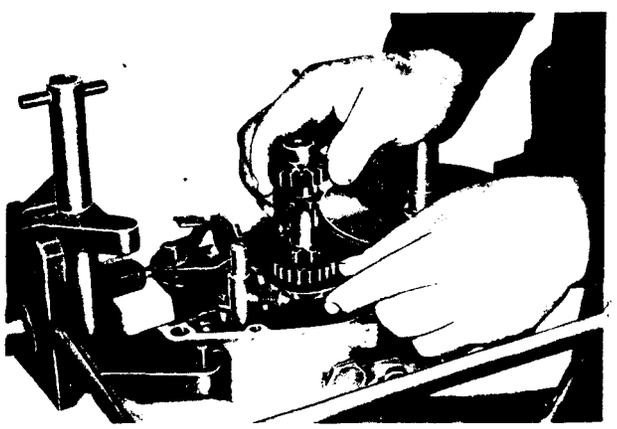

Fig. 39. Mounting the gear-shift set

Put the shaft wheel (1) in place and check the contact plate for the neutral indicator (2) – if necessary, straighten the plate (dimension "A" 10 to 11 mm – while the gear-shift shaft is pressed down).
Meanwhile, the right-hand half of the casing has been heated to a temperature of about 100 °C and the crankshaft sealing ring (from the inside) driven in (press in rings without steel coat) so that it is flush with the inner edge of the casing – sealing lip pointing outwards (see Fig. 3).
The inner race of the 6004 bearing must be heated by means of a mandrel and then fitted into the casing by means of the 11-MW 7-4 drift.

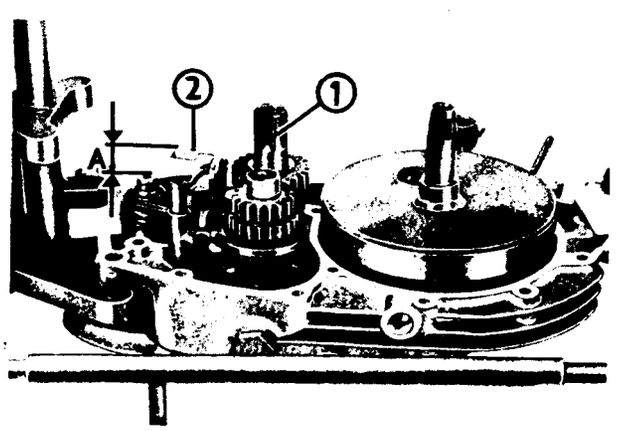

Fig. 40. Left-hand casing half readily mounted

Apply a thin film of jointing compound to the sealing surfaces (most of the jointing compounds can be diluted with nitro diluent). Do not smear over the tapped holes or the gearbox vent (Fig. 26)! Put the casing half in place and properly fit it by applying slight blows with a rawhide mallet.
Readjust the bearing 6004 at the shaft wheel by means of the 11-MW 7-4 drift.
Drive the two fitting sleeves (see arrows) in place, using the 11-MW 3-4 drift.

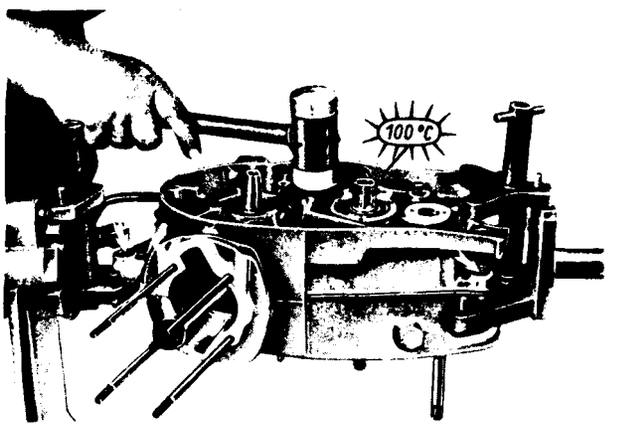

Fig. 41. Mounting the right-hand casing half

Tighten all 14 casing screws by means of a properly fitting screw-driver (if possible use a breast drill) [maximum torque 12.7 Nm (1.3 kp-m)].
Observe the correct succession, namely:
Starting in the centre of the casing, then tightening alternately and crosswise right-hand and left-hand screws (order indicated by numbers in the illustration).

Make haste to ensure that the casing is still warm enough for the next operations.

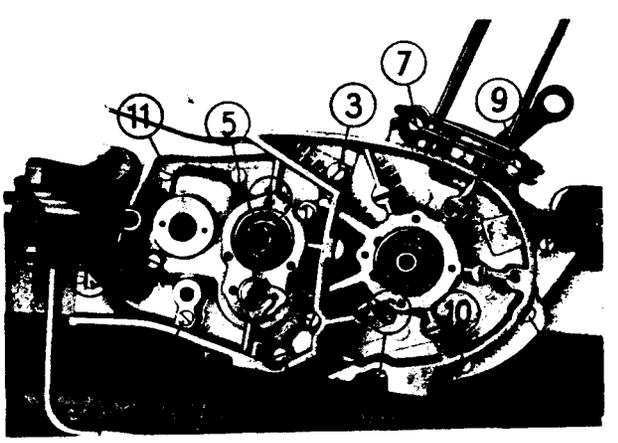

Fig. 42. Tightening the casing screws

Use a heated mandrel to bring the inner race of the 6303 bearing to a temperature of about 80 °C and, using the 11-MW 7-4 drift, apply slight taps to insert it until it contacts the collar of the crankshaft tail end.
Especially in the right-hand crankshaft bearing everything depends on the fact that the cold outer race slides in the hot casing – and the hot inner race of the bearing on the cold end of the crankshaft – when

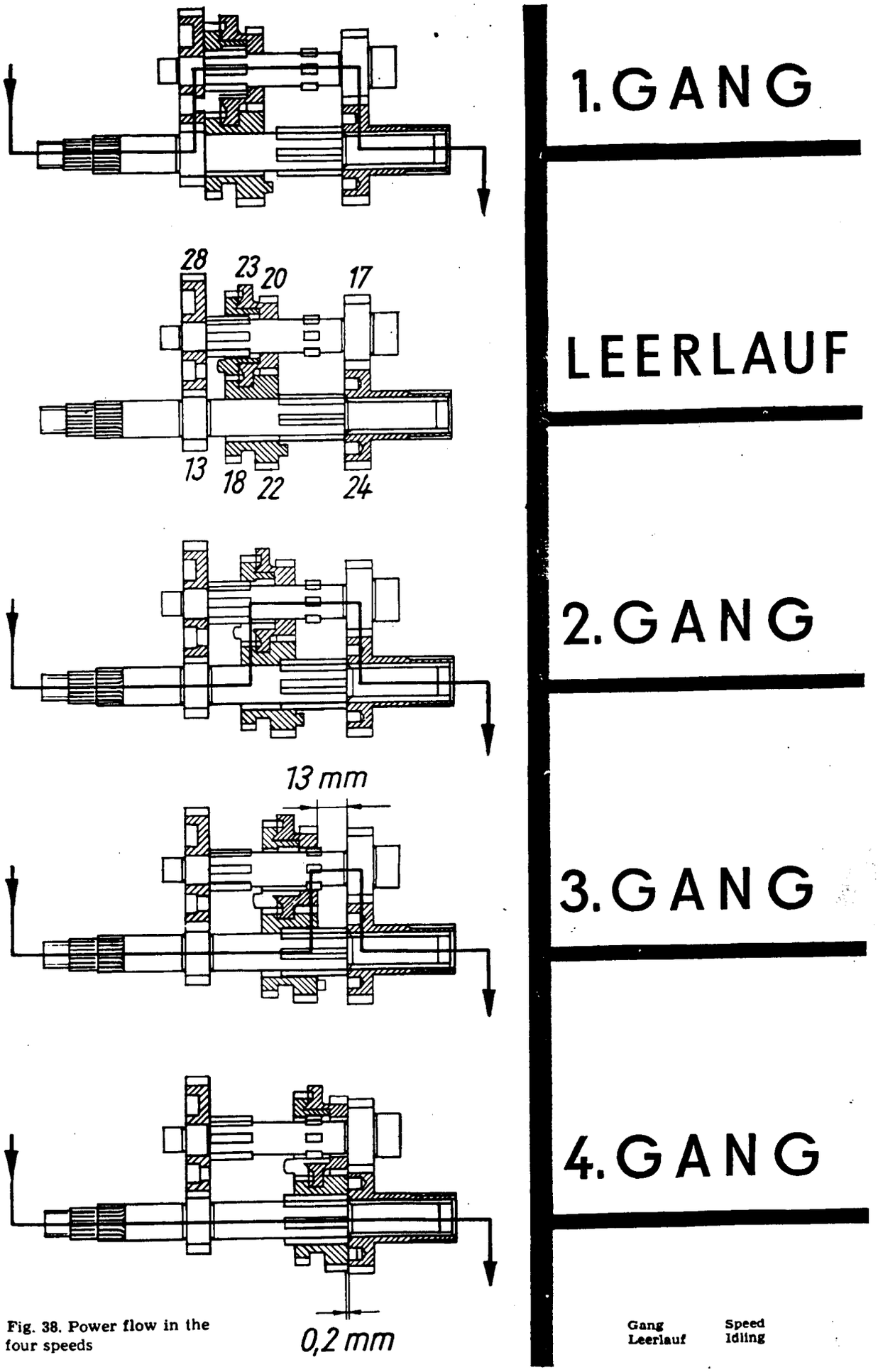

Fig. 38. Power flow in the four speeds

Gang Speed
Leerlauf Idling

a few slight blows by a hammer are applied. If this is not the case you could not feel whether or not the bearing already contacts the collar (see Fig. 3).

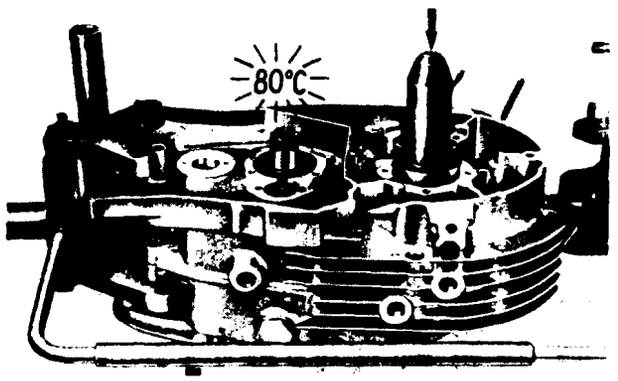

Fig. 43. Inserting the right-hand crankshaft bearing

One vigorous blow by a hammer more than required may cause the following:
The crankshaft is exposed to axial thrust because the bearing was driven in too deep. The inner race presses back the slightly resilient crankshaft. As a consequence, the bearing clearance (lubrication film!) in the left-hand bearing is also removed. The balls no longer bear radially but run on the sides, producing a "whining" sound until they will fail prematurely.

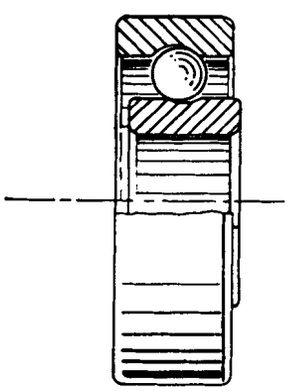

Fig. 44. Distorted bearing

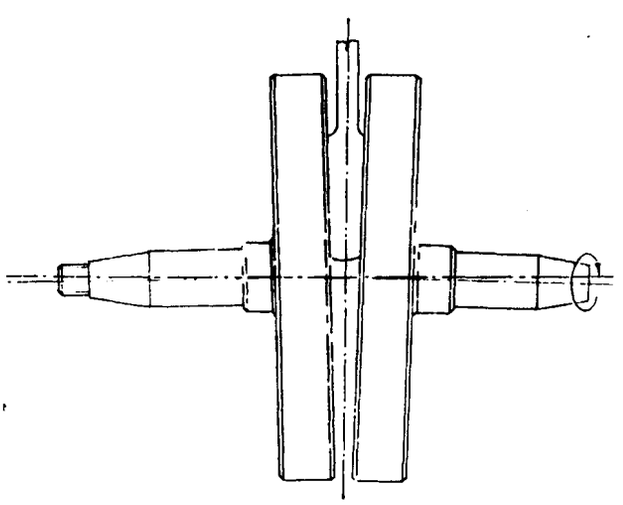

Fig. 45. Displaced crankshaft

If the blows applied were still heavier, the crankshaft will be laterally displaced and will be forced out of true; then it is useless for the following reasons:

1. The contact breaker fails to lift at the specified point or the adjusting range of the contact-breaker base plate will become insufficient.
2. The amount the crankshaft is out of true will cause the engine to vibrate and, as a consequence, the warranted engine output will no longer be reached.

If the bearing is driven in with undue force into the cold casing and without the inner race being heated, there is the additional risk of the outer race becoming tilted, i.e. it will not fit axially parallel.
In addition to the state described in Fig. 44, the casing becomes useless. A correctly mounted bearing would again be tilted because of the damaged seat of the bearing.
(For a better demonstration, the representation of the sketches is slightly exaggerated.)

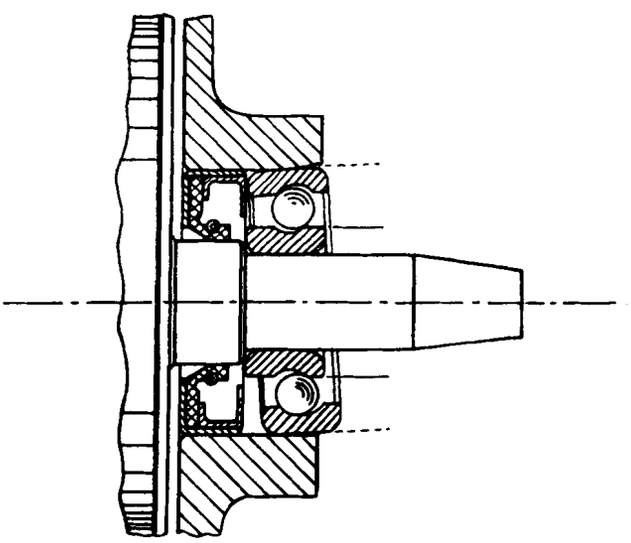

Fig. 46. Tilted bearing

Meanwhile the inner race of the third crankshaft bearing has been heated to about 80 °C. The casing is turned in the assembling device through 180° and the bearing driven in until it contacts the lock ring by means of the 11-MW 7-4 drift.

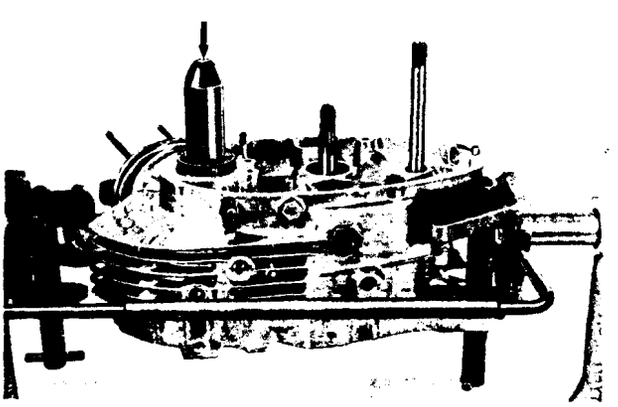

Fig. 47. Inserting the crankshaft bearing at the left-hand side

The distance between the outer edge of the casing and the bearing outer race must be measured and, if required, adjusted to the correct dimension by means of spacers.
A distance from 0.2 to 0.3 mm to the cover plate must remain. The thickness of the original packing (0.5 mm) must be taken into account. Find out whether the spacer bush (1) has been damaged by the sealing lip and check that the sealing ring is in perfect working condition.
Properly clean the joint surface of the cover plate, insert a paper packing (use jointing compound) and tighten the screws crosswise [Torque 4.9 Nm (0.5 kp-m)].

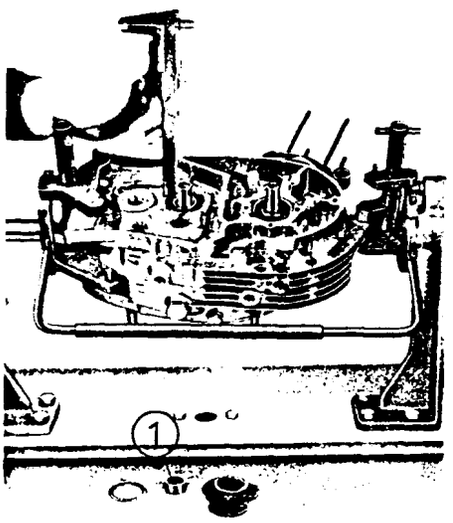

Fig. 48. Aligning the cover plate

Place the engine in upright position – if there is no assembling fault (Figs. 44 to 46), the crankshaft must be free to be moved with ease.
By way of trial, shift the gears of the gearbox – at the same time turn the clutch shaft.
The clutch shaft must be free to move easily; if this is not the case, use a rawhide mallet to drive the shaft (lower arrow) forward through a distance of 0.2 mm and then use a copper mandrel (placed through the shaft wheel) to beat the shaft back (upper arrow). Now the end clearance shown in Fig. 38 between the face of the keyway section of the clutch shaft and the shaft wheel must be present.
Slightly grease the lip of the sealing ring in the cover plate – put on the distance bush [(1) in Fig. 48].
Fit the gearbox sprocket (recess pointing to the engine) and lock plate. Tighten the nut with a width over flats of 27 with 58,9 Nm (6 kp-m) (left-hand thread) and fit the lock plate.
Arrest the assembly with the 05-MW 45-3 holder or an old chain.

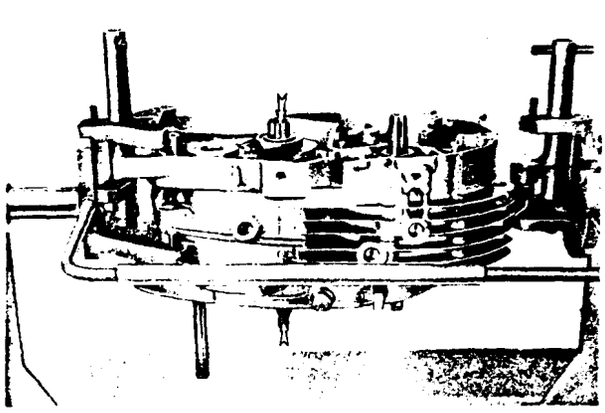

Fig. 49. Aligning the gearbox

After checking the 17 × 30 × 7 sealing ring in the sealing cap measure the distance (1) between sealing cap and ball bearing by means of a vernier caliper and see to it that the end clearance is 0.2 to 0.3 mm, if necessary apply shims. The thickness of the original paper packing (2) of 0.5 mm must be taken into account.

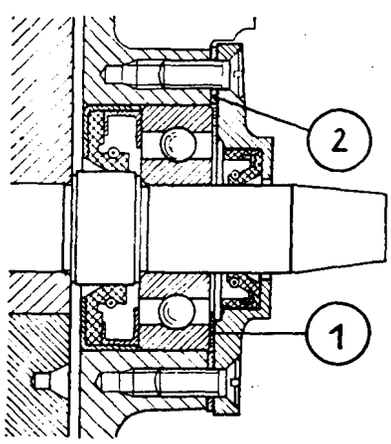

Fig. 50. Aligning the sealing cap

If (with the engine mounted) the green control light fails to light up, then loosen the clamp at the lead and apply the cable end from the control lamp to ground.

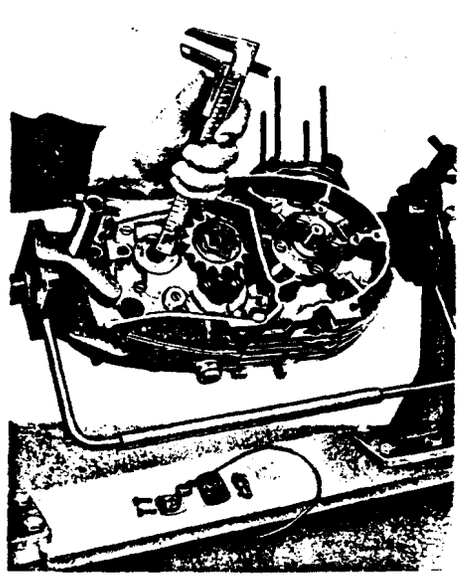

Fig. 51. Adjusting the neutral control switch

If the green lamp again fails to light, the lead or the electric bulb is defective. If it lights, the fault is in the contact switch: the contact gap at the contact plate is less than required (Fig. 40).
A distance of 12.5 mm is required between the outer edge of the casing and the upper edge of the contact plate. If necessary, use an offset bicycle or motorcycle wheel spoke to draw the contact plate to the desired dimension (for this purpose, the gearbox must be in neutral position).

Or the distance between contact pin (A) and contact spring (B) is too large because the latter is bent back. Earth continuity is also lacking if the contact spring is oxidised or dirty.
When replacing the contact switch only use original parts, when the contact pin is too long it may be possible that the pin hooks on behind the contact plate and thus obstructs the switch mechanism, that is to say, the gear-shift pedal can be moved without shifting gears.
Apply a thin film of jointing compound to the plane surface of the switch and screw it to the casing.

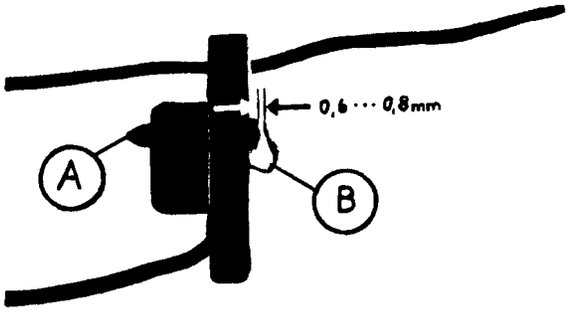

Fig. 52. Neutral control switch

Shift all four gears by way of trial. At the same time check, by counter-rotating clutch shaft and gearbox sprocket, that the gears properly mesh and engage.

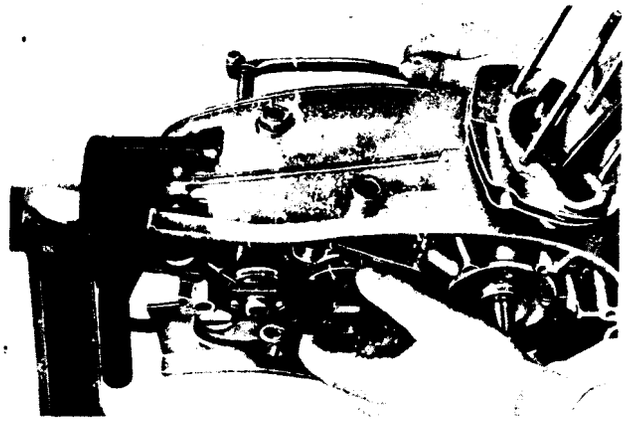

Fig. 53. Gear-shifting test

Fit the lock plate (1) of the nut of the gear-shift detent axle.
Check the teeth of the starting segment at the contacting side (2) for wear.
Insert the offset end of the kick-starter spring into the slot in the starting segment – if necessary, restraighten so that the end of the spring fits tightly.
Fit the guide (or thrust) washer 30 × 17 × 1 and mount the starter shaft with spring. Put the kick-starter lever in place and pre-load the starter spring by turning it through one revolution clockwise. For this purpose withdraw the starter shaft just far enough to ensure that the segment passes the stop (3). Press the rolled up end of the spring into the holder.

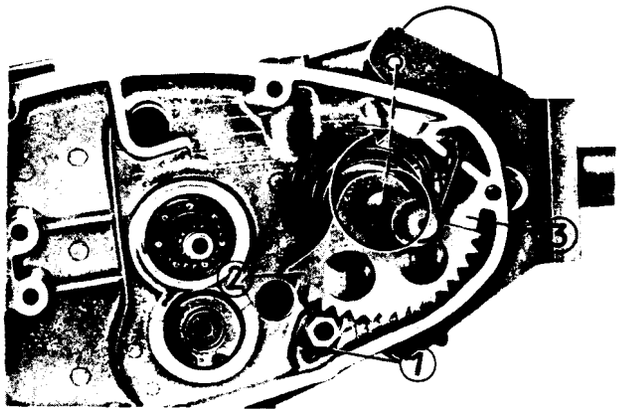

Fig. 54. Mounting the kick-starter assembly

At the complete clutch drum check

(A) if the dogs of the frictional lining disks have produced indentations in the clutch drum.
Small notches are removed by means of a smooth file. If there are deeper indentations, the part must be replaced because in this state the clutch fails to separate properly.

(B) if the edges of the window in the driver and the dogs of the kick-starter wheel in engagement with this window are heavily worn (rounded). If there is a large amount of wear, replace the part otherwise the kick-starter will slip.

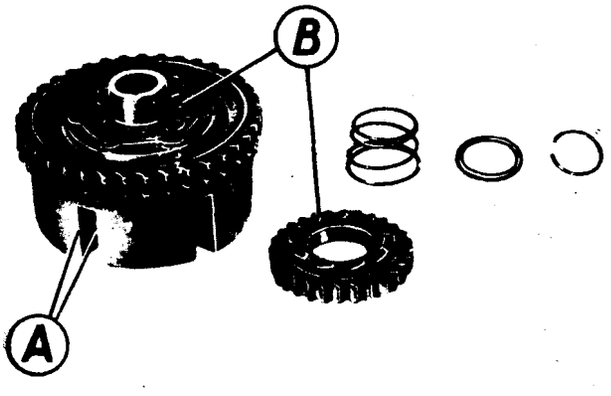

Fig. 55. Wear of the clutch drum

Check the sprocket on the crankshaft, the sleeve-type chain and the clutch sprocket for wear. For this purpose, provisionally fit these parts.
With the engine standing vertically, the sag in one strand of the chain must not exceed 8 to 13 mm if the other one is taut. If the sag is excessive, the chain will "whip", mount the teeth and perhaps break.
When selecting a new chain, take the colour marking into consideration and observe the stamp on the packing:

green = normal, for practically new sprockets

yellow = 0.1 mm less, to be used in the case of little wear

white = 0.2 mm less, to be used in the case of more wear

blue = 0.3 mm less

There is only a limited stock of sleeve-type chains for the tolerance ranges "white" and "blue".

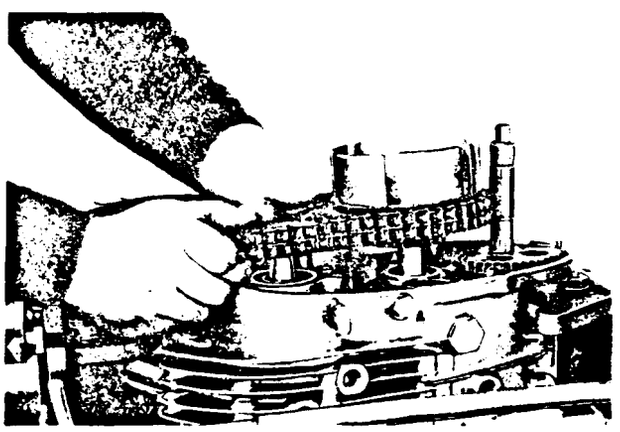

Fig. 56. Checking the primary drive

First slip the thrust washer 25 × 15 × 0.5 and then the clutch drum with bush on the clutch shaft and then put the sprocket on the crankshaft.
Use a ruler or vernier caliper to check that the two sprockets are in line. Necessary corrections are made with shims (0.1; 0.2; 0.3; 0.5 mm thick) which are placed between bush and thrust washer.
Not properly aligned sprockets cause premature wear of chain and sprockets.

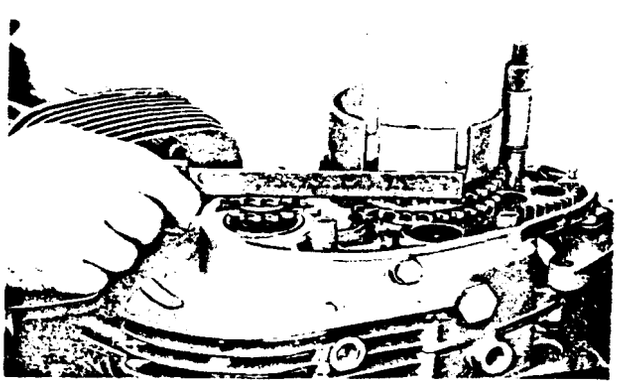

Fig. 57. Aligning the primary drive

Check the inner driver to see that the internal gearing is in proper mesh with the profile of the clutch shaft without excessive backlash.
Indentations in the grooved profile of the driver caused by the (steel) disks and which can just be felt or are just visible can be neglected.
In the case of indentations deeper than 0.1 mm, the inner driver must be replaced.
The drivers for the designs duplex or simplex chain are not exchangeable because of different heights of collar (A).

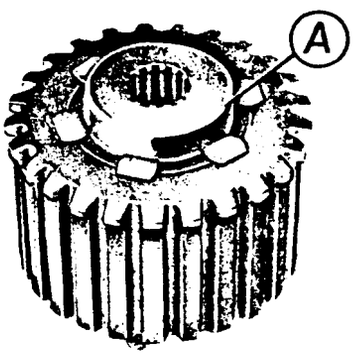

Fig. 58. Internal clutch driver

Insert the 12-MW 5-3 (1) holder, fit the inner driver (2) and arrest it by means of the 01-MW 22-4 (3) holder. First put the spring ring and then the lock plate on the clutch shaft – place the eyelet over one of the spring bolts with the drop downwards. Tighten the nut by means of a socket wrench (width over flats 19) with a torque of $58.9^{+9.8}$ Nm (6^{+1} kp-m). (Left-hand thread.) Fit the lock plate.
Fit the spring ring on the crankshaft end and tighten the nut by means of a spanner (width over flats 19 – right-hand thread) with $58.9^{+9.8}$ Nm (6^{+1} kp-m).

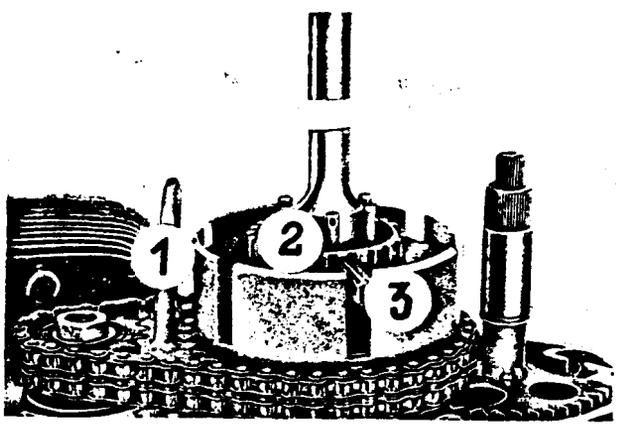

Fig. 59. Fastening the driver

Steel disks:

Use a ruler or a vernier caliper to check that the surfaces are still plane – if necessary, use a surface plate for checking.

Disks with frictional lining:

Thickness, new	3.4 ± 0.1 mm
maximum amount of wear	— 0.2 mm

Compression springs:

Length, slack	49 mm
spring power	157 N (16 kp) with a
mounting length of	31.5 mm

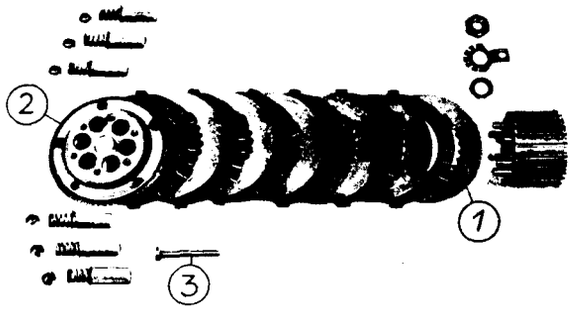

Fig. 60. Clutch dismantled
(1) Holding disk, (2) Spring plate, (3) Pressure pin

First fit the retaining disk, which is slightly thicker than the other ones, and then the other clutch disks in correct succession (Fig. 60). Grease the pressure pin on either side and put it into the clutch shaft.
Mount the spring plate (1) in such a manner that the spring bolts (2) are exactly in the centre of the circular opening — this is ensured when the bolt (B) with colour spot (or punch mark on the clutch driver) and the curvature (A) of the opening are opposite each other. The spring caps and the compression springs must not jam or rub.

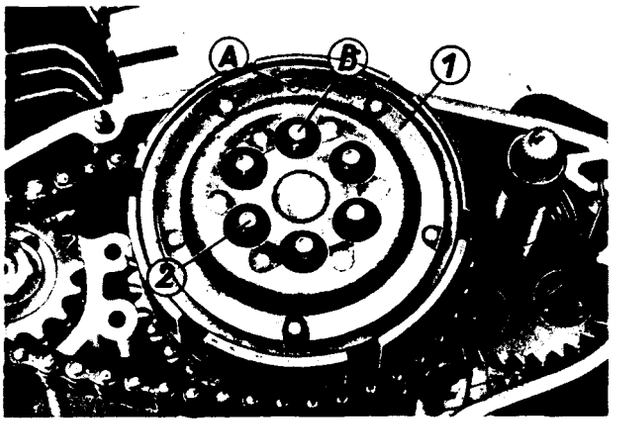

Fig. 61. Mounting the clutch

Using the "Push pin for clutch compression spring" 11-MW 15-4, press down the nipples and compression springs and insert the cylindrical pins.
Place the 20 × 30 × 1 washer on the kick-starter shaft.

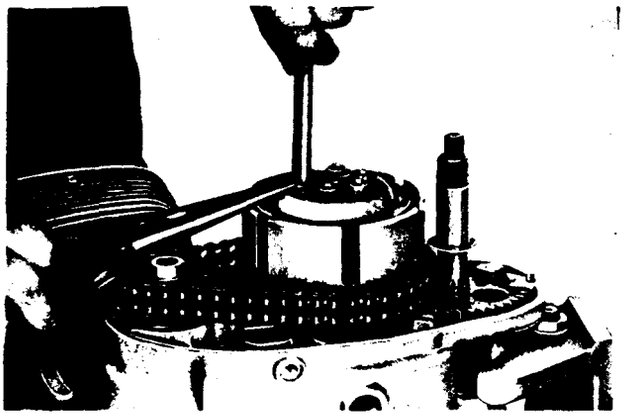

Fig. 62. Fastening the clutch compression springs

Put the paper packing (without jointing compound) and the touched-up clutch cover in place — uniformly tighten the screws [torque 12.7 Nm (1.3 kp-m)].
Slip on kick-starter lever and control lever and tighten the clamping screws. After the trial run retighten the two screws.
Screw the oil drain plug 18 × 1.5 (with magnetic plug incorporated to retain metallic particles) into the crankcase and the oil-level check screw (A) into the clutch cover. Take care to see to it that the packing rings are in proper condition.

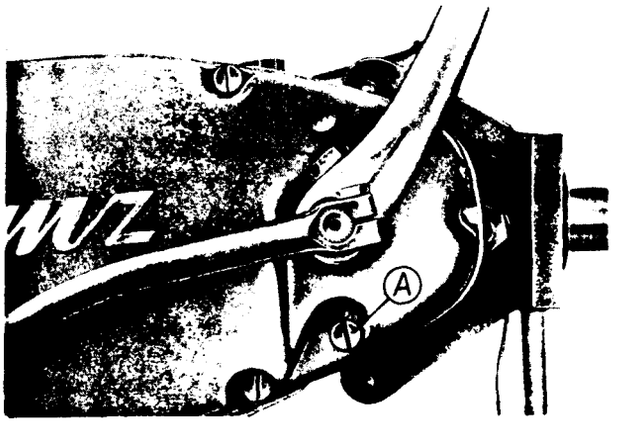

Fig. 63. Mounting the clutch cover

The markings on the piston head have the following meanings:

(a) Arrow — when the piston is mounted as in normal use, the arrow must point in the direction of the exhaust port.

(b) 51.98 — this is the "nominal size" of the piston, that is to say, it is 51.98 mm in diameter. Matched with a cylinder marked "+ 1", a fit with an assembly clearance of 0.03 mm is obtained.

Tolerances are allowed for cylinder bore (honed) and piston diameter, as is the case with any other part, e.g. the tolerance for the cylinder bore is + 4 to 6 µm.
In order that the upper tolerance limit of the piston and the lower tolerance limit of the cylinder (or vice versa) do not coincide, the two parts must be measured and selected according to the specified assembling clearance.

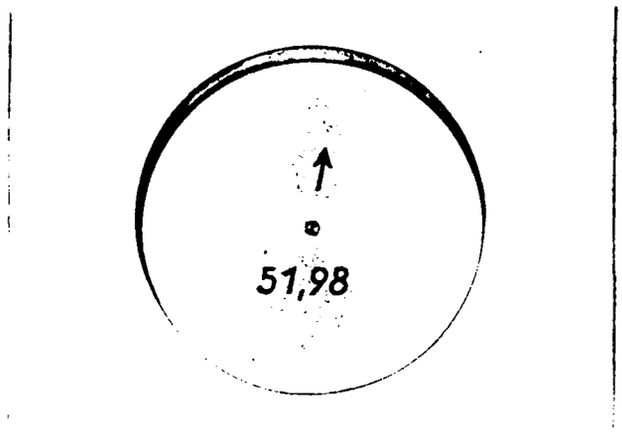

Fig. 64. Piston marking

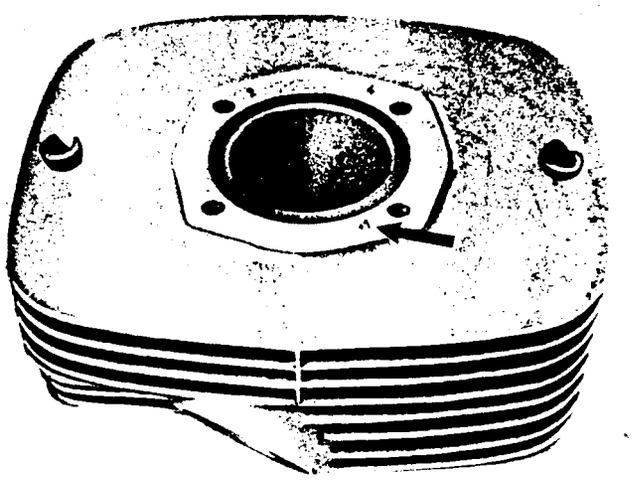

Fig. 66. Cylinder marking

The "nominal size" is measured at the lower edge of the piston skirt. The piston skirt is conical, the smallest diameter is the ring section.

Assembly clearance	piston – cylinder	wear value
ES/TS 125/150	0.03 mm	0.25 mm

Oversizes of pistons for the two types 8 oversizes – each by 0.25 mm larger than the previous one – are available. More than 2 mm must not be removed in internally grinding, otherwise the cylinder liner is liable to the risk of deformation.

To avoid errors in measuring, the internal-measuring instrument must precisely be set to the relevant basic size of 52 or 56 mm by means of a ring gauge (or a micrometer, as a makeshift).

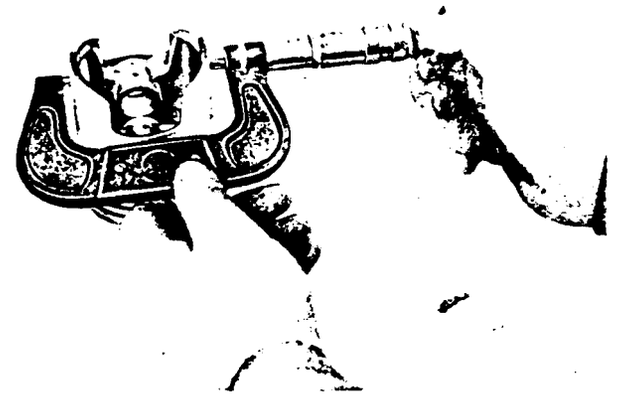

Fig. 65. Measuring the piston

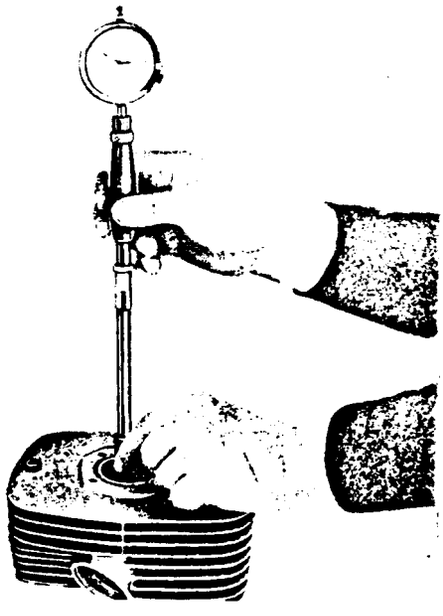

Fig. 67. Measuring the cylinder

The wear value (assembly clearance) is related to the values measured in the upper and lower quarters of the working surface of the cylinder. In the centre, between the ports, the wear rate naturally is somewhat higher. The arrow shows the marking of the nominal size on the cylinder.

0 = full size
+ 1 = 0.01 mm over full size
+ 2 = 0.02 mm over full size

The other numbers indicate manufacturing month (2) and year of manufacture (4); here, February 1974.

All MZ motor-cycles have a "symmetric" timing diagram. Related to the transfer angle of 115° that is to say that the transfer ports open 57.5° before bottom dead centre and close 57.5° after B.D.C.
Exhaust and transfer are measured from B.D.C., inlet from T.D.C.

Timing

	ES 125	ES 150	ES 125/1 and 150/1 TS 125 and 150
Inlet with point	142°	142.5°	150°
Inlet without point	126°	126°	
Transfer	110°	110°	115°
Exhaust	152°	150°	165°

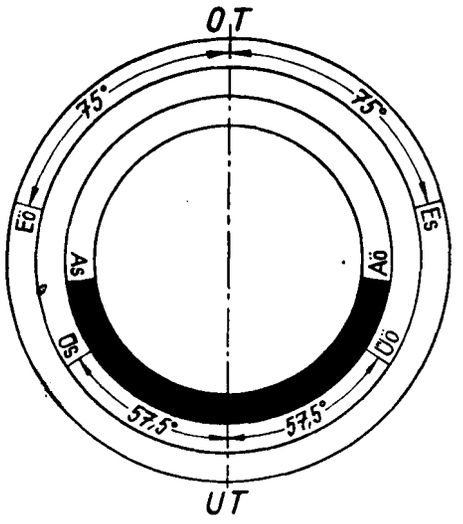

Fig. 68. Timing diagram

OT	TDC
UT	BDC
Eö	Inlet opens
Üs	Transfer port closes
Es	Inlet closes
ÜÖ	Transfer port opens
Aö	Outlet opens
AS	Outlet closes

As a makeshift a graduated disk (360° protractor) can be used which is available from any stationer's shop (teaching aid). The disk is reinforced for workship use by riveting a sheet metal disk on it.
Clamp the cylinder before reading the values determined with the help of a pointer.

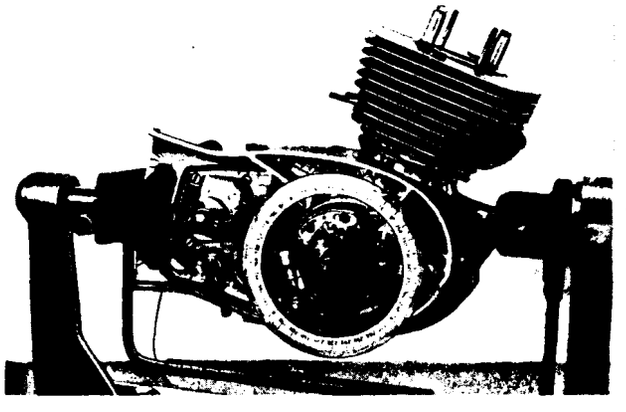

Fig. 69. Determining the timing

If an old piston is reused, the piston rings must be checked that they are free to move in the piston ring grooves. Special attention must be paid to the top ring because it is exposed to the highest temperatures. In the case of abnormally high operating temperature due to wrong carburetter tuning or ignition timing, it may be distorted; this is indicated by a corrugated contact surface.
Each ring must be placed in the same groove (and not with the sides reversed) in which it was located before removal and run in.

Width of piston ring groove	Wear value
$2.04^{+0.02}$ mm	2.10 mm

Piston rings whose vertical play is excessive fail to ensure a gas-tight seal and produce a "whining" sound.

If the locking pins in the piston ring grooves have become loose, the piston cannot be reused.

Fig. 70. Checking the ring grooves

For cleaning the piston ring grooves, a sharpened piece of piston ring should be used, because a scraper or screw-driver might enlarge the groove.
Loose scale deposits on the piston head are removed by means of a wire brush. The firmly adhering layer is left on the piston head because it protects the piston from an uncalled-for heat absorption.
The same applies to deposits on the ring section and the piston skirt.

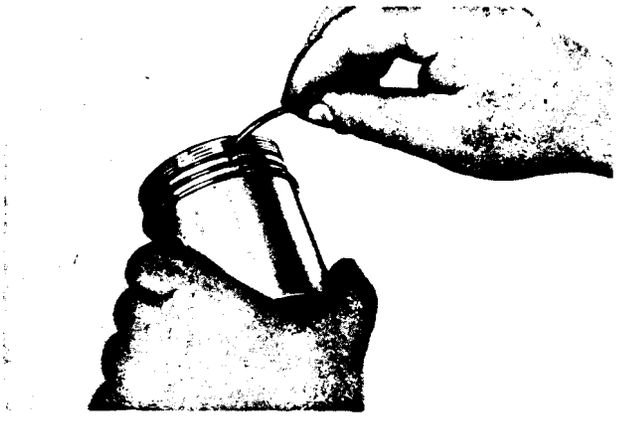

Fig. 71. Cleaning the ring grooves

Piston-ring gap in new condition	0.2 mm
Wear value:	1.5 mm

If the piston-ring gap is too small, the ends will butt; as a consequence of the increased friction the wear rate will increase, too.
The view that by fitting a new set of piston rings the performance of an engine that has run for a long pe-

riod will be improved is wrong. In accordance with the engine performance, the cylinder bore has become more or less oval whereas the new rings are perfectly cylindrical. As a consequence, exhaust gases escape, the rings are heated, become distorted and may eventually seize. This may lead to piston seizure!
If during assembly a piston ring is broken, the fitting of a new ring is a proper remedy only up to a road performance of maximum 3000 km. If this figure is exceeded, the cylinder must be rebored or honed and a new piston installed.

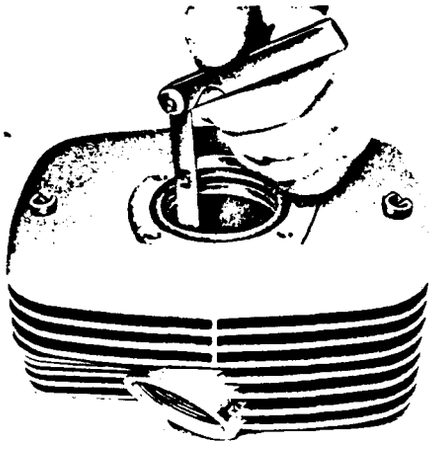

Fig. 72. Checking the piston ring gap

Seizing traces are removed by means of a smooth-cut file or an oil-stone (emery stick) but not by means of emery-cloth or abrasive paper.
The piston shown in the accompanying illustration was seized because the gudgeon pin had a too tight fit in the gudgeon-pin boss.
Notice in any case:
Do not use a piston with the marking "GG" on the piston head. This type of piston is provided for the grey cast-iron cylinders of the older MZ types.

Fig. 73. Piston seizure

For fitting the gudgeon pin, the piston must not be too cold but "lukewarm" (about 35 to 40 °C). After oiling the small-end bush and putting the piston on the support 22-50.412, the gudgeon pin can be pressed in place with the thumb with the help of the guide mandrel 02-MW 33-4 (F).
The studs for fastening the cylinder must be tightened with a torque of 19.6 Nm (2 kp-m).

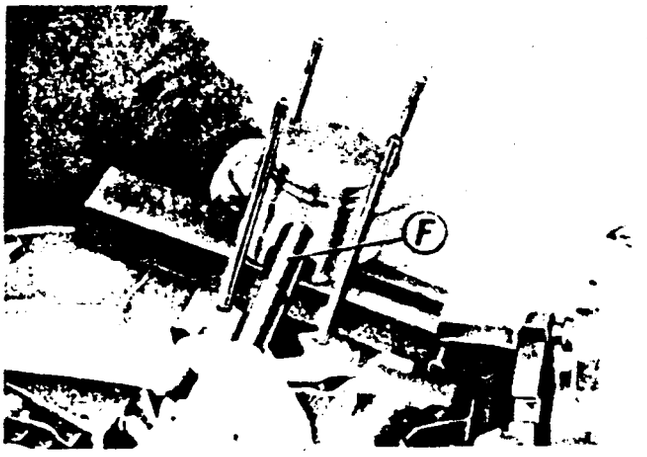

Fig. 74. Inserting the gudgeon pin

The locking rings are inserted in such a way that the eyelets point upwards or downwards but not sideways. See to it that the rings have a tight fit in the grooves.
In any case only use new locking rings.
Gudgeon pins are available in the following oversizes:

0.01 mm
0.02 mm
0.03 mm

When fitting the gudgeon pin, please, observe the text for Fig. 30.

Fig. 75. Locking the gudgeon pin

When mounting the cylinder take care that the ring gap is at the locating pins, otherwise the ring in question will break!
To protect the cylinder base gasket from damage, stick it to the cylinder by means of two dots of grease. Then apply a film of engine oil to the working surface of the cylinder and slip the cylinder over the piston without the application of undue force.

Withdraw the piston support.
During this operation, retain the cylinder with one hand so that it cannot go down.

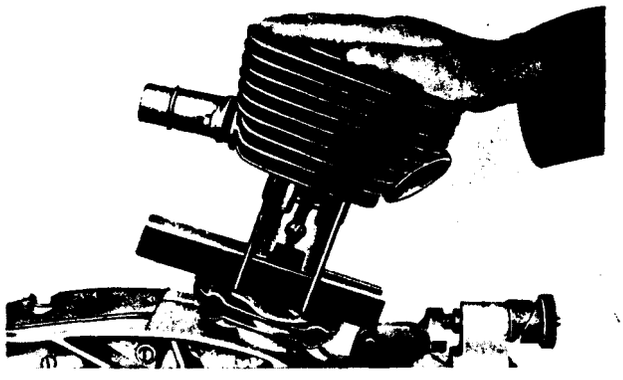

Fig. 76. Mounting the cylinder

There is no gasket between cylinder and cylinder head.
Not for reasons of economy but to ensure a better heat transfer. The sealing surfaces of the cylinder head (in any case) and of the cylinder must be checked that they are perfectly plane on a surface plate (see also Fig. 24).
If the head is significantly distorted, it can be returned by means of a turning mandrel with threaded pin M 14 × 1.25. The pin is screwed into the thread for the sparking-plug.
Remove not more than 0.3 mm of metal in re-turning, otherwise the compression ratio becomes excessive.
The four support corners must be recessed by no more than 0.1 to 0.15 mm.

Combustion chamber with the sparking-plug screwed in place:

ES 125 = 15.4 cm³
ES 150 = 18.0 cm³
ES 125/1 and TS 125 = 14.0 cm³
ES 150/1 and TS 150 = 16.5 cm³

When measuring, use petroil mixture, pour in with graduated measuring glass.

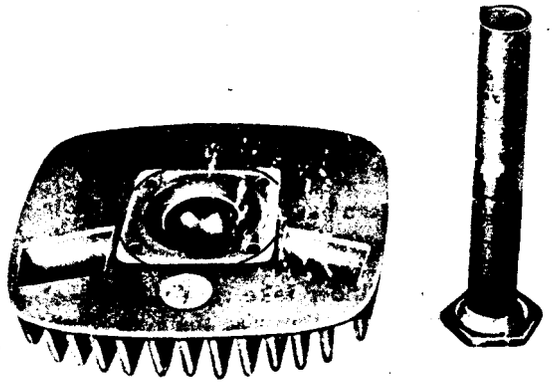

Fig. 77. Measuring the chamber of combustion

If the cylinder head fails to be gas-tight, this is exclusively due to an incorrect tightening of it. Always tighten "crosswise", that is to say, tighten in the sequence 1 — 2 — 3 — 4. First tighten only slightly; at the next stage in tightening use a torque of about 17.6 Nm (1.8 kp-m).

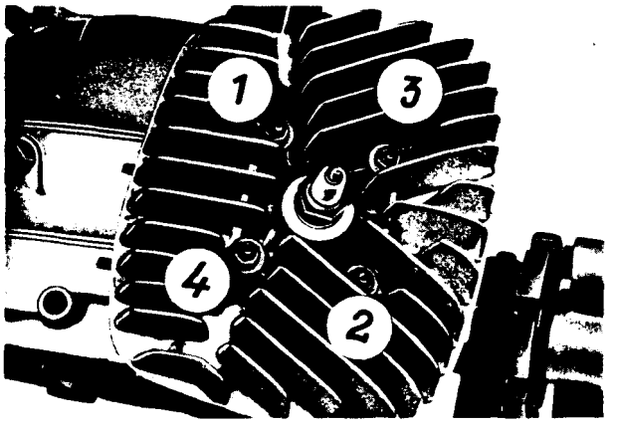

Fig. 78. Fastening the cylinder head

After the casing has cooled down, the 14 casing screws are tightened once more (observe Fig. 42).
The bore for gearbox venting (see arrow) must be cleared by means of a wire in order that it cannot be clogged by hardened jointing compound.
Do not forget to fill oil.

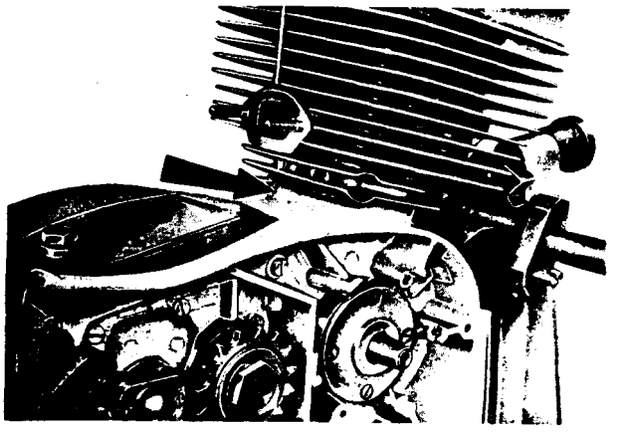

Fig. 79. Completing the engine

5. Electrical Equipment

If repairs in the electrical equipment are required which call for expert knowledge, it is advisable to call on an authorised workshop for repairs in vehicle electrical systems.
All denotations of connections for electrical devices and lines occurring in the following text are also shown in the wiring diagrams (Fig. 80 and 81 as well as the coloured supplement, Fig. 82).

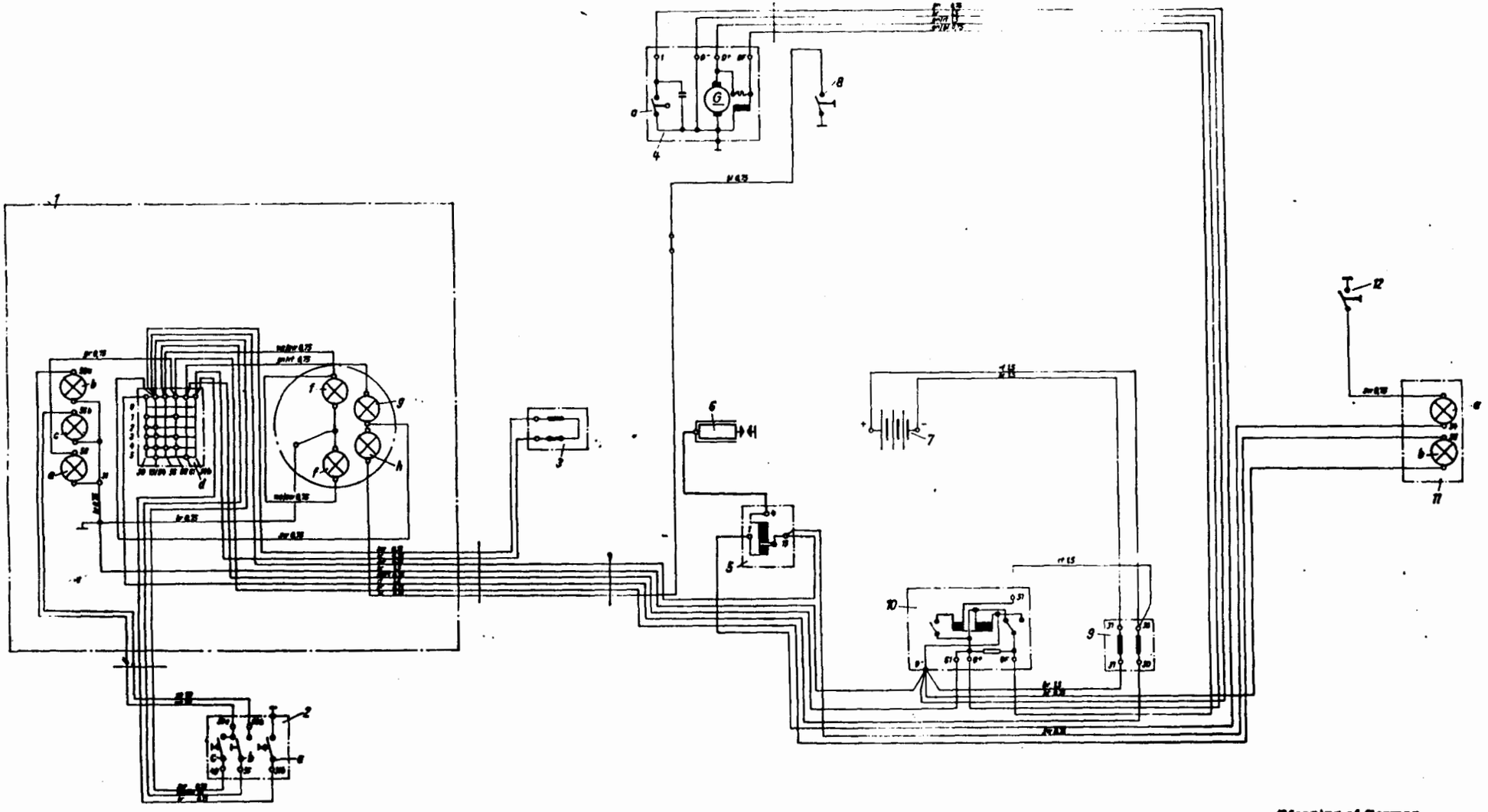

Fig. 80. Wiring diagram without flashing-light direction indicators (TS 125 and 150)

(1) Headlamp
(1a) Parking light
(1b) High headlight beam
(1c) Passing beam
(1d) Ignition-light switch
(1f) Speedometer illumination
(1g) Charging control light
(1h) Idling control light
(2) Combined dimmer switch
(2a) Horn push-button
(2b) Dimmer switch
(2c) Light-signal push-button
(3) Horn
(4) Dynamo
(4a) Contact breaker
(5) Ignition coil
(6) Sparking plug
(7) Battery
(8) Idling switch
(9) Fuse box
(10) Regulator cut-out
(11) Combined stop, tail and number plate lighting fitting
(11a) Stop lighting fitting
(11b) Combined tail and number plate lighting fitting
(12) Stop light switch

(Meaning of German abbreviations)

rt = red
br = brown
ws = white
sw = black
gn = green
gr = grey
bl = blue
ge = yellow

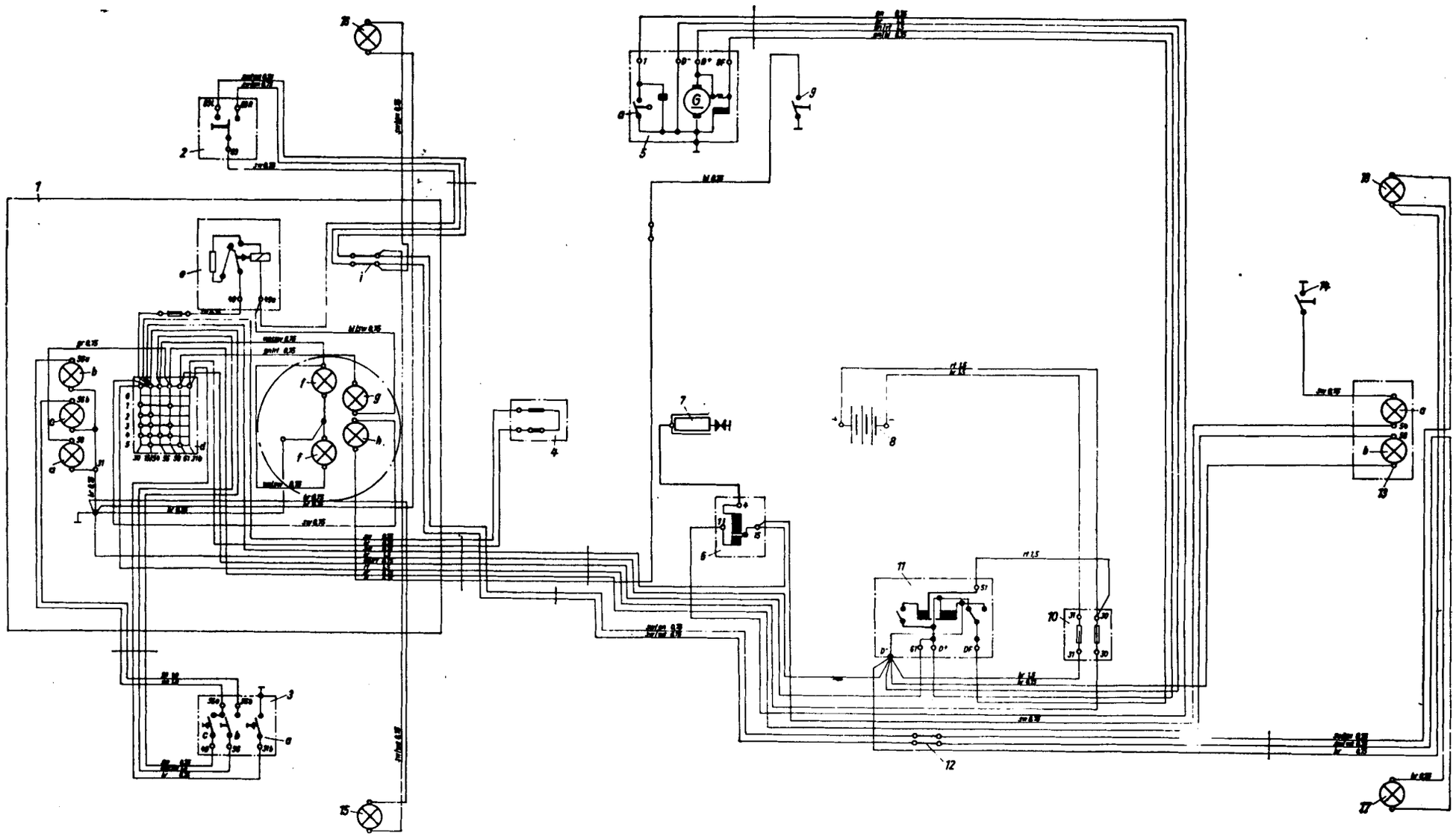

Fig. 81. Wiring diagram with flashing-light direction indicators (TS 125 and 150) (loose inset in colour printing is Fig. 82; for legends see page 86)

(1) Headlamp
(1a) Parking light
(1b) High headlight beam
(1c) Passing beam
(1d) Ignition-light switch
(1e) Flasher unit
(1f) Speedometer illumination
(1g) Charging control light
(1h) Idling control light
(11) Contact-tube terminal strip, 2-pole
(2) Flasher switch
(3) Combined dimmer switch
(3a) Horn push-button
(3b) Dimmer switch
(3c) Light-signal push-button
(4) Horn
(5) Dynamo
(5a) Contact breaker
(6) Ignition coil
(7) Sparking plug
(8) Battery
(9) Idling switch
(10) Fuse box
(11) Regulator cutout
(12) Contact-tube terminal strip, 2-pole
(13) Combined stop, tail and number plate lighting fitting
(13a) Stop lighting fitting
(13b) Combined tail and number plate lighting fitting
(14) Stop light switch
(15) Flashing-light direction indicator, front, left
(16) Flashing-light direction indicator, front, right
(17) Flashing-light direction indicator, rear, left
(18) Flashing-light direction indicator, rear, right

(Meaning of abbreviations in German)
rt = red
br = brown
sw = black
ws = white
gr = grey
bl = blue
ge = yellow
gn = green

5.1. Dynamo

5.1.1. Checking the Armature for Accidental Earth

For checking the armature for accidental earth, a line continuity tester also known as "Prüf-Fix" (trade name) is used.

Checking by means of an electric bulb and mains voltage (110/220 V) is forbidden.

The tapping terminal of the line continuity tester is applied to earth (armature lamination pack) of the armature removed from the engine and the individual laminations of the armature are touched with the feeler pin tip in succession.

When the insulation of the armature winding and of the commutator are in order, the tubular lamp in the tester will not light during testing. If the tubular lamp emits a dim or even bright light, then a slight or an intense accidental earth leakage is given. The armature must be replaced by a new one or repaired.

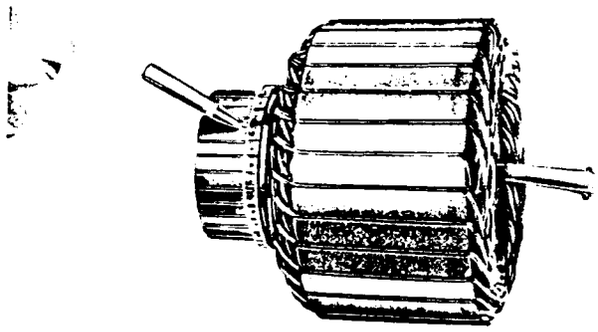

Fig. 83. Checking the armature for accidental earth

5.1.2. Checking the Armature for Shorted Turns

Before checking the armature for shorted turns, clean and blow out the commutator in any case. This is necessary to prevent two copper segments from being connected with each other and thus producing a short-circuit. When the armature is removed from the engine, it is tested by means of a shorted-turn tester (220 V a.c.).

5.1.3. Checking the Field Coil for Accidental Earth

Before checking the field coil removed from the assembly for earth leakage, disconnect the end of the coil connected to earth and the adjustable resistor. Like the armature, the field coil is also checked with the help of line continuity tester.

Here, the use of an electric bulb and mains voltage (110/220 V) for testing is also not allowed.

If the tubular lamp lights up when the tapping terminal is applied to DF and the feeler pin point to the frame, accidental earth is present. Then loosen the individual coil connections and check each field coil separately.

Defective coils must be replaced by new ones in a special workshop.

Before removing the coils, mark their location and that of the poles with respect to the terminal case.

If, however, the tubular lamp does not light when the two terminals of the tester are applied to DF and the frame, all coils are in order as far as earth leakage is concerned.

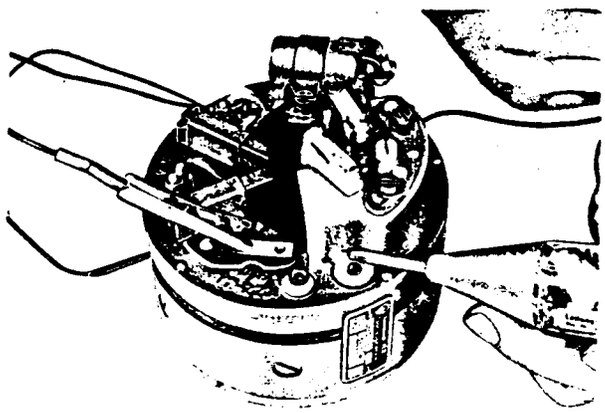

Fig. 84. Checking the field coil for accidental earth

5.1.4. Checking the Field Coil for Shorted Turns

For this test, an ohmmeter is required.

The two tapping terminals connected with the measuring instrument are applied to the negative and positive sides of the field coil.

If there are no shorted turns in the field coil, the reading of the measuring instrument will be anything between 1.7 to 2.1 ohm. When the indicated value is below 1.7 ohm, turns are shorted.

If the pointer of the measuring instrument fails to deflect, the field coils is interrupted. For the replacement of the defective coils, the same as has been said in Section 5.1.3. applies.

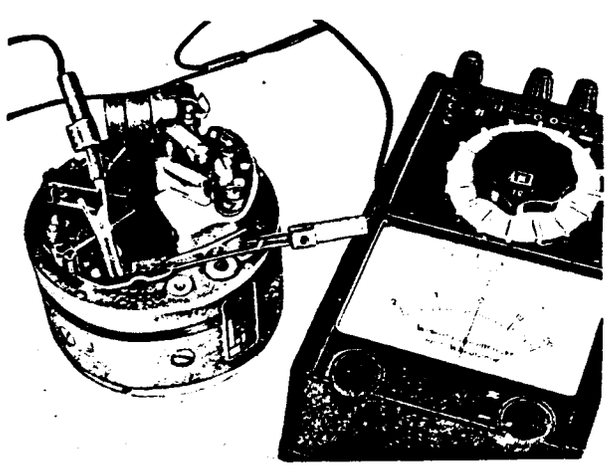

Fig. 85. Checking the field coil for shorted turns

5.1.5. Servicing the Carbon Brushes

Because of the high electrical load (2 × 21 W flashing-light indicators and 21 W stop light), the carbon brushes should be checked for their condition after every 5,000 km of operation.

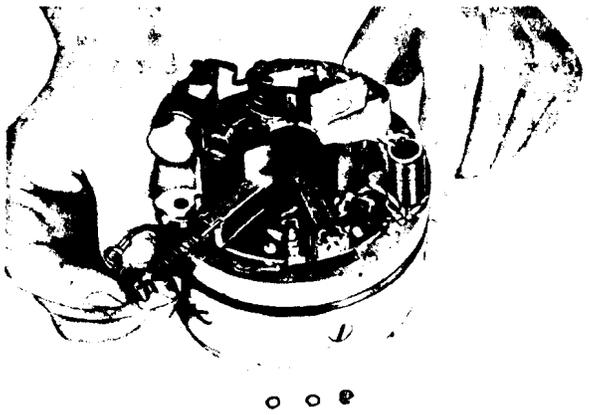

Fig. 86. Replacement of the carbon brushes

The brushes can be withdrawn after loosening the connections and slackening back the springs.
On this occasion, the brushes, brush holders and the surrounding area should be cleaned (use a clean rag soaked in benzine).
When re-inserting the carbon brushes, observe the following instructions:

1. The brush must be capable of easily moving to and fro in the holder. The copper pigtail at the carbon brush must also be free to move.
2. Brushes shorter than 9 mm must be replaced by new ones (use brushes of the same dimensions).
3. The spring must be engaged with the pin of the brush and the spring clip, otherwise the spring may jam in the brush holder.
4. Only use springs and spring clips that are in proper condition.
5. The cable (copper braid) embedded in the brush must be checked for tight fit. If the cable is loose, the brush must not be fitted. Due to the high contact resistance, brush and commutator will be heated and, as a consequence, the dynamo destroyed.

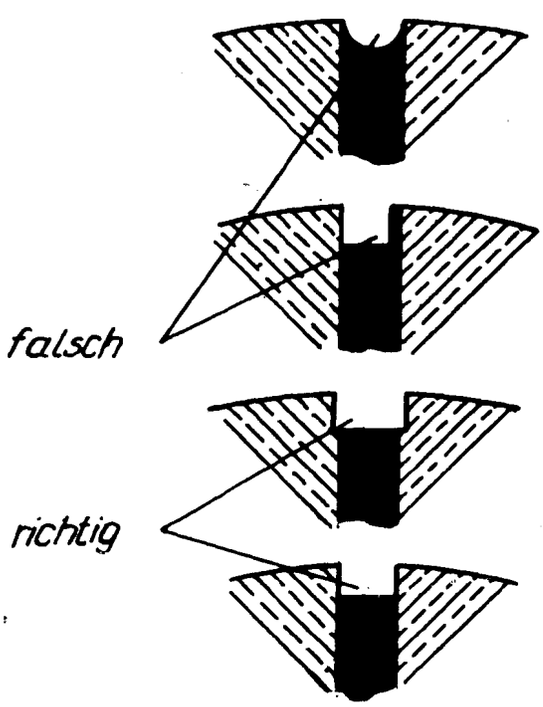

Fig. 87. Milling out the mica segments
falsch wrong
richtig correct

5.1.6. Servicing the Commutator

The commutator surface on which the brushes slide must be clean and smooth. A uniform brown to grey-black colour of this surface is without any significance. If this surface shows scratches, however, the commutator must be turned down in a lathe in a special workshop (the commutator must not be more than 0.03 mm out of round). If the eccentricity of the commutator exceeds this value, the brushes will jump and thus impair the reliability of the dynamo.
The brushes may also be caused to jump by crankshaft bearings having an excessive clearance in radial direction.
After turning the commutator, scrape out the slots between the commutator segments on a milling machine or a saw (about 0.4 + 0.2 mm deep and maximum 0.7 mm wide).
Use very fine emery cloth to remove the burr while the armature is rotating. The mica dust thus produced must be blown away by means of compressed air and the commutator surfaces are cleaned by means of a non-fluffy piece of cloth.

5.1.7. Fault Indication by the Charging Control Light

If the charging control light does not go out at higher speeds, the lines D+, 61 or the field coil have accidental earth contact or the regulator fails to operate properly.
If, with the engine stationary, the control light fails to light, the following defects may be present:

1. battery discharged;
2. the fuse in the fuse box is blown;
3. the line 30 from the "positive" terminal of the battery to terminal 30 of ignition lock is interrupted

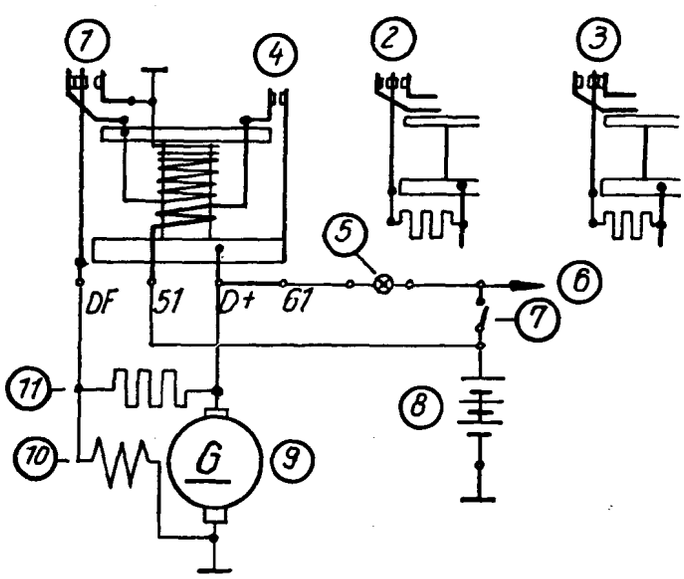

Fig. 88. Circuit diagram dynamo/regulator cut-out – 3 control positions

(1) Lower Position
(2) Suspended position
(3) Upper position
(4) Reverse-current switch
(5) Charging control light
(6) Ignition, terminal 15
(7) Ignition switch
(8) Battery 6 V, 12 Ah
(9) Dynamo 6 V, 60 W
(10) Field coil 1.7 to 2.1 ohm
(11) Adjustable resistor 4.5 ohm

or the line 31 from the "negative" terminal of the battery to the earth point is interrupted;
4. the line from dynamo D+ to regulator D+ and from regulator 61 to ignition lock 61 and control lamp is interrupted;
5. the control lamp is blown;
6. the regulator cut-out is defective.

5.1.8. Adjustable Resistor

Together with the regulator cut-out, the adjustable resistor has the task to keep the desired voltage constant. Current passes through the adjustable resistor at that instant when the regulating armature is in suspension state because in this position the adjustable resistor and the excitation winding are connected in series.
In the lower position, the adjustable resistor is bridged by the regulating armature and thus is of no importance to voltage regulation.
In the upper position, the armature has also no function to fulfil because the excitation winding is short-circuited and thus the voltage breaks down.
If the adjustable resistor is blown, this will be indicated by an irregular firing order. A charred insulation varnish on the turns of the adjustable resistor and carbonised contacts of the regulator will then be the proof.
When the charging control light flashes up while the engine is running, the adjustable resistor may have earth contact. When a blown adjustable resistor is replaced by a new one, first find the cause of the trouble unless the new resistor will be exposed to the same hazard.
Another cause may be a broken or loose D+ line at the regulator or in the dynamo.
The adjustable resistor is connected as follows:

long cable (1) to D+ (positive carbon brush),
short cable (2) to DF (positive pole of field coil),
socket (3) and negative pole of field coil to earth.

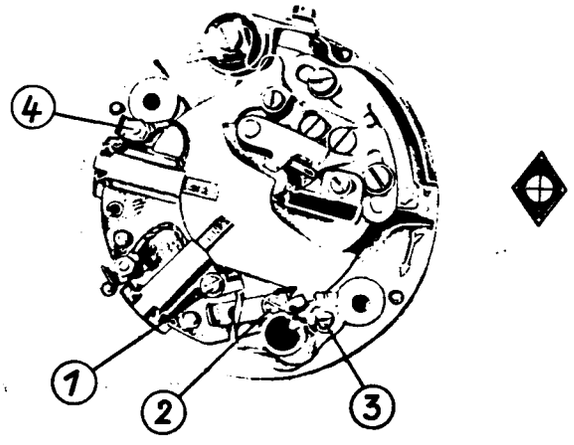

Fig. 89. Dynamo without armature

5.1.9. Polarity Reversal in the Dynamo

If, inadvertently, the wrong cables are connected to the two terminals of the battery (red cable to the negative pole and brown cable to the positive pole) and then the engine started, the polarity of the dynamo is surely changed. In most cases, the contacts of the regulator cut-out are also carbonised.

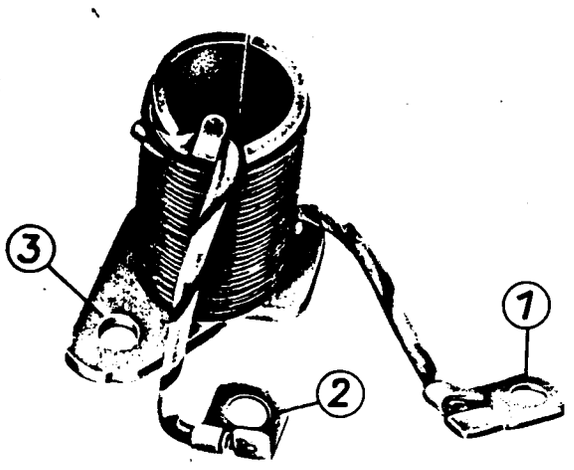

Fig. 90. Adjustable resistor

In any case, the regulator must be checked in a workshop. In order to restore the dynamo to the original polarity, the following has to be done:
Put the negative cable of the battery to earth and use the positive cable of the battery to touch the D+ terminal of the dynamo. The same will be achieved when pressing the reverse-current cut-out for about 2 to 3 s (the battery is connected to the electrical system of the motor-cycle). If with the wrongly connected battery the motor-cycle was operated for some time, discharge it with 0.6 A and subsequently charge it with the same current intensity (Section 5.3.1. should be observed in this connection!).

5.2. Regulator Cut-out

When replacing the regulator take care that one of the original regulators is used. If this is not possible, especially in countries other than the GDR, see to it that the regulator to be installed shows the following parameters:

Voltage	6 V
Wattage	60 W
Type of regulation	positive regulation! — three contact regulation

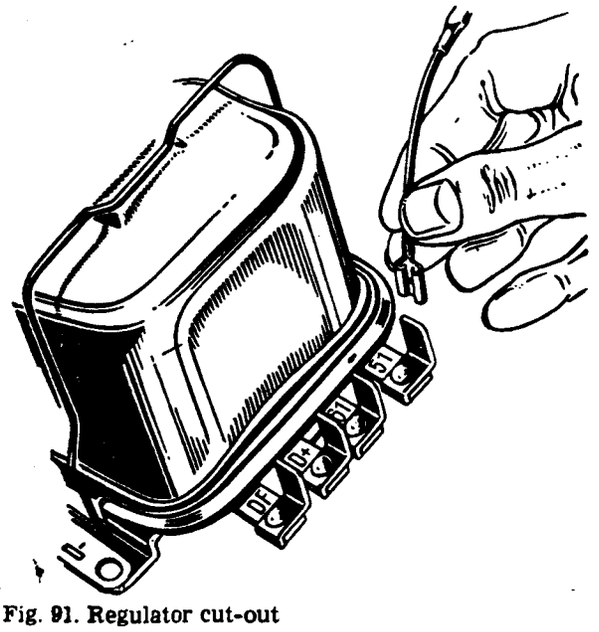

Fig. 91. Regulator cut-out

5.2.1. Adjustment

It should be underlined that a proper adjustment of the regulator cut-out can only be carried out with a dynamo of the specified type which is in perfect working order on a test bench which is infinitely variable within the speed range from 0 to about 6000 rpm.
The mechanical adjustment of the regulator and of the reverse current cut-out is a precondition for the subsequent electrical adjustment. It can also be used as a provisional adjustment. It must be effected according to the adjusting scheme (shown in Fig. 92).
Setting values for electrical setting:

	regulator 8106.7/1	regulator 8106.7/2 (temperature-compensated)
Switching-on voltage	6.5 to 6.9 V	6.5 to 6.9 V
Switching-off voltage	5.4 to 6.2 V	5.4 to 6.2 V
No-load voltage	7.1 to 7.6 V	7.3 to 7.8 V
Rated-load voltage at a rated current of 10 A and 1,800 to 2,200 rpm	6.2 to 6.8 V	6.5 to 7.1 V

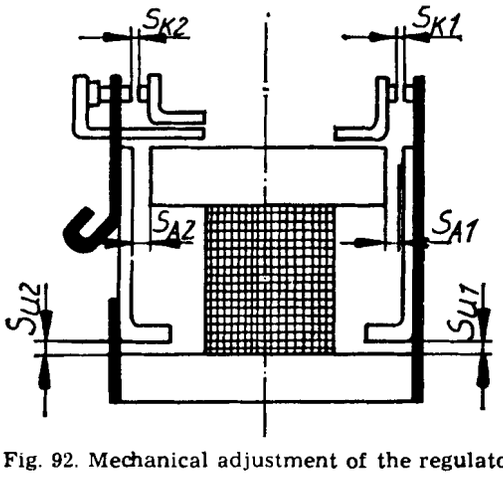

Fig. 92. Mechanical adjustment of the regulator cut-out
S_{K1} = 0.4 mm
S_{K2} = 0.3 to 0.4 mm
$S_{A1} \approx$ 1.0 mm
S_{A2} = 0.9 to 0.1 mm
S_{U1} = 0.5 mm
S_{U2} = 0.5 mm

5.2.2. Mounting and Servicing

In general, servicing the regulator cut-out is limited to the cleaning of the connections. If the headlight is too dim, if there are troubles in starting and the like, do not blame the regulator cut-out immediately and do not interfere with it but first check the lines and their plug-type connections for proper contact and corrosion.

During a general overhaul of the motor-cycle, in any case have the regulator cut-out checked by an expert and, of required, replaced by a new one.

5.2.3. Faults and Their Causes

Carbonised switch contacts may be the result of an excessively high continuous load (heated twist-grips, additional headlamps, etc.), loose or broken D+ line at dynamo or regulator.
The same symptons can be observed as a result of riding without gear-shifting as required, too high an idling setting, incorrectly connected battery (positive and negative cables changed by mistake), a broken adjustable resistor, earth leakage of the adjustable resistor or shorted turns in the field coil.
If the protective cap of the regulator cut-out is not properly fitted, accidental earth may be the result if the cap gets in touch with the core or with the contact angle of the regulator cut-out. The lugs at the sides of the cap must be properly inserted into the recesses at the regulator base provided for this purpose. The wire bow must tightly press on the cap.

5.3. Battery

5.3.1. Putting the Battery into Operation

The electrical equipment includes at flat lead battery with a rated voltage of 6 V and a rated capacity of 12 Ah.
When putting the battery into operation, sulphuric acid for accumulators (in the following text called electrolyte) of a density of 1.28 ± 0.01 g/cm³ (in the tropics 1.22 ± 0.01 g/cm³), measured at a temperature of 20 ± 2 °C, is poured in the battery.
In the filled state, the liquid in the three cells of the battery should be 5 mm on top of the separator plates or reach up to the given level mark. When pouring in, the temperature of the electrolyte should not exceed 25 °C.
After about 2 to 3 hours, plates and separators have soaked in enough electrolyte so that the electrolyte level has dropped.
Top up with an electrolyte of the same density and temperature to reach the original level. Then charge

Fig. 93. Assembled position of the regulator

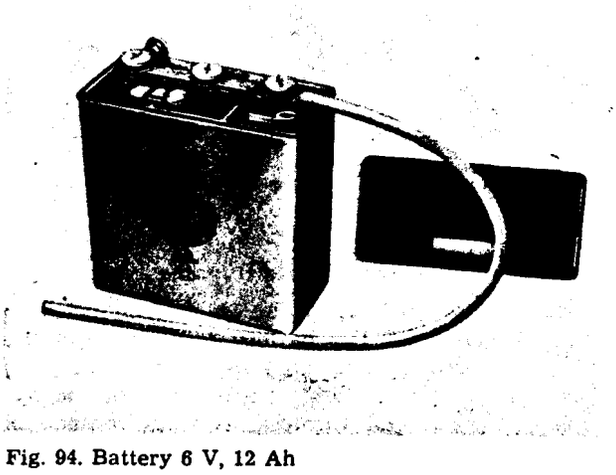

Fig. 94. Battery 6 V, 12 Ah

the battery with direct current of 0.6 A. During charging, the screw plugs must be unscrewed!
Charging must be continued until all cells uniformly and briskly evolve gas and the desired voltage is reached, i.e. about 2.5 to 2.7 V/cell.
Two to three measurements taken at an interval of one hour must show a constant electrolyte density (1.28 ± 0.01 g/cm³) and cell voltage. The specified current of 0.6 A must be maintained at any rate.
During charging, the temperature of the electrolyte must not exceed 50 °C.

Please notice!

Do not subject the battery to a rapid charging process! As a consequence, the battery will become useless before long and you will lose the right to raise guarantee claims.

Before connecting the battery to the vehicle, connect the two battery cables to the poles (red cable to the positive pole – brown cable to the negative pole) and apply a thin film of grease for battery terminals or acid-free Vaseline to the poles.
After fitting the protective cap in place, the battery can be installed and the two battery cables connected to the lower contact blades of the plug-type at the fuse base [(1) in Fig. 93].

Again pay attention to the correct way of connecting:

red cable to the red cable,
brown cable to the brown cable.

The vent hose must be placed in such a way that acid that may be spilled through this hose cannot damage lacquered or other metal parts.

5.3.2. Servicing the Battery

The average life of a battery is about two years. This time can be extended or shortened by good servicing or by neglecting it. In the main, servicing operations are restricted to the cleaning of the terminals – a thin film of grease for battery terminals must always be applied – and the checking of the acid level at regular intervals (every four weeks during the warm season of the year, every two weeks during the cold season of the year).
When greasing the terminals take care that no grease enters the cells. If the acid level has fallen below the desired level, only top up with distilled water.
Do not use so-called improving agents!
If, nevertheless, acid is spilled from the battery, the density of the acid used for topping up should be so selected that the density of the complete amount of acid in the battery in fully charged condition will be 1.28 ± 0.01 g/cm³.
If the battery is not used or if less than 50 km are covered daily, the battery must be re-charged once every month.

5.4. Ignition System

5.4.1. Ignition Coil

The ignition coil may be compared with a transformer which transforms a low voltage into a high one. As only an alternating current can be transformed, the vehicle electrical system is supplied with direct current, however, a continuous voltage change must be caused, and this is effected by the contact breaker in conjunction with the capacitor. The normal voltage of the electrical system of the motorcycle of 6 V is stepped up to an ignition voltage of about 12,000 V.
The two terminal pins of the ignition coil are marked.

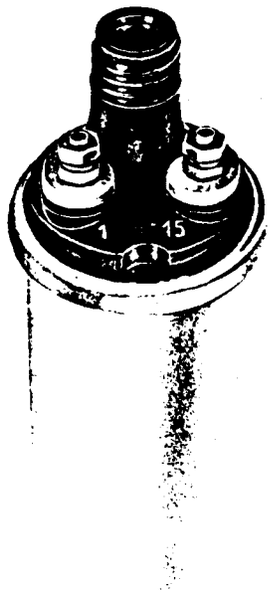

Fig. 95. Ignition coil

Terminal 1 is connected with the contact breaker and terminal 15 with the terminal 15/54 at the ignition lock.

Please notice!

With the engine stationary, the ignition system switched on and the contact breaker closed, the ignition coil will be energised; if this condition is maintained for a longer period of time, the current passing through the coil will cause the temperature of the coil to rise. As a consequence, the insulating material will be destroyed. The ignition coil will burn down and thus become useless.
When using ignition coils of Polish origin, the corresponding terminal designations should be taken into consideration:

Terminal 1 = 22
Terminal 15 = 21.

5.4.2. Ignition Timing

A precondition is that the cam is not out of true and that all parts of the ignition system are in good repair.
Ignition timing starts with checking the contact breaker points: Loosen the terminal screw (1) of the connection from the capacitor, remove the contact lever, and clean the contact face by means of an emery stick. If they are seriously pitted, insert new parts.
The breaker points must make contact with their full face; adjustments of the contact angle are possible. Remove remains of lubricant from the pivot (2).
Uniformly apply a few drops of special contact breaker oil (viscosity from 700 to 1,300 cSt at 50 °C). Refit the contact lever.
Seriously burnt contact faces are indicative of a de-

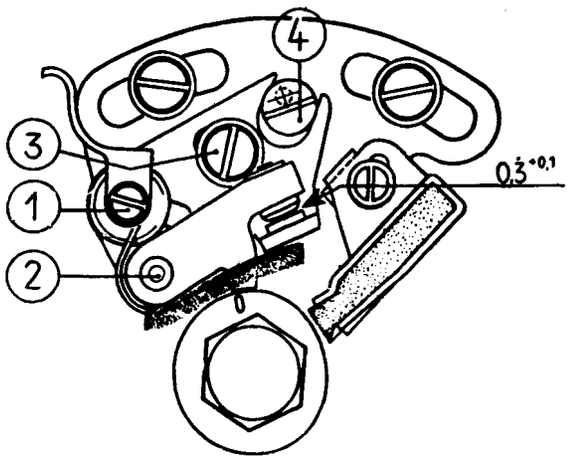

Fig. 96. Contact breaker

fective capacitor (initial stage). If several plies of the capacitor winding break down, the engine will be able to idle but will stall when it is accelerated (any attempts to adjust the carburetter will in this case be in vain naturally). Make sure the earth contact is in order!

To adjust the contact-breaker points gap, the crankshaft must be turned until the high-level portion of the cam ("0") lifts the contact lever. The feeler gauge must lightly contact both breaker points, in other words, it must not be tight or loose.

After loosening the setscrew (3), adjustments are made by means of the eccentric screw (4), Fig. 96.

The specified gap is adjusted by turning the latter. Then properly tighten the setscrew and once more check the gap.

Contact-breaker points gap: $0.3^{+0.1}$ mm

Measure the gap with particular care when the firing point has already been timed and only the contact-breaker points are readjusted.

N o t e :

If the contact-breaker points gap is increased, the ignition is advanced (the cam starts lifting the contact breaker at the beginning of the cam lobe); if the contact-breaker points gap is reduced (due to wrong adjustment or wear) the ignition is retarded (in this case, the contact breaker only slightly contacts the high-level portion of the cam. The ignition coil is not in a position to built up the required strong magnetic field, a weak spark will result — the engine causes the carburetter to spit back).

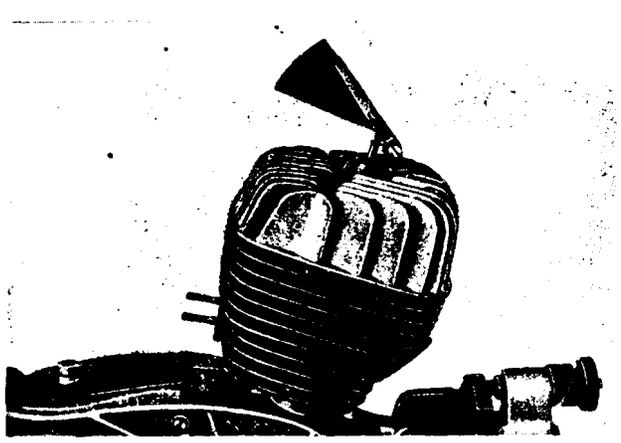

Fig. 97. Ignition setting gauge H 8-1408-3 screwed in place

Screw in place the ignition timing gauge 29-50.801 (special tool) or a similar gauge ensuring accurate measurements (dial gauge).

5.4.2.1. Ignition Timing by Means of a Graduated Dial

If the special tool "timing gauge 29-50.801" is not available, a graduated dial may be used which can be bought at any stationer's shop (teaching aid).

In order to be in a position to check the contact points gap during the timing operations, the dial is provided with three windows (drill, saw or file them out).

The pointer (Z) must be at least 2.5 to 3 mm thick to avoid timing errors due to inadvertently bending it.

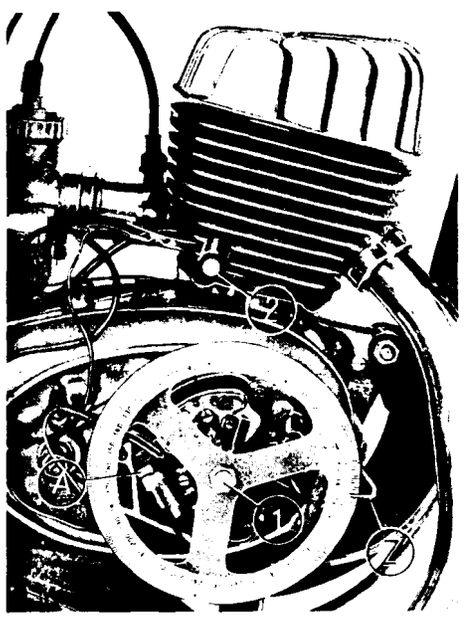

Fig. 98. Ignition timing with graduated dial

A precondition for the correct ignition timing is the accurate determination of the top dead centre (T.D.C.). For this purpose, a stop for the piston must be prepared (Fig. 99).

The stop is made of a useless sparking-plug by removing the insulator and fitting a bolt in its place. A hole is drilled in the side to allow the compressed fuel-air mixture to escape. The hole is drilled in the side because in the front part an M-4 setting screw should be screwed in if required. In this way, the stop can also be used for other engines. After having tightened the T.D.C. stop (it must not be loose!), turn the crankshaft anti-clockwise up to the stop, using the dynamo armature screw (1) for turning — then record the degrees indicated by the pointer. Prior to this adjust the

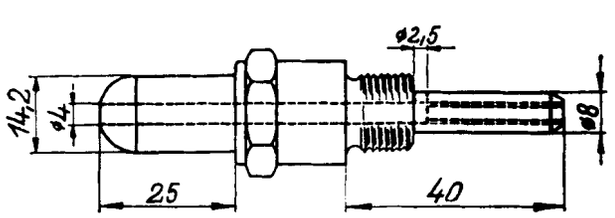

Fig. 99. Stop for piston

dial to a whole number of degrees, if necessary. Then turn back until the piston contacts the right-hand stop and record the degrees (and minutes).
It follows that the T.D.C. is exactly in the centre of the section through which the pointer did not pass.
Record this number or mark it at the graduated dial but do not displace dial or pointer!
Then, proceeding from the determined T.D.C. count 22° 45′ to 23° 45′ in the sense of rotation of the engine and mark at the point thus found the firing point.
Then unscrew the stop for the piston and set the firing point by means of a test lamp.

5.4.2.2. Setting the Firing Point

Firing point: 3.0$_{-0.5}$ mm before T.D.C. or
22° 45′ to 23° 45′ before T.D.C.

When setting outside the vehicle, connect a 6 V battery, interposing a 1.2-W test lamp (2), with the positive pole to terminal "1" (A) and the negative pole to earth (lamp flashes up when the contact breaker closes).
If setting in the vehicle, apply one terminal of the lamp (2) to connection "1" (A) at the capacitor (or contact rail) and the second terminal to earth.
For the timing operation switch on the ignition.
With the 29-50.801 ignition timing gauge screwed in place, use the armature screw (1) to turn the piston over the T.D.C. – the scale of the gauge automatically adjusts itself to the T.D.C. Continue to turn the crankshaft in the sense of rotation of the engine until the firing point is reached.
At this instant, the test lamp must flash up. If this is not the case, loosen the two screws (3) and shift the contact-breaker base plate sideways.
After setting, apply a few drops of special contact-breaker oil to the lubricating felt pad. Adjust the pad so that it just slightly contacts the high-level portion of the cam.

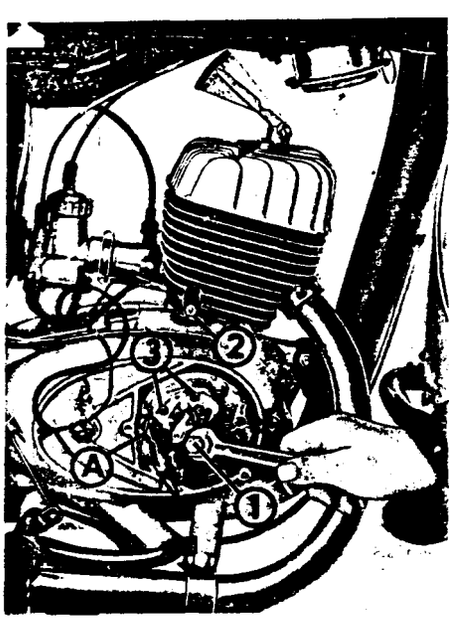

Fig. 100. Ignition timing with ignition setting gauge

If the pad contacts the full cam profile, the lubricant will be pumped out of the pad before long, the dry felt then rises the temperature of the cam track – premature wear of the nose at the contact lever will be the result!

5.4.3. Sparking-plug

The sparking-plug in essence consists of three parts. These are the central electrode and the carrier which also acts as the earth electrode. The spark jumps over between these two electrodes, igniting the fuel-air mixture. The third part of the plug is the insulating body or insulator. It must have a high dielectric strength. To ensure this dielectric strength at all times, the sparking-plug must be treated gently. By improper

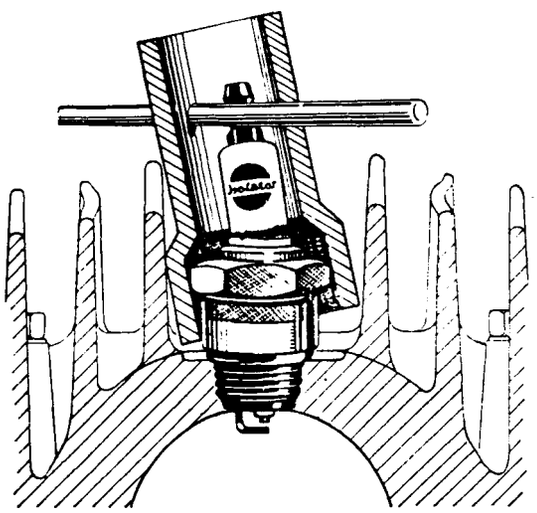

Fig. 101. Improper screwing-in or screwing-out of the sparking-plug

handling (impact and the like), almost invisible hair cracks may be brought about which render the plug useless.
The average service life of a sparking-plug in two-stroke engines is equal to about 10,000 to 15,000 km of road covered. When this mileage has been reached, it is advisable to replace the sparking-plug by a new one. The TS/ES 125/150 are provided with an M 14/260 sparking-plug. It is advisable to use always the same type of plug (the specified thermal value should be observed). The use of a plug of a lower thermal value in winter or of a higher thermal value in summer will not offer additional advantages but disadvantages.
If difficulties are presented (poor startability in winter or overheating in summer), they should not be attributed to the thermal value of the sparking-plug.
The correct seat of the plug must also be taken into consideration. The thread of the plug must be flush with the thread in the cylinder head. If the plug projects too far into the chamber of combustion (packing ring under the plug missing or pressed flat) or if the plug is not properly down on its seat (two packing rings placed under the plug), heat will accumulate and symptoms of overheating will appear.
The servicing requirements of the plug are relatively small. The spark gap must be checked from time to time (0.6 mm).
For changing sparking-plugs, a properly fitting plug spanner should be used to avoid breaking of the in-

sulator. In any case, pay particular attention to the appearance of the plug. After a longer period of operation of the plug, the appearance is indicative of the action of the engine, the formation of fuel-air mixture, of the petrol used, of the carburetter tuning and suitability of the plug for the engine.

5.4.4. Plug Cable Connector

The function of the plug cable connector is to establish a connection between sparking-plug and ignition cable and to screen the electric field of the sparking-plug from the environment.
To ensure a proper radio-shielding of the sparking-plug, take care that the sheet-metal shell fastened to the plug cable connector is properly fitted on the hexagon of the plug.
In the case of ignition failures and difficulties in starting, especially in wet weather, thoroughly clean the plug cable connector with clean petrol and dry it. If this does not improve the conditions, replace the connector by a new one.
On no account should the sheet-metal shell be removed because this will lead to interferences with VHF and television reception.
The plug cable connector, must be handled as gently as the sparking-plug. Hair cracks in the insulating body which lead to the formation of leakage paths render it useless.

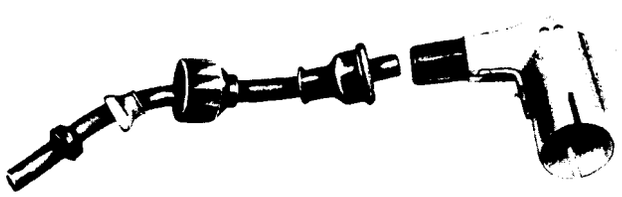

Fig. 102. Plug cable connector with ignition cable

5.4.5. Troubles

Faults in the ignition system may be caused by wear and ageing of the individual devices and components.

Below follow brief descriptions of main causes and their effects.

1. Cam track insufficiently lubricated
   Wear of the lobe,
   no contact-breaker points gap or it is too small =
   difficulties in starting; irregular running; loss of power
2. Capacitor broken down due to
   a high rate of wear on the contacts =
   ignition failure at higher engine speeds
3. Variations of the contact-breaker points gap in the case of intense pitting on the contact surfaces, as a consequence, the true gap is too large =
   ignition failure at higher engine speeds; weak spark; loss of power
4. Crankshaft bearing worn down
   Crankshaft and thus cam out of true by an amount that exceeds the permissible limit
   Carbon brushes "jump" =
   ignition failures
5. Contact pressure exerted by contact spring too low
   Contact arm has no exact guide on the cam track =
   ignition failures at higher engine speeds

Plug cable connector:

1. Dust and water between insulating body and sheet-metal shell =
   difficulties in starting; ignition failures
2. Fissures (hair cracks) in insulating body due to improper handling
   Leakage path to ground formed =
   difficulties in starting; weak ignition spark; loss of power

Lines:

1. Defective insulation of high-voltage line (ignition cable)
   Spark flashing over to ground (cylinder head) =
   difficulties in starting, especially in wet weather; ignition failure at high engine speeds
2. Broken wires
   Short-circuit =
   blown fuses;
   when D+ line is interrupted, the adjustable resistor frequently is blown
3. Flat connectors heavily corroded
   Very high contact resistance =
   the voltage applied to the various devices is too low

5.5. Electric Horn

If on actuation of the push-button switch, the electric horn fails to produce the desired sound level, the feed cables, their connections and the push-button switch must be checked for dirty contacts. In this case, the voltage applied would be too low.
If this is not the cause, by way of trial turn the screw (E) clockwise or anti-clockwise until the sound is loud enough.

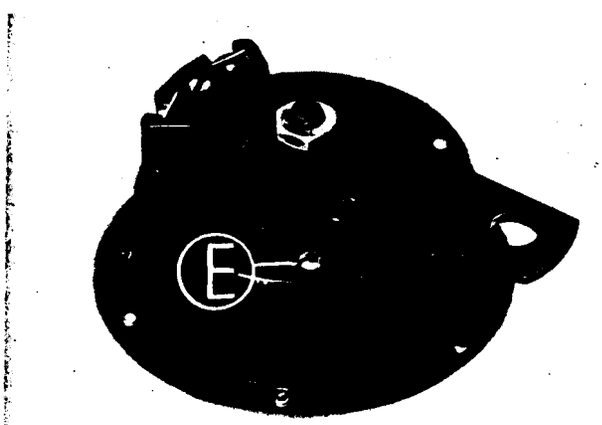

Fig. 103. Electrical horn

5.6. Ignition-light Switch

Dismantling the ignition-light switch is very simple. Only one screw must be loosened which is arranged in the front part of the headlamp in the centre, and then the ignition-light switch is drawn out of its guide together with the insulating foil and the fastener. Now the ignition-light switch and the cable connections can be easily inspected.
To be in a position to plug the cables to the correct lugs after a replacement of the ignition-light switch, the various connections are once more clearly indentified in Fig. 104.

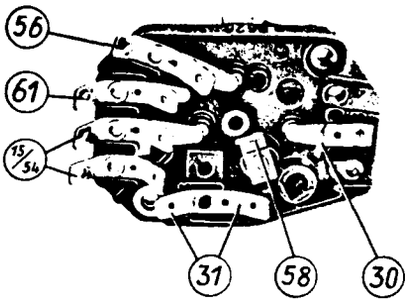

Fig. 104. Connections of the ignition/light switch

5.7. Headlamp

If the road is not sufficiently illuminated, check the contact points in the leads to the bilux lamp because

dirty contacts cause considerable voltage drops!

Particular attention should be paid to the combined dimmer switch at the left-hand side of the handlebars.

The contact screws must be properly tightened – but care must be taken not to pinch off the cable ends – and then they must be protected against loosening by a dot of paint.
It is advisable to protect the contact blades from corrosion by the application of contact grease. Do not forget to place the rubber backing between switch and holder at the handlebars (otherwise there is the risk of accidental earth).

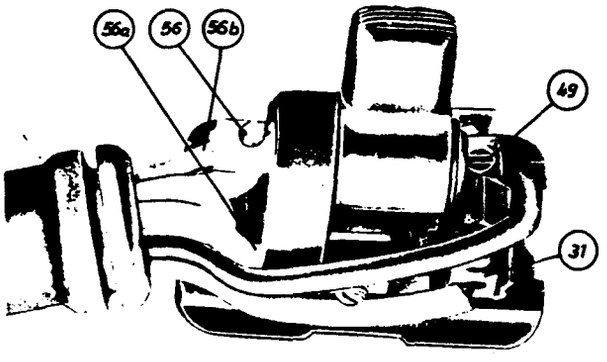

Fig. 105. Connections at the dimmer switch

Access to the connections of the bilux lamp is obtained after removing the reflector:
In the TS 125 and 150, loosen screw (2) (Fig. 109) and remove the front ring with reflector.
As to the ES headlamp, unscrew the polyamide ring, draw out the two retaining clamps (1) and hook them on the sides. Reflector and diffusing screen are glued together – do not separate them.
Carefully remove the connecting piece (2) – distorted contact blades may no longer establish contact. Withdraw the parking light cable after pressing down terminal (3).

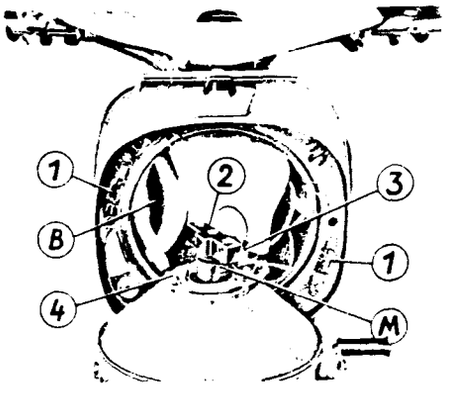

Fig. 106. ES-headlamp open

Properly clean all contacts, straighten the blades, if required. In view of the high current intensity for 45/40-W lamps, see to it that the earth connections (M) are in perfect order.
The bilux lamp can be replaced by a new one after removing the spring (4) and withdrawing the bulb holding device. The glass bulb of the bilux lamp must not be touched with bare fingers!

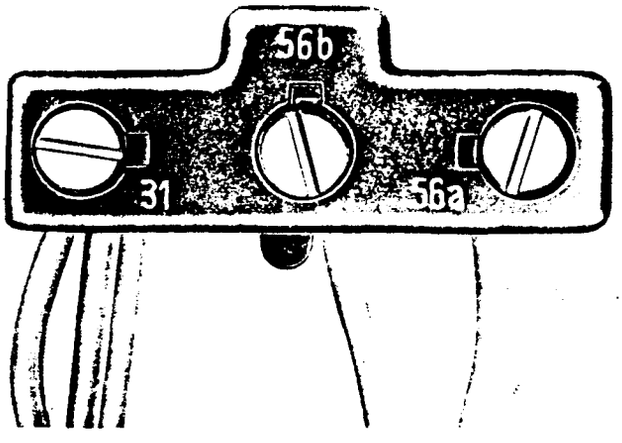

Fig. 107. Connecting piece for bilux lamp

5.7.1. Focusing the Headlamp

The vehicle is placed according to the schema and loaded with the rider. The suspension units of the rear wheel are to be set to "soft".
The light dark-boundary must not be above the "Z"-line, and the angular deflection of the asymmetrical

passing beam must lie in the centre between the "V" and "W" lines.
For checking, the suspension units of the rear wheels are set to "hard" and the vehicle additionally loaded with the pillion rider.
The "Z"-line complies with the statutory regulations regarding the illumination of the road of 25 m for the dimmed light.

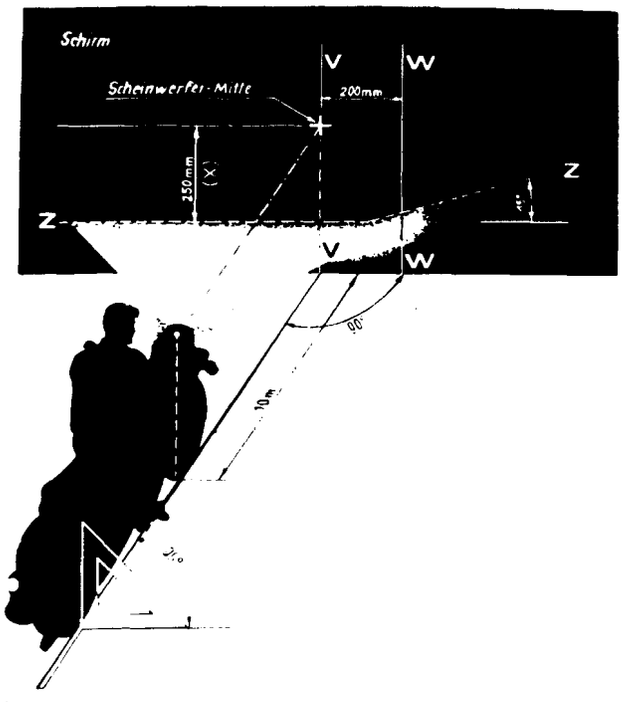

Fig. 108. Headlamp focusing scheme

Schirm	Screen
Scheinwerfer-Mitte	Centre of headlamp
Obere Grenze	Upper limit

For TS vehicles, the headlamp is adjusted in the direction of the arrow after having loosened the fastenings (1).

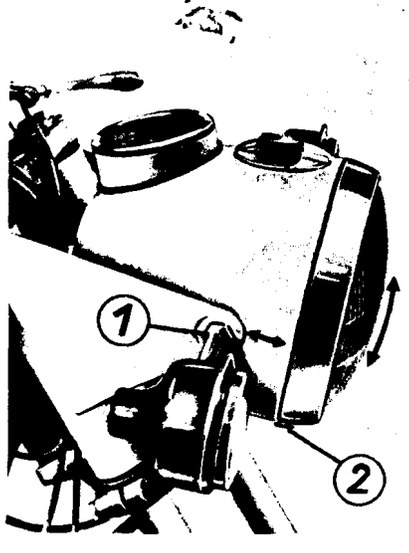

Fig. 109. TS-headlamp focusing

A rough adjustment of the ES headlamps is possible after having loosened the lower fastening screw (1). For precision adjustment turn the screws (2) and (3) — as a consequence, the reflector holding frame position is changed.

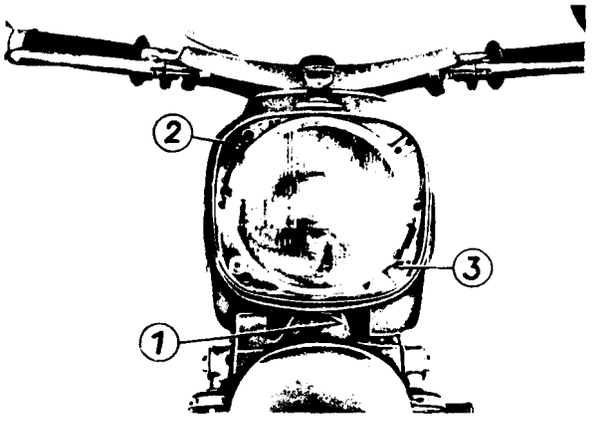

Fig. 110. ES-headlamp focusing

5.8. Tail Lamp and Stop-light Switch

(1) Connection for stop light, terminal 54
(2) Negative line to stop-light switch at rear brake cover, terminal 31 b
(3) Connection for number-plate lamp, terminal 58
(4) Connection for negative line (leads to terminal strip to terminal 31 or to regulator base)

Wipe the reflectors with a dry piece of cloth only.

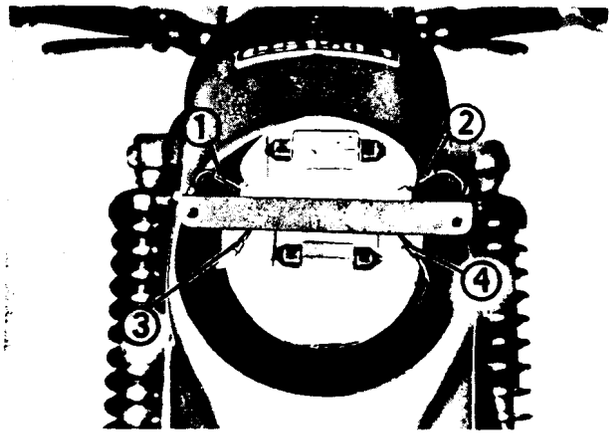

Fig. 111. ES 125/1 and ES 150/1

31 Earth
54 Stop light
58 Tail and number-plate lighting fitting

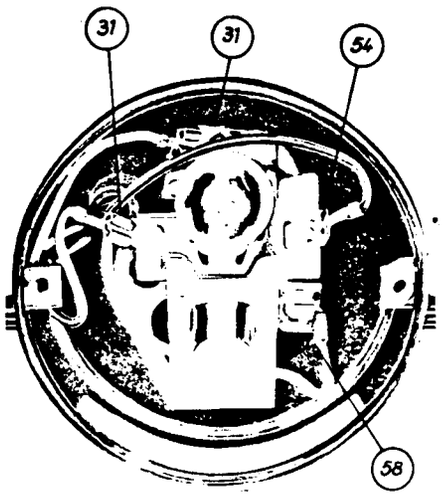

Fig. 112. TS 125 and 150

For re-adjusting the stop-light switch (here the brake lamp has accidental earth contact!) pull the plug and slacken back the two nuts (width over flats 9) through a quarter of a revolution. An assistant steps on the brake pedal until the brake shoes are applied to the rear wheel while the latter is turned.
In this position retain the brake lever and turn the slotted-head screws until the stop light flashes up with the ignition system switched on (plug put in place).
Gently tighten the rear nut – the insulating bush is of plastic. Check with a second nut.
If the range of adjustment is insufficient, the contact spring at the cam spindle can be re-adjusted.

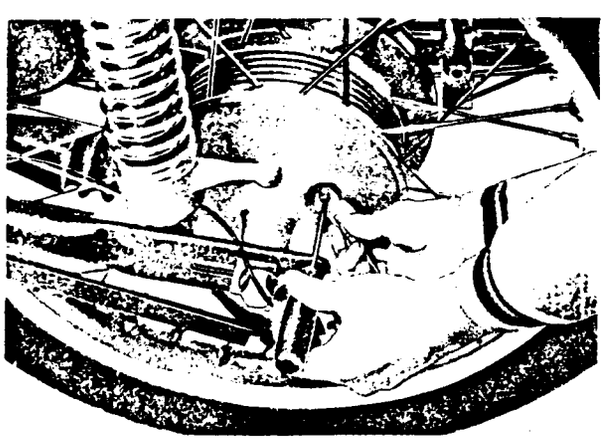

Fig. 113. Re-adjusting the stop light switch

Rear brake cover, one brake shoe removed.
(1) is the stop light contact (earth) which is adjustable from outside. The contact spring (2) must be re-adjusted in such a manner that it is applied with a slight pre-load.

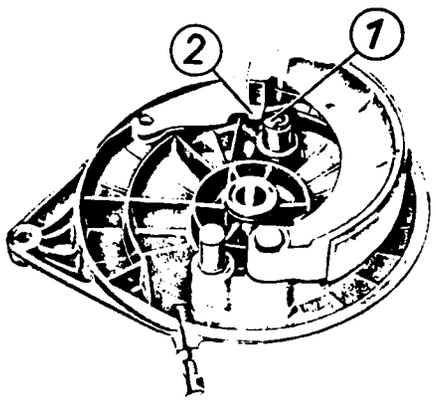

Fig. 114. Stop light contact

5.9. Flashing-light Direction Indicator System

The flasher unit (B) shown in Fig. 106 in sensitive to impacts and the like and, therefore, it is embedded in foamed plastics.
Mounting position of flasher: Vertical, connections pointing downward.
Withdraw the ignition key always when subjecting the

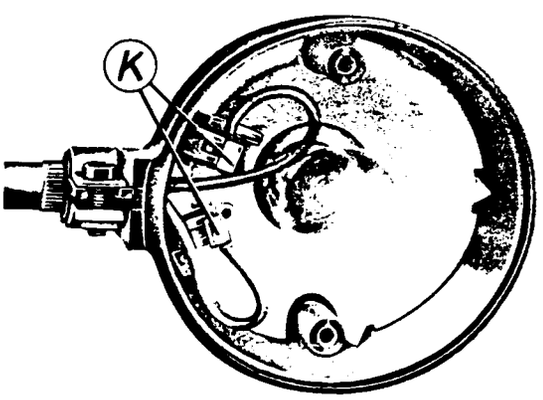

Fig. 115. Connections at the flashing-light indicator

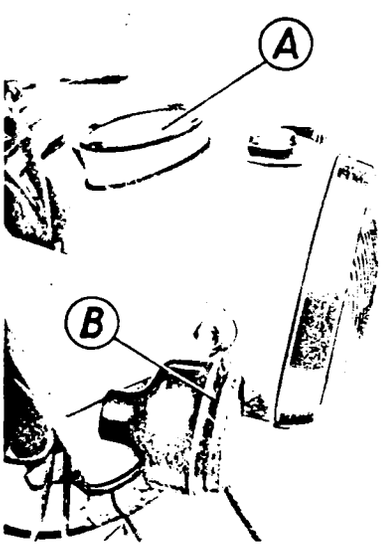

Fig. 116. Flashing control

flasher unit or the flashing-light indicators to any repair work or the like.
To protect the flasher unit from damage due to short-circuits, a 4-A fuse is interposed. By counter-rotating the tow halves of the moulded enclosure (bayonet catch), the fuse can be replaced (recently a fuse sleeve with a transparent plastics enclosure which can be drawn off has been fitted)!
When the flashing-light system fails, first check the fuse and then remove the fault. (TS flashing light system is protected by an 8-A fuse).
For the flashing-light fittings only use 18-W festoon lamps (ES 125/1 and 150/1) or such of 21 W (TS 125 and 150), other loads, e.g. 15 W, change the flashing frequency of 90 ± 30 cycles per minute.
It should be noted that for the 4-lamp flashing direction indicating system (TS 125 and 150) a flasher unit of 6 V, 21 W is required. The flasher unit of 6 V, 18 W, can only be used for the 2-lamp system (ES 125/1 and 150/1). The cables are clamped in the flashing-light fitting of the TS 125 and 150 [(K) in Fig. 115].
The function of the 4-lamp system can be checked by means of the rim (B) of the diffusing screens of the front flashing lights or via the flashing charging control light (A). If one flashing light fails, the f l a s h i n g f r e q u e n c y of the other lamp is increased.

Function of the Flashing Charging Control Light

Ignition switched on, engine stationary, flashing-lights off	Control light burns	Engine runs, flashing-lights on, dynamo charging	Control light flashes in dark phase of flashing-lights
Ignition switched on, engine stationary, flashing-lights on	Control light flashes in the same phase as the flashing-lights	Engine runs, flashing-lights off, dynamo fails to charge	Control light burns
Engine runs, flashing-lights off, dynamo charging	Control light goes out	Engine runs, flashing-lights off, dynamo fails to charge	Control light flashes in the same phase as the flashing-lights

5.10. Speedometer

In the speedometer – mounted in the headlamp by means of a metal strap and a plastics nut – four lamps with plug-socket holder are arranged which have the following functions :

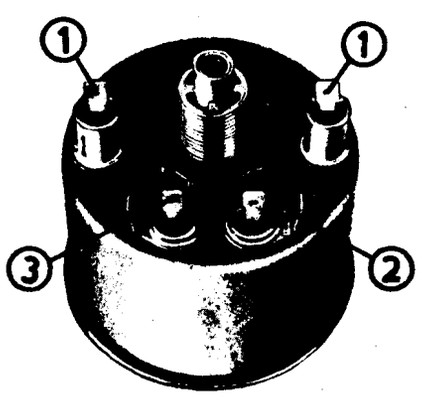

Fig. 117. Speedometer

The two lamps (1) serve for illuminating the speed indicator and the odometer during night operation.
Lamp (3) is a tell-tale light indicating whether or not the neutral is engaged in the gearbox. With the ignition system switched on and the neutral engaged, the lamp will emit a green light.
Lamp (2) is the flashing charging control light. Its function is described in the Table in Section 5.9.

6. Induction System

The carburetter is not an independently operating part but a component of an integrated system. It starts with an air filter and ends in the silencer tail piece. The timing diagram is also included. If, after a longer period of operation, the fuel-air mixture becomes too lean or rich, it is not necessarily the carburetter which is to blame. All members which operate in conjunction with the carburetter must be checked together with the carburetter.

C a u s e s o f f a u l t s :

a) Closing plug (1) of the varnish draining hole missing
b) Filter not in the centring ring (2)
c) Induction tube (3) leaky (cracks)
d) Filter defective

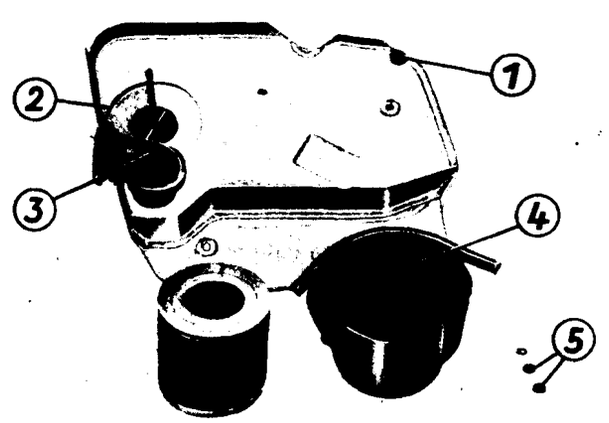

Fig. 118. Induction system

e) Cover cap (4) at the face cracked
f) Screwed connection loose [2 nuts (5) to be locked!]

Dirty paper air filter to be cleaned by tapping or replaced (every 10,000 km on an average).

6.1. Carburetter BVF 22 N 1-3 and 24 N 1-1

6.1.1. General

The correct tuning and proper functioning of the carburetter is not only decisive for a good engine output, a reasonable fuel consumption, and excellent startability, but also for reliability in operation and minimum wear. If, however, with an adjustment that provides too lean a mixture or secondary air, the operating temperature rises considerably, the maintenance of a minimum wear rate is doubtful.
The phrase "to step on the gas", which is used in some countries, is incorrect. The carburetter is not used to "gasify" anything because this would require heat from which the carburetter must be protected (thermal insulation flange). Heated air has a larger volume than cold air and would impair the charge of the cylinder and thus reduce the power output. (That is why the engine lacks power in the heat of mid-summer, whereas the full output is given in the cool morning.)
For the internal combustion of 1 litre of petrol about 9.300 litres of air are required. This enormous quantity of air (with only about 20 per cent of oxygen) must be mixed with fuel by the carburetter so thoroughly that a fine fuel "mist" is produced. Everything depends on the correct "density" of this vapour for the engine to produce the rated output.
In this connection the terms "fuel-air mixture too lean", and "fuel-air mixture too rich" are used. How can this be distinguished? Which effects are produced?

For the ratio of air to fuel in the mixture the unit λ (Lambda) is used. The mean value adopted for $\lambda = 1$ ($\hat{=}$ 13.8 parts by weight of air and 1 part by weight of fuel). Values over 1 have a surplus of air, values below 1 lack air. [1 m^3 of air has a weight of 1.2 kg at 10 °C and a pressure of 0.1 MPa (1 kp/cm^2)].
The tuning of the carburetter must be correct at an ambient temperature of plus or minus 20 °C, therefore, the standard tuning provides for a slightly richer mixture ($\lambda = 0.95$ to 0.90).

This small lack of air ensures:

a) a good full load performance (full load operation requires a slightly rich mixture because the suction at the needle jet is silghtly reduced due to the completely open carburetter passage).
b) good cold starting and proper transition (the slightly rich mixture provides for a compensation for the fuel drops condensing in the cold intake pipe and crankcase).

The permissible carburetter tuning range (partial load needle) is given with $\lambda = 0.95$ to 1.0. Since neither a repair shop nor an amateur constructor normally has an engine test bench with the required measuring equipment, a test run over a distance of least 10 km is the only alternative for adjusting the carburetter.
The engine must have reached normal operating temperature, otherwise misinterpretations of the engine behaviour will be inevitable.
Engine operating behaviour and the appearance of the sparking-plug are the only criterions for evaluating the correctness of the carburetter tuning. A short trial run is useless because a change in the carburetter tuning. A short trial run is useless because a change in the carburetter adjustment will not be mirrored in the appearance of the sparking-plug after a very short time.

Mixing Ratio of Rich Air-fuel Mixture
Below $\lambda = 0.9$

Since the mixture is too rich a lack of oxygen is locally given, consequently "retarded combustion" = poor engine output! Due to the incomplete combustion, not only the relatively harmless carbon dioxide (CO_2) but also the colourless but poisonous (!) carbon monoxide (CO) are produced. The latter is combustible, that is to say, fuel energy is wasted!
Especially in short-trip driving hydrocarbon particles remain in the engine which cause corrosion at the big-end bearing, cylinder liner and piston. This is the cause of premature wear.
A certain quantity of oil found in the crankcase after its dismantling is no sign of normal operating conditions. This emulsion is engine oil which is "saponified" with hydrogen and has no lubricating properties but should be considered an acid.
Symptoms: Engine starts from cold even without the choke pulled. The output of the engine is satisfactory as long as the engine is cold, but decreases with increasing engine temperature. Inclination for "four-stroke cycling". Black exhaust gases, high consumption, sparking-plug of correct thermal value is oiled up.
Causes: Dry filter dirty, has become wet or is too old (over 15,000 km). Float needle seat pocketed. Needle jet loose or worn (with partial load needle). Central float bent so that float needle valve does not close properly. Main jet too large (rebored?).

Mixing Ration of Lean Air-fuel Mixture
Over $\lambda = 1.0$

The air percentage in the mixture is excessive, the speed of combustion is extremely high, the exhaust gases are not visible and contain only little poisonous gases, there are no deposits in the engine which increase the rate of wear.
Symptoms: Engine starts well with correct setting of the slow running air screw, however, it must be run with a more or less pulled choke for a longer period. The engine output is satisfactory up to about half of the throttle valve opening, with increased throttle opening drop in output. If the engine is run within the range from half to full load, the operating temperature will raise abnormally.
The engine causes the carburetter to "splash". Pinking and even inclination to seize. Due to overheating the sparking-plug shows blue-grey deposits, beads, and heavy consumption of the electrodes.
Causes: Air leak in induction system or directly at the engine, central float bent — fails to open sufficiently, float needle sticking, fuel feed obstructed (tank cap, fuel shut-off cock?). Silencer inserts removed, therefore, back pressure too low (losses of fresh gas).

6.1.2. Description of the BVF Carburetters 22 N 1-3 and 24 N 1-1

These tow types of carburetters are starting carburetters which are basically of the same design. They are only distinguished by different throttle opening

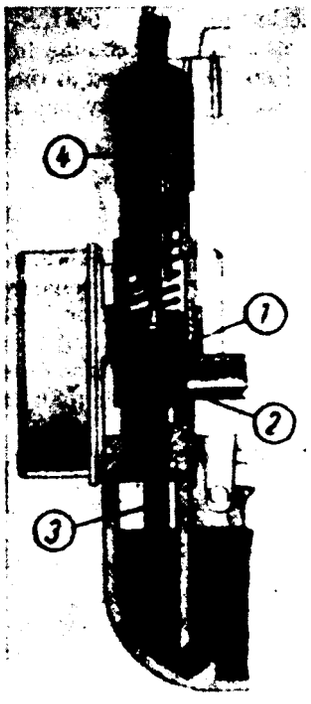

Fig. 119. Starter piston closed (driving position)

widths, different sets of jets and tuning characteristics. The name "starting carburetters" indicates that these types of carburetters are provided with a cold-starting device in the place of the conventional "choke". This cold-starting device practically is a small carburetter in itself.

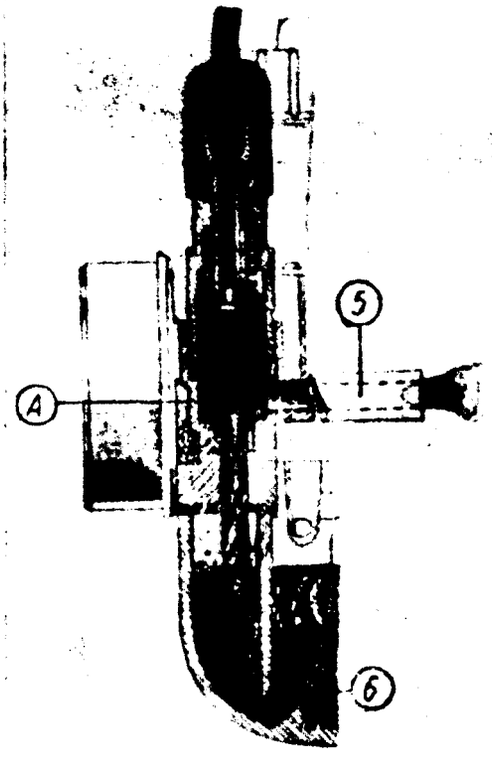

Fig. 120. Starter piston raised (cold-starting)

It is actuated by the starter lever at the right-hand handlebar:

Starter lever drawn (towards the driver) = position for cold-starting

Starter lever pushed forwards = driving position

With the starter lever closed, the starter piston (1) and the sealing disk attached to it (2) must close the starter mixing tube (3).

For this reason, a clearance of 2 mm is required between cable control setscrew (4) and cable control sheath so that the compression spring can completely close the starter piston. In the case of high fuel consumption, always check the sealing disk for leaks because the engine may get additional fuel if the piston fails to close or the sealing disk is damaged.

When starting from cold, the starter piston is lifted by drawing the starter lever. The fuel in the starter-mixture delivery duct is carried off and sucked up by the engine through the starter duct (5). This duct discharges into the intake pipe behind the throttle valve (see diagrammatic representation, Fig. 122).

To provide the required intense suction in the starter system, the throttle valve must be in idling position (about 1.5 mm open).

Do not accelerate for cold-starting, otherwise the starting device is of no effect!

The starter-mixture delivery duct discharges into a duct which is in connection with the float chamber through the starter jet (6) whose bore is designed in such a way that, after the full quantity of fuel has been sucked up from the duct, only such an amount of fuel is allowed to pass through the starter jet that the engine may operate as if in a four-stroke cycle but will not be "flooded" completely.

Pre-mixing is effected in the starter duct, the air is allowed to enter through a recess at the upper edge of the duct from the float chamber. Air is admitted through the overflow bore below the carburetter outlet.

The starter air duct has no passage to the mixing chamber (A).

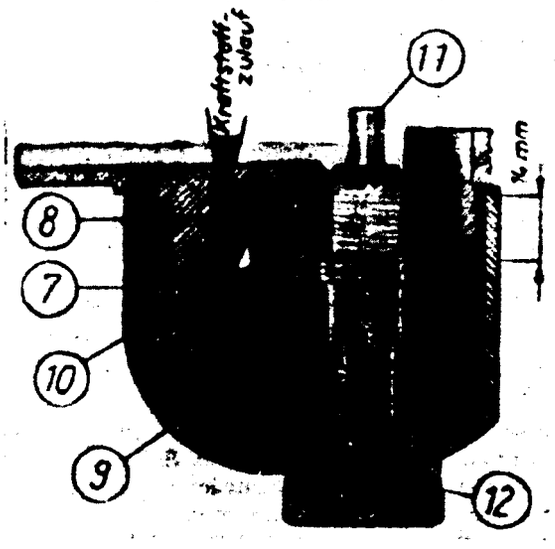

Fig. 121. Float valve, section view

Kraftstoff-Zulauf Fuel supply

The float needle (7) is of the elastic type in order to reduce wear and to keep the fuel at an almost constant level. In the event of a worn float valve (over 30.000 km) the float needle and the valve seat (8) only

must be replaced. When ordering valve seats, state the size – besides the part No. – as in the case of the jets.

Treat the central float with every care when dismantling the carburetter. If the two bodies are displaced in relation to each other or the link (9) lifting the float needle or limiting the stroke (10) distorted, the fuel level is no longer as required for a proper functioning.

At the top of the jet holder, the needle jet (11) and at the bottom the main jet (12) are screwed in place.
Wear limit for needle jet and stepped needle is 30,000 km.
The diagrammatic representation shows the arrangement of ducts in a horizontal sectional view (Fig. 122).

6.1.3. Trouble Shooting and Tuning

The appearance of the sparking-plug is always and exclusively decisive for carburetter tuning. The interior of the sparking-plug must be light sand-coloured. Light, because the additives included in the two-stroke engine oils prevent the deposition of products of combustion not only in the engine but also in the interior of the sparking-plug to a large extent. If the specified sparking-plug M 14/260 shows heavy beads with a normal driving performance, do not use a sparking-plug with a higher thermal value but find the cause and remove it.
Do not extremely change the basic carburetter tuning by reboring the jets but take into consideration all factors associated with the function of the carburetter and restore the latter to the standard condition.

In the case of signs of overheating, the following is involved:

a) Air leaks in the intake socket between carburetter and cylinder (insulating flange, packings).

b) Air leaks in the induction system – filter box leaky. Filter is seated near the centring edge. Rubber suction tube defective.

c) Paper element of the filter damaged due to improper handling, therefore unobstructed air passage.

The opposite, namely, feeding too rich a mixture, as indicated by the appearance of the sparking-plug (with normal carburetter tuning!) may be due to the following faults not caused by the carburetter:

a) Paper element of the air filter dirty (clean by tapping) or wet, therefore, no or a reduced air passage. Paper filters that have become wet are useless in spite of their impregnation.

b) Silencer (especially its tail piece) clogged by deposits left after combustion. The back pressure becomes higher than permissible, burnt residual gases remain in the cylinder (poor degree of filling). Due to a retarded combustion the sparking-plug appearance shows a dark colour.

c) The specified mixing ratio of 33:1 was not observed and 25:1 used.

A normal fuel feed is a prerequisite for proper carburetter function! Therefore, before any carburetter re-adjustments take place, pull the petrol-resistant hose from the nipple of the carburetter and, by opening the fuel shut-off cock for a short time, check that a sufficient supply of fuel is ensured. If this is not the case, any adjustment at the carburetter is useless. Normal rate of flow through the filter cock is about 12 l in 60 min.

Causes for a reduced rate of flow may be:

a) Vent hole in tank cap closed by preserving agent or polish.

b) The ports drilled through the rubber packing were compressed by tightening the two screws of the retaining disk at the filter cock too much or they were partly obstructed by abraded material.
The fuel passing through may suffice for half throttle, for full throttle the output drops or the engine stalls because the float chamber of the carburetter is almost empty.

c) Due to an addition of graphite or MoS_2 preparations to the fuel, the inlet filter at the fuel shut-off cock is clogged by deposits. This will also result in an insufficient supply of fuel – see above!

Trouble shooting in the carburetter should be started with checking the partial load needle position. For normal operating conditions, the needle positions 2 to 4 are sufficient (see setting table). But one should not proceed without discrimination; it is always the appearance of the sparking-plug that is decisive for the selection of the needle position. Thus, it may be possible, to use needle position 5 for the running-in period and then position 4 in order to ensure optimum operating conditions.
The correct setting also is the most economical! With a setting for an extremely lean supply, you have to shift gears earlier and more frequently (inclination to pinking) – this will cost you fuel!
A resilient double plate, the needle holder, guides and retains the partial-load stepped needle. For setting take care that the lower plate (A) is used as reference in connection with the notch to be used (to be counted from top to bottom). The upper plate engages with the notch above the selected one.
When mounting the needle holder with stepped needle take care that the former fully contacts the bottom of the throttle valve, otherwise there will be setting errors (difference in level) or the partial load needle may be deformed.

Float bodies distorted due to improper treatment can be aligned by means of easily made control devices. Either prepare a U-shaped wire stirrup or a sheet-metal template of the desired dimensions. If a vernier caliper is available, use it for taking measurements.
For checking, unscrew the needle jet carrier and hold the carburetter in the way shown in Fig. 125. Measure at the point indicated by the arrow.
A uniform distance of anything between 0.3 to 0.5 mm must be present between the two float bodies and the ruler (see arrow). If this is not the case, realign the valve lever (A) as required. This measure must be adhered to because the correct fuel level is dependent upon it; below 27 mm there is the risk that the floats contact the carburetter casing and, consequently, fuel flows over the carburetter.

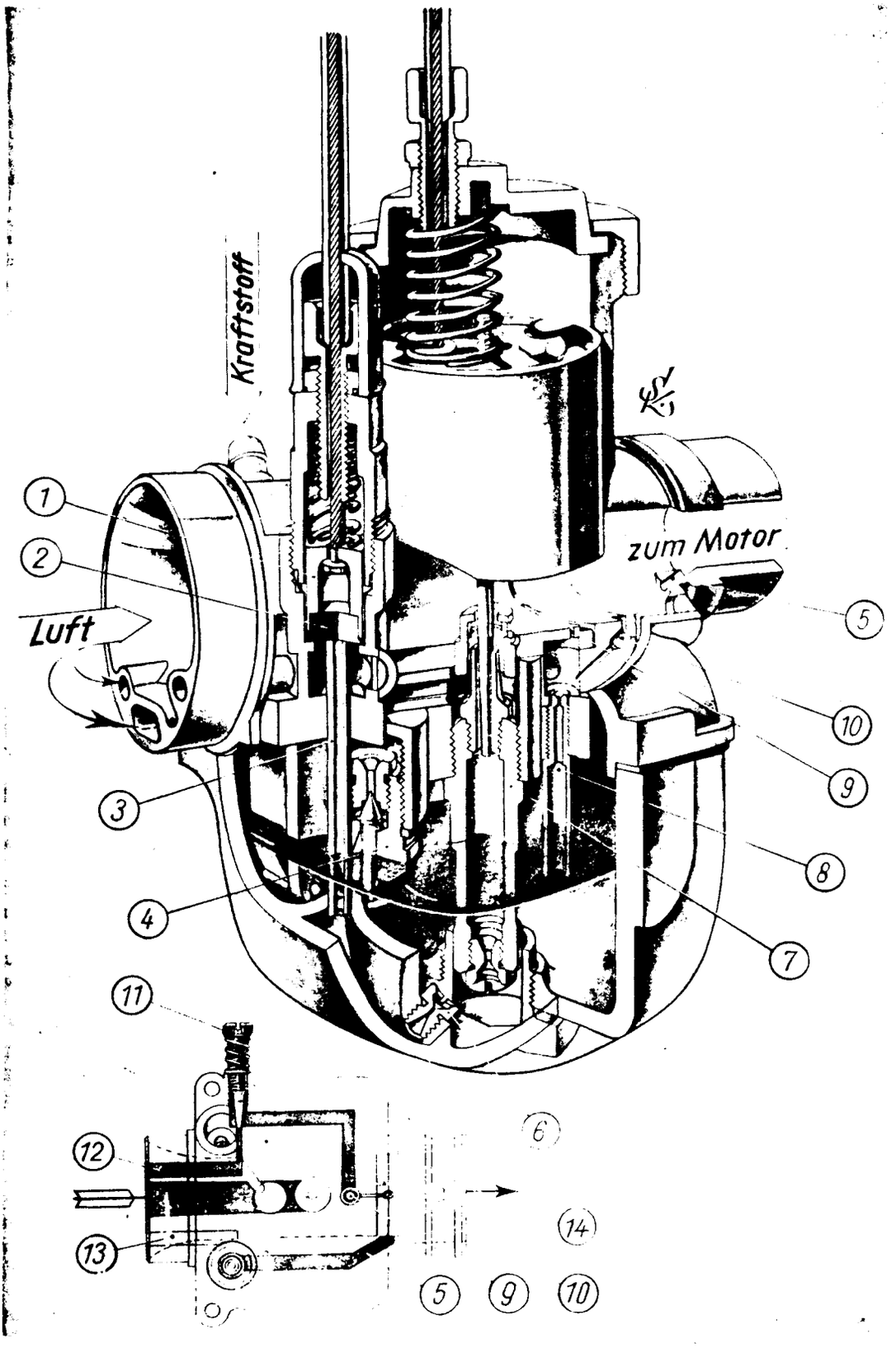

Fig. 122. Starter carburetter, sectional view

(1) **Starter piston**
(2) **Sealing washer**
(3) **Starter mixing tube**
(4) **Float valve, complete**
(5) **Starter duct**
(6) **Starter jet**
(7) Jet carrier with needle and main jets
(8) Slow running jet
(9) Transition bore 1.0 mm
(10) Slow running bore 0.6 mm
(11) Slow running air screw
(12) Slow running air duct
(13) Starter air duct (without **passage** and function)
(14) Aeration hole

Zum Motor	**to engine**
Kraftstoff	**fuel**
Luft	**air**

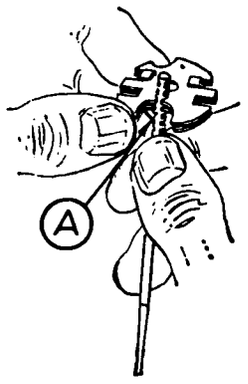

Fig. 123. Needle holder

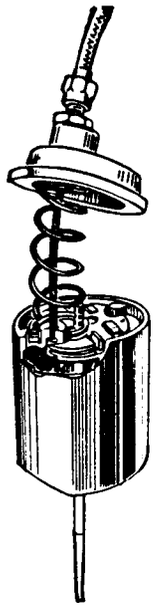

Fig. 124. Partial load needle with needle holder inserted in throttle valve

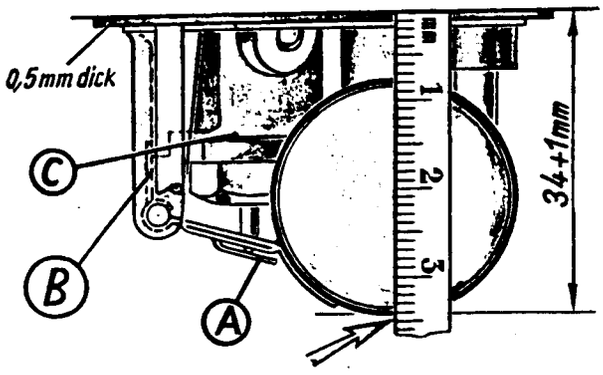

Fig. 126. Float valve open
(A) Valve lever
(B) Stop lever for maximum float lift
(C) Original packing. 1.5 mm thick
0.5 mm dick 0.5 mm thick

If the floats are higher than 28 mm, difficulties will be presented in starting, poor transition, etc. because the fuel level is too low.
Naturally, one float body or both of them must not be tilted, that is to say, you have to look for a proper lateral alignment.
In order that the float valve opens wide enough, the position of the stop lever (B) is of importance. The measure of 34 + 1 mm shown in Fig. 126 – measured from the sealing face of the casing to the lower edge of the float – must also be set correctly, otherwise an insufficient amount of fuel will be fed in full load operation and the engine will stall or the maximum speed will not be attained.
If this measure is exceeded, the floats may contact the casing and will be damaged.
By moving the float in working direction check that the float needle actually is free to move easily and does not stick now and then (check several times!).
If this is the case, the fuel level will occasionally be too low and then again normal. Perhaps the fuel supply will also be interrupted sometimes.

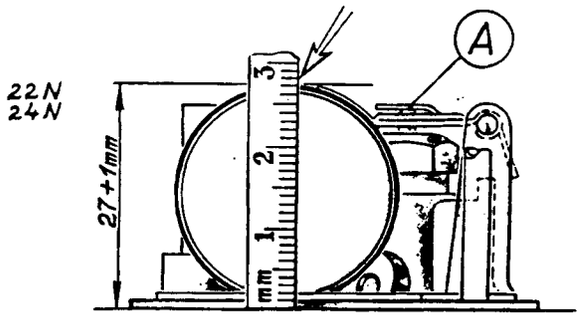

Fig. 125. Float valve closed, spring plunger pressed down
(A) Valve lever

Only use original packing rings having a thickness of 1.5 mm, otherwise deviations from the specified fuel level will occur.

The fuel-air mixture for the slow-running range of the carburetter is prepared in the s l o w - r u n n i n g d e v i c e comprising the slow-running air screw (11) (see diagrammatic representation in Fig. 122) for dosing the air for slow running and the slow-running fuel jet (8). As in the partial load and full load ranges, in this range, too, the engine must get fuel and air in the correct ratio, i.e. in an ignitable ratio. An excessive supply of air in the slow-running range will result in erratic running of the engine – when suddenly accelerating, the engine will stall.
When the slow-running air screw is almost closed, the engine tends to cycle as a four-stroke engine – a layman then thinks the connecting-rod is defective. Besides good startability, proper transition also depends on the correct setting of this screw. When opening the throttle valve, the transition bore (9) (Fig. 122) becomes effective additionally, but this also depends on the position of the air screw. To ensure smooth running and good road performance, particular attention should be paid to the adjustment of the slow-running device.
With the engine having normal operating temperature, regulate the idling speed by actuating the cable control setting screw for the throttle valve in such a manner that the engine just continues running when the twist-grip is in idling position. (A high idling speed causes noise in shifting gears!) Then – starting from the position "for 2 revolutions open" – slowly turn the slow-running air screw down and back by way of trial. Find the position with the highest engine speed.
Proceed slowly enough so that the engine can respond to the change.
After having regulated the idling speed down to normal, screw in the air screw for about $^1/_4$ of a revolution – this is necessary for a good transition in cold starting!
Precondition for a correct idling setting (i.e. idling speed and slow-running air) is the fact that the setting of the partial load and full load range is correct, otherwise the engine will not respond to adjustments of the slow-running air screw!
It should be noted that all jets are subject to tolerances, i.e. they have different flow values. Therefore, for carburetter adjusting, one should have available

several jets of the same dimension in order to be in a position to exchange them.
For needle jets, for example, the dimens according to darwing is $2.65^{+0.009}$ mm.
The types ES 125/1 – 150/1 and the types before them are provided with a small compression spring arranged between twist-grip control member and cable control retaining member.
In relaxed state, this spring is the stop for the idling speed. In this position, the throttle valve is open for a distance of about 1.5 mm.

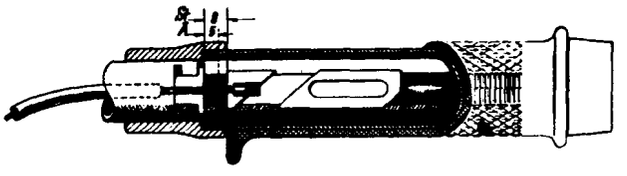

Fig. 127. Stop spring
"St" = Idling fuel supply with the motor cycle stationary or in neutral position
"A" = Switching off (throttle valve completely closed)

To stop the engine, the twist-grip must be closed overcoming the resistance offered by the spring which is compressed to about 5 mm. Now the throttle valve completely closes the air passage.

Please, notice in any case:

A proper carburetter tuning is always associated with the correct ignition timing and contact breaker points gap.
If, for example, the cam is out of true, the contact breaker lifts two times per revolution. At high speeds. a strong magnetic field cannot be built up in the ignition coil – ignition fails. Then you may presume fuel to lack; the dark appearance of the sparking-plug, however, shows that there are ignition faults. Similar symptoms can be observed in the case of insufficient contact-breaker points gap, retarded ignition, capacitor defects or defects in the adjustable series resistor.

7. Cycle Parts

7.1. Exhaust System

The exhaust system is so properly matched with the engine that, firstly, the desired performance characteristics are reached and, secondly, the permissible noise limit is observed. It sould be noted that the exhaust should not be subjected to any changes.

The exhaust muffler (Fig. 128) is welded and no longer of the detachable design.
In the case of unusual contamination, check the carburetter tuning and critically consider your driving habit (driving at too low engine speeds in the various gears?).
Clean the muffler by riding at high speeds on an autobahn or highway.

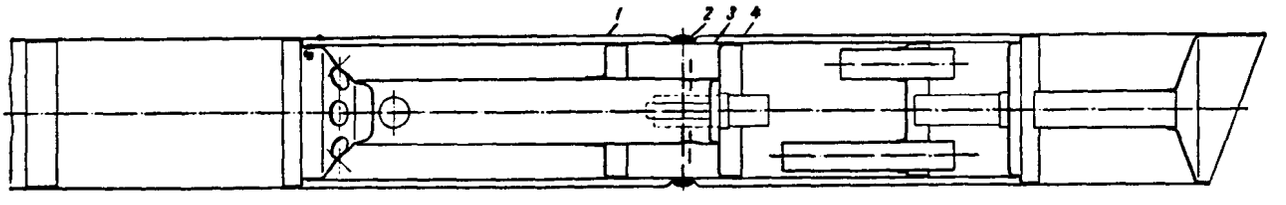

Fig. 128. Sectional view of the exhaust muffler

(1) Exhaust shell
(2) Weld
(3) Silencer
(4) Exhaust pipe tail piece

The exhaust pipe is attached to the cylinder by a union nut which presses the tapered and knurled edge against the cylinder (without packing).
In new condition, the union nut should be tightened with a torque of 147 Nm (15 kp-m) and must be retightened after having covered a distance of about 500 km, using the same torque value because the taper of the exhaust pipe will require this period of operation for properly matching with the jointing face at the cylinder and thrust point of the union nut.
Fore re-tightening, a hook spanner of type B TGL 39-442 (or No. 00-04.215) with a plugged-in extension tube (Fig. 129) should be used.
If, after repeated disassembling and assembling operations, the joint between silencer and exhaust pipe has become leaky, a strip of sheet metal having a thickness of 0.2 to 0.3 mm and a width of 20 mm should be fitted between exhaust pipe and silencer.
In mounting the exhaust pipe, care should be taken that all three suspension points (cylinder, lower connection, rear brace) are firmly fitted and fastened. If one of these points is defective, the other two will be subjected to excessive stresses and work loose.

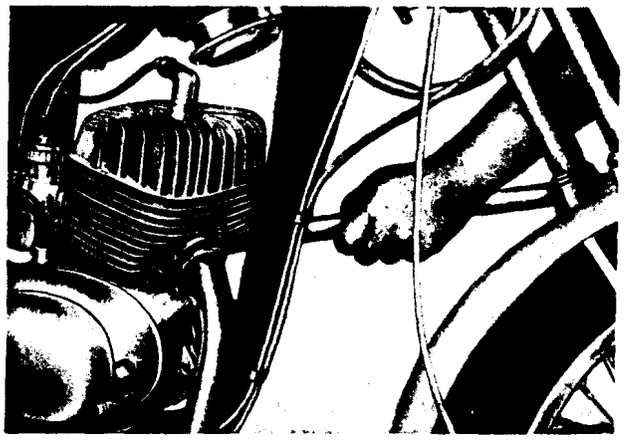

Fig. 129. Re-tightening the union nut for the exhaust pipe

7.2. Steering

7.2.1. ES 125/1 and 150/1

7.2.1.1. Removing the Handlebars

After removing the plastic cover, loosen the nut (width over flats 26) by means of a socket wrench or a twelve-point box wrench with offset head. To avoid damage to the coat of varnish, place a paper packing or the like under the wrench.

Fig. 130. Loosening the end nut

Remove the intermediate ring, slacken back the clamping screw for about 8 revolutions by means of a socket wrench (width over flats 14).

Observe in assembling:
The cone head is clamped after the tightening of the hexagon nut (chamfer on top). The last member to be fitted is the plastic cap.

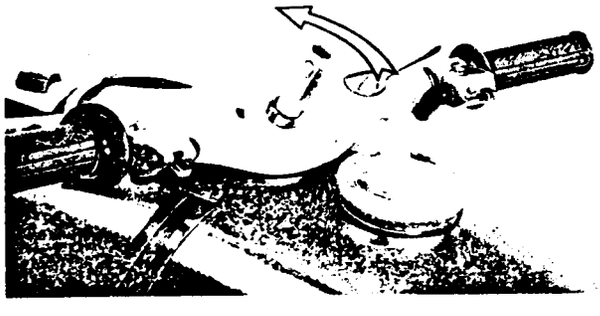

Fig. 131. Loosening the cone head screw

When applying a blow of a hammer on the clamping screw, the cone (1) moves downwards and the expanding sleeve (2) becomes loose.
The central part of the handlebars is fitted with its two webs (3) into the recesses (4) of the tube. That is the reason why the handlebars cannot be screwed out but must be drawn out, while slightly tilting them.
Do not beat the handlebars out of the assembly, otherwise the handlebar accessories or the handlebars themselves might be damaged.
Always make sure the expanding cone is actually loose.

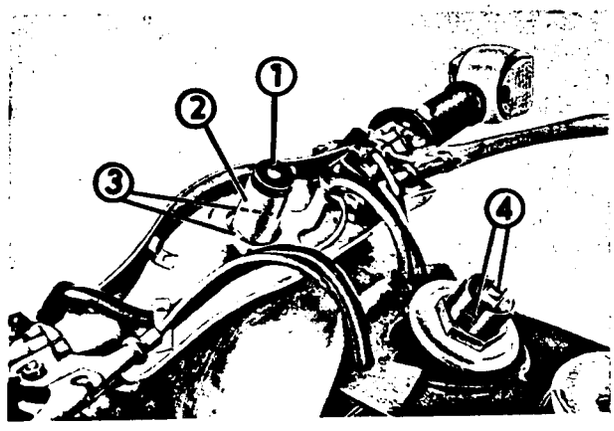

Fig. 132. Handlebars mounting

7.2.1.2. Front Fork and Steering Bearing

Replace the "dotted" frame and fork bearing rings on the ball races. Touching-up by polishing or grinding is not recommendable because this changes the radii of the races in an uncontrollable way.
Fit the lower fork bearing ring in a hot state (about 100 °C) and press it down by means of a suitable piece of tube until it properly contacts its seat.
Provide the rings with 22 balls each (6.35 mm in diameter), using highly viscous antifriction bearing grease.

The steering assembly must be adjusted in such a way that it is free from play but it must not jam because the "steering stability" of the vehicle depends on the correct adjustment.
For checking, shake the mudguard (up and down) with one hand while feeling the upper and lower steering bearings with the other hand.

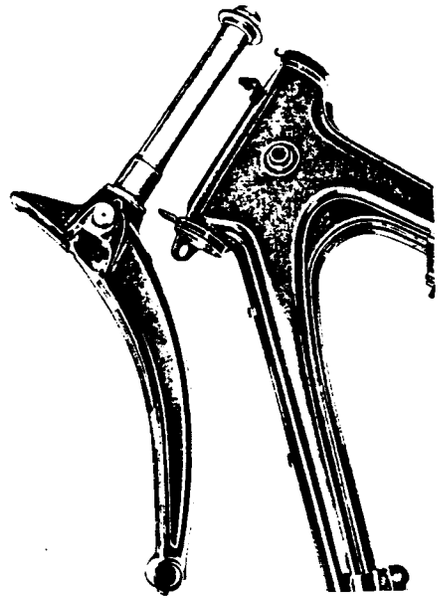

Fig. 133. Front carrier with lower and upper fork bearing rings

7.2.1.3. Replacement of the Swing-arm Bearing Pin

The bearing pins are made of seamless tube; that is why old pins should not be beaten out (because they may be distorted) but pulled out by means of the adjusting nut.

First insert short pieces of tubes, then larger ones. Fix the swing arm by means of the 05-MW 26-4 centring bolt (1) and push the new pin in place from the left-hand side (see arrow). Make sure the indicated surfaces (see arrow in Fig. 135) of the bearing pin are located below the retaining screws of the front carrier, otherwise the next dismantling operation will meet with difficulties.
The end clearance is balanced by means of the lock nuts; the swing arm must slide down by virtue of its own weight. Tighten the retaining screws and lock them by means of nuts.

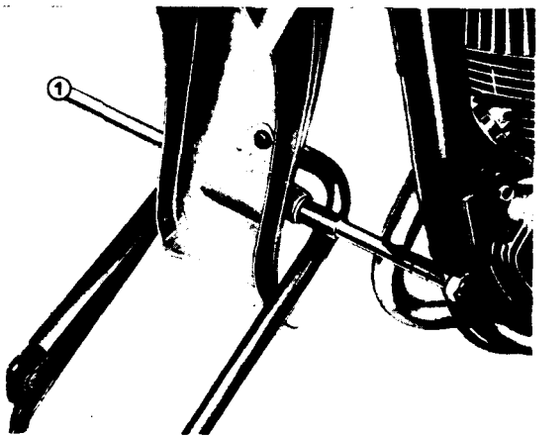

Fig. 134. Replacing the front swing-arm bearing bolt

The two bearing points of the front and rear swing-arm bearing pins are provided with two rubber packings each to prevent the lubricating oil (only use engine oil or gear oil) from leaking away sidewards.
For fitting the packing rings, use the 13-MV 26-4 tapered sleeve to prevent damage.
Bearing pins lubricated with grease by mistake must be taken out and cleaned thoroughly.
Only use g e a r o i l because of the narrow fit (cf. Section 2.4.). Use perfectly tight lubricating nipples; the bearing pins must be provided with an ample supply of oil.
In order to ensure a certain permanent lubrication, the use of molybdenum sulphide suspensate is recommended.

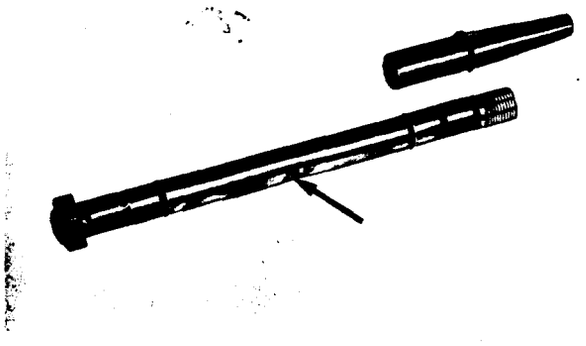

Fig. 135. Swing-arm bearing bolt
(See Fig. 136, page 54)

7.2.2. TS 125 and TS 150

7.2.2.1. Steering Bearing

The ball bearings are driven into the frame in the following manner:

1. Press the lower bearing down to the stop, using the intermediate ring 54 mm in diameter × 20 mm, so that pressure is exerted on the outer ring;
2. Insert the distance sleeve;
3. Press the upper bearing down until its inner ring contacts the distance sleeve; in this operation take care that the distance ring, 54 mm in diameter × 40 mm, is placed under the lower bearing in order that the lower bearing is not pressed out; and then also exert pressure on the intermediate ring, 54 mm in diameter × 20 mm, in order that the inner and outer rings of the upper bearing properly contact their mating parts.

Since the steering components are mounted on ball bearings, no adjusting operations are required. The steering bearing is in perfect working condition if the ball bearings have a proper press fit and the covering nut is properly tightened. The specified torque for this operation is 147 Nm (15 kp-m) (use a box spanner or socket wrench only). The screwed joint need not be locked.

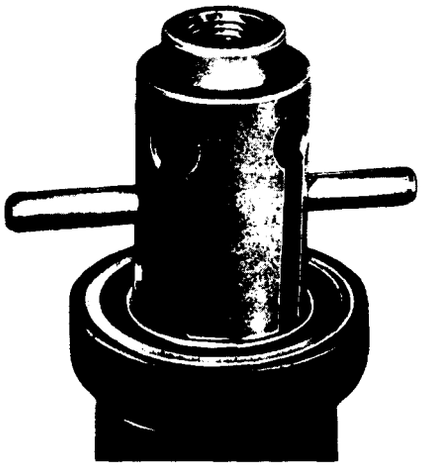

Fig. 137. Press the inner part of the puller into the ball bearing and pull upwards by means of the cross pin

The ball bearing should be removed from the frame in the manner illustrated in Figs. 137 to 139, using the 22-51.006 extractor. For fitting and removing the clamping heads and the other components of the telescopic fork see Section 7.2.2.2.

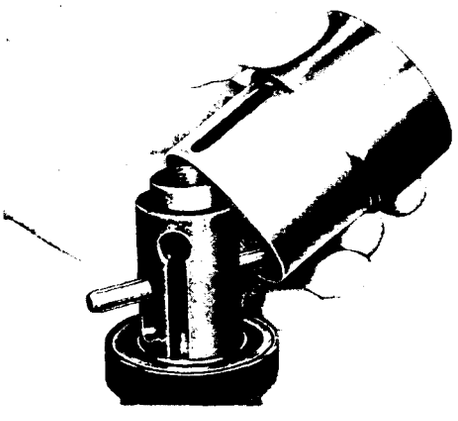

Fig. 138. Fitting the upper part of the puller

7.2.2.2. Telescopic Fork (see Fig. 136)

The front part of the machine is disassembled into its main components as follows:

1. Remove front wheel and front wheel mudguard.
2. Remove handlebars and place them on the fuel tank (place a protective cloth underneath).
3. Loosen cable connections and speedometer spindle from headlamp (mark the plug-in type connections for identification) and dismantle head-lamp.
4. Loosen screw plugs and covering nut.
5. Remove the upper clamping head (drive upwards by means of a rubber mallet) together with headlamp holder and rubber pad for headlamp holder.
6. Withdraw the lower clamping head together with the guide tubes downwards, tapping the control tube by means of a rubber mallet, if required, (note that the guide tubes should remain clamped in the lower clamping head, unless the telescopic units have to be dismantled).

Fig. 139. Screwing in the screw, tightening and in this way pulling the bearing out of the frame

Mounting is to be done in the inverse order of the disassembling operations.
The screwed joints should be tightened in the following order:

1. Covering nut.
2. Screw plugs for telescopic units, applying a thin film of the "Chemisol 1405" adhesive lacquer (manufacturer: VEB Schuh-Chemie, Erfurt) to the thread of the screw plugs for sealing them.
   ("Chemisol" is made on the basis of synthetic caoutchouc, viscosity: 30 s run out time of 50 ml with a 5-mm jet. In countries other than the GDR, an adhesive lacquer of similar properties should be used for sealing.)
   Torque: 147 Nm (15 kp-m).
3. Clamping screws at the lower clamping head – torque 34.3 to 44.1 Nm (3.5 to 4.5 kp-m).
4. Nut of the knockout spindle; then, while the motorcycle is stationary, vigorously more the system several times through the full travel from bump to rebound (while the mudguard screws are still loose) to ensure that the knockout spindle assumes proper position in the opening provided for the spindle, the spindle bush, where a sliding fit must be ensured; if necessary, finish ream the left-hand spindle receiving bush to a size of 20 mm in diameter.
5. Clamping screw for knockout spindle.

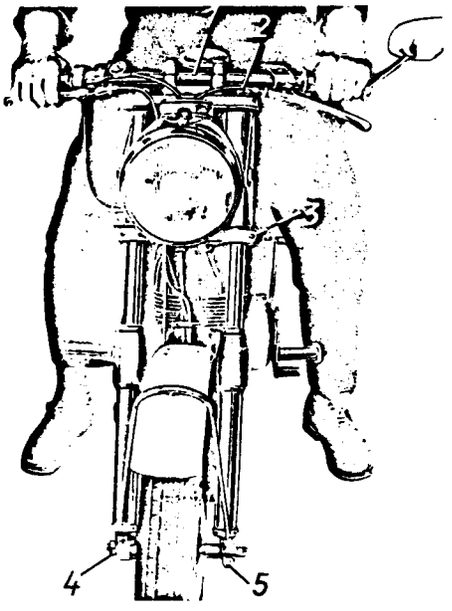

Fig. 140. Sequence in tightening the screws; Take care: before operation (5) compress and expand several times vigorously

Repairing the telescopic units of the fork

The permissible amount of wear is reached if the fully extended slide tubes of the units can be moved to and fro at the spindle bush through a distance of more than 3.5 mm.
In this test, the two fork units must not be subjected to any deformation because this would reduce the actual play. In cases of doubt, the telescopic units must be completely removed from the assembly, the guide tubes gnetly clamped in "soft protective jaws", and the actual play measured at the spindle bush by means of a dial gauge.
When completely removing the telescopic members, the clamping heads and the headlamp holders can be left at the vehicle.
After removing the front wheel and the front wheel mudguard, and after loosening the screw plugs and the clamping screws from the lower clamping head, the telescopic units are driven out by means of the combined 19-MW 22-1 assembly spanner.

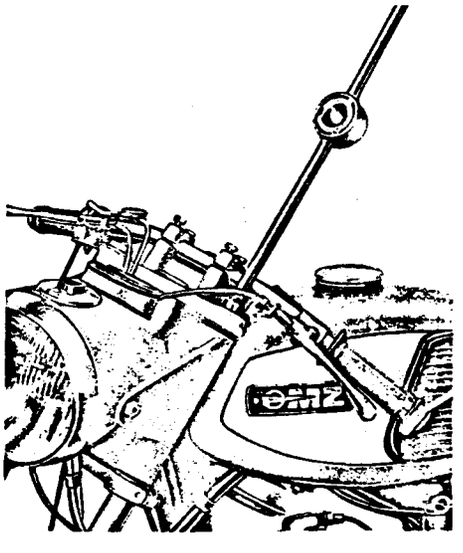

Fig. 141. Assembling and removing the guide tubes with the help of the combined assembling spanner

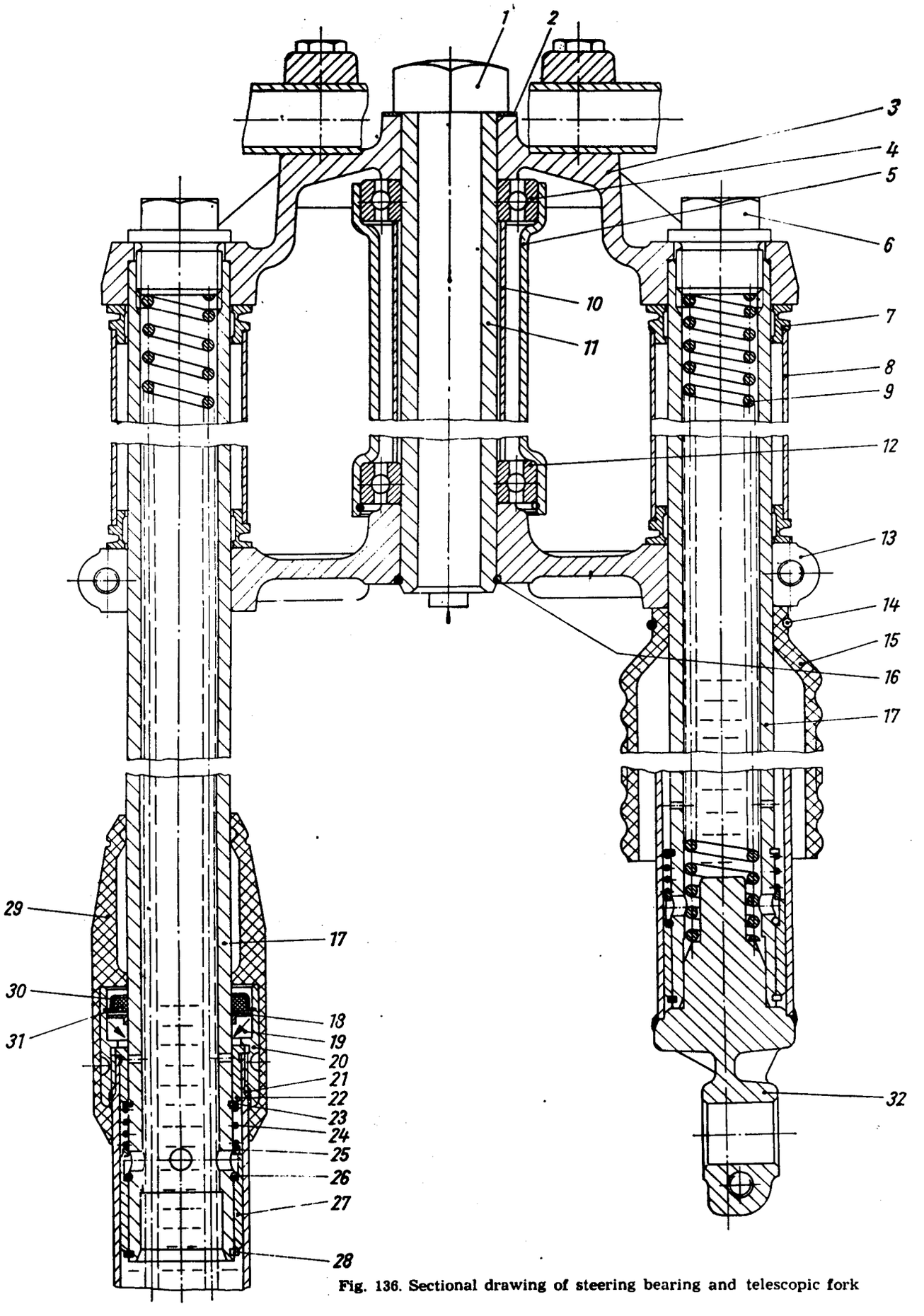

Fig. 136. Sectional drawing of steering bearing and telescopic fork

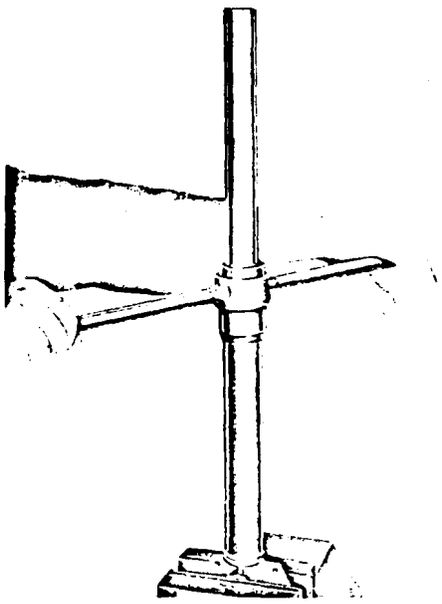

Fig. 142. Loosening and tightening the threaded ring by means of the combined assembling spanner

For this purpose, the spanner is screwed into the M 27 × 2 thread of the guide tubes. The assembled position of the guide tubes must be marked by colour dots below the lower clamping head before dismantling.
To facilitate re-assembling, it is advisable, immediately after having removed one telescopic unit, to insert another guide tube or a suitable piece of pipe with a diameter of anything between 31.7 and 31.8 mm form the bottom and in order that the rubber pads for the headlamp holder will not be dislocated.
For assembling and disassembling only adequate tools should be used. With makeshift tools, damage will be caused and successful repairs will not be ensured.
For dismantling a telescopic unit, it is to be clamped at the spindle bush but not at the guide tube!

After removing the protective cap or protective bush, the threaded ring can be loosened by means of the combined assembling spanner and the guide tube together with the lower slide bush and the damping valve withdrawn from the sliding tube. After loosening the circlips (Fig. 143), the telescopic unit can be dismantled into its parts.
The D 32 × 45 × 7 packing ring will be destroyed when being pressed out of the threaded ring.
When inspecting and repairing the parts, the following should be observed:

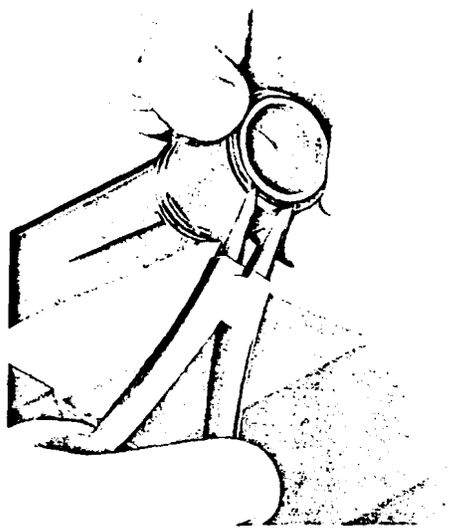

Fig. 143. Loosening the lower circlip

Guide tube

The tubes must be replaced by new ones if they are distorted by unusual outer influences (do not straighten them, experience has shown that guide tubes after straightening assume their original position of the distorted condition; permissible out-of-true error 0.05 mm) or the chromium plating is worn away.
The portion of the guide tube subjected to the highest rate of wear is at the front end, about 150 mm above the lower edge, i.e. where the most intense sliding takes place of sliding bush and packing ring. Wear of the chromium coat is indicated by dark spots and grooves. If a telescopic unit is to be re-assembled with a new packing ring and a used guide tube, which still

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Legend for Fig. 136 on page 54

left-hand half of illustration:

Design "guide tubes exposed", completely expanded

right-hand half of illustration:

Design "guide tubes covered with protective sleeve", completely compressed

(1) End nut
(2) omitted
(3) Upper clamping head
(4) 6006 ball bearing
(5) Steering head tube of the frame
(6) Screw plug
(7) Rubber ring for headlamp holder
(8) Headlamp holder
(9) Compression spring for telescopic fork
(10) Spacer sleeve
(11) Control tube
(12) 6006 ball bearing
(13) Lower clamping head
(14) Wire circlip 38
(15) Protective sleeve
(16) Wire circlip 30
(17) Guide tube
(18) Supporting ring
(19) Radial seal ring D 32 × 45 × 7
(20) Threaded ring
(21) Slide tube
(22) Upper sliding bush
(23) Circlip 32
(24) Compression spring
(25) Packing ring for damping valve
(26) Wire circlip 32
(27) Lower sliding bush
(28) Same as part (23)
(29) Protective cap
(30) Felt ring holder
(31) Felt ring
(32) Axle bush

is in perfect working order, it is advisable to mount the guide tube in such a manner that it is displaced through 180° with respect to its former assembled position.
When reassembling telescopic units which were not disassembled into their component parts, it is advisable, however, to fit the guide tube in their original position in the assembly. Over its entire length, the guide tube must be free from impact marks, grooves and other surface irregularities to ensure that the packing ring will not be damaged when it is slipped on the assembly. Surface irregularities must be removed by a fine-grained oilstone moved longitudinally.

Upper sliding bush

The required measure of the hole is 31.850 to 31.889 mm. Experience has shown that limited wear occurs so that replacement practically is not necessary.

The inner surface of the hole partly exhibits a non-uniform appearance caused by a small eccentricity in the position of the assembled components parts due to manufacture; this is not associated with any drawback, however.

Lower sliding bush

The outer diameter is 37.875 to 37.900 mm. This part is also subjected to a low wear rate so that replacement will become necessary only after 30,000 to 50.000 km of road operation.
The given axial play of the sliding bush between the circlips of the guide tubes can lead to a clicking sound emitted from the telescopic fork on the move which has no influence on the function. This insignificant flaw can be removed by fitting an adequate spacer between circlip and lower edge of the sliding bush to remove this axial play. This washer must exactly fit on the guide tube, diameter 31.7 mm, and its external diameter must not exceed 35.5 mm to prevent these washers from rubbing against the inner surfaces of the sliding tubes at any rate.

Sliding tube

The surface of the hole exerts a great influence on the ease of motion and wear of the interior of the telescopic fork. The drilled hole is not mechanically finished because by emery grinding or similar processes the extremely smooth surface obtained in the manufacturing process would be destroyed and lead to an unusual wear of the lower sliding bush.
If, by extraordinary conditions (foreign particles or similar things), the interior surface of the sliding tube is damaged, the surface may be restored to proper working order by honing (in a manner similar to that used in finishing the cylinder bore). The required dimension of the diameter of the sliding tube hole is 38.00 to 38.05 mm.

Damping valve

In this part, only an insignificant amount of wear is involved so that a replacement of the components is practically not necessary.
The sealing rings for the damping valve, made of piston ring material, must be free to move easily, free from burr and absolutely clean. Small contaminations may easily lead to jamming of the sealing ring or to leaks in the valve.

Fig. 145. Pressing the packing ring into the threaded ring by means of the combined assembling spanner (in a vice or under a hand-lever press)

Threaded ring with packing ring

In order that the packing ring is not damaged when pressed into the threaded ring, the combined assem-

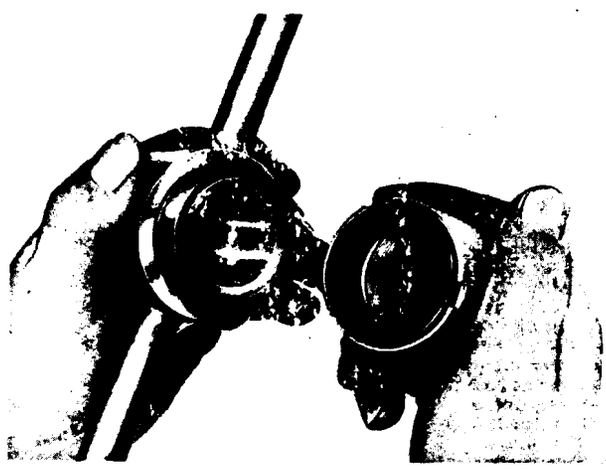


Fig. 144. Combined assembling spanner for pressing the packing ring into the threaded ring

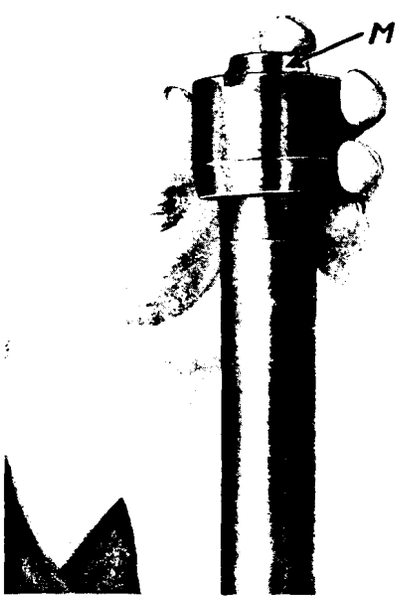


Fig. 146. Fitting the threaded ring (with the packing ring pressed in place) on the guide tube by means of a fitting sleeve

bling spanner should be used for this purpose (Figs. 144 and 145).
This special tool is designed in such a way that the packing ring is not placed on the lower face and the fitting tool does not press on the upper face where damage to the rubber lining of the packing ring would be caused. After pressing the packing ring in place, back-up washer, felt ring and felt-ring holder must be fitted. Then the complete threaded ring is slipped over the guide tube from top by means of the fitting sleeve (Fig. 146).
To provide a proper seal between sliding tube and threaded ring, apply a thin film of "Chemisol 1405" adhesive lacquer to the thread of the sliding tube before assembling. On no account shouldadhesive be applied to the thread of the threaded ring because the excessive supply of adhesive lacquer would be squeezed upwards to the packing ring.
The required torque for tightening the threaded ring is 196 Nm (20 kp-m).

Functional test

After assembling, the telescopic units must be subjected to a functional test for tightness and damping power. For this purpose, an amount of 220 cm^3 of shock-absorber fluid must be poured in each unit.
If possible, the telescopic units should be clamped in a test equipment (at the top use the screw plug and at the bottom the spindle receiving hub for clamping) and sprung, i.e. moved through a travel of 80 mm of the spring, up and down, at a frequency of 100/min. The damping power required for the rebound motion under these test conditions is 157 ± 39 Nm (16 ± 4 kp).
If a suitable test equipment is not available, the test must be carried out by hand by compressing and expanding the unit. The damping effect must be clearly perceptible in expanding.
After the completion of the functional test, the telescopic units are completely assembled; for this purpose, the unit is clamped at the spindle bush.
The telescopic units are also mounted in the vehicle by means of the combined assembling spanner (cf. Fig. 141).
Sequence of tightening the screws according to Fig. 140.
The correct oil level in assembled condition is checked according to the manner shown in Fig. 147.

7.3. Fuel Tank

Because of the danger of explosion, repairs at the fuel tank should only be carried out in a special workshop. Repairs of the mounting for fuel tanks (chassis) and at the fuel shut-off cock can be done by the rider himself.
The fuel tank is, at its rear and front ends, elastically mounted on the frame (Figs. 148 and 149, they analogously apply to the ES 125/1 and 150/1).
In this way, a transmission of vibrations from the frame to the fuel tank is effectively damped.

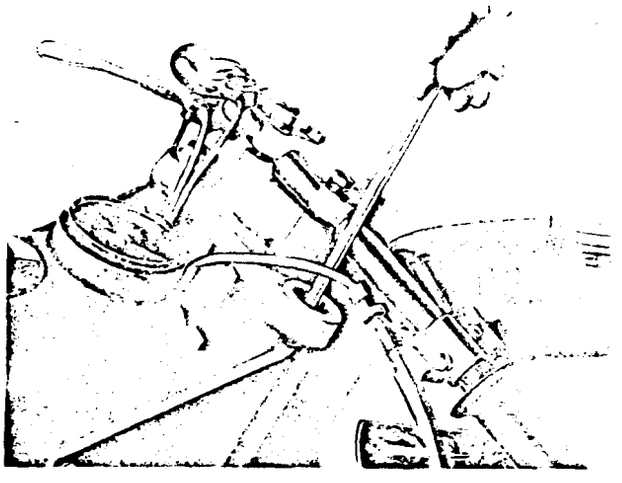


Fig. 147. Oil level checking by means of dip-stick:
Insert dip-stick inside the compressing spring up to the stop; required oil level 210 mm above lower edge of dip-stick

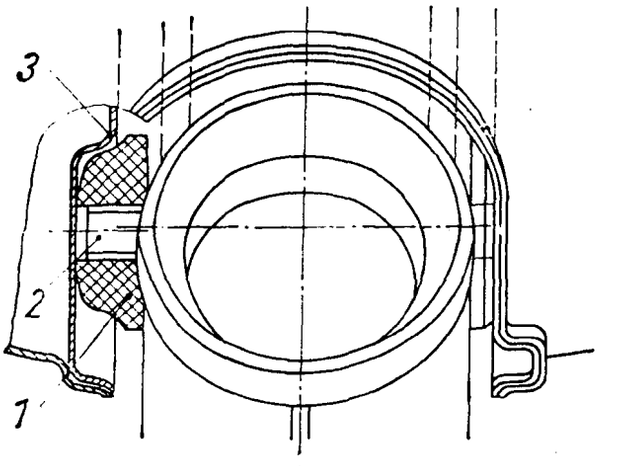


Fig. 148. Front mounting the fuel tank (TS 125 and 150)
(1) Rubber pad
(2) Frame with the carrying tube 10 ∅ welded in
(3) Fuel tank

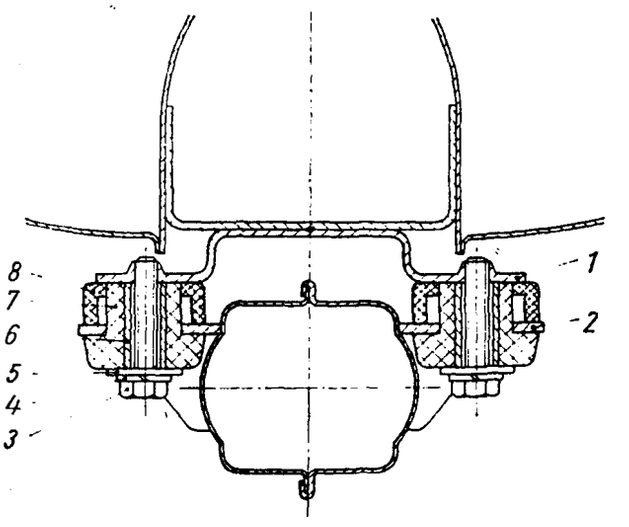


Fig. 149. Rear mounting of the fuel tank at the frame (TS 125 and 150)

(1) Fastening bow at fuel tank
(2) Frame
(3) Hexagon head screw M 6
(4) Spring ring
(5) Washer
(6) Spacer sleeve
(7) Rubber pad
(8) Rubber disk

To remove the fuel tank, unscrew the two screws (1). After having turned the fuel-shut off cock, remove the tank in the direction of the arrow (bend open the cable holder!).
At the **ES 125/1** and **150/1** remove the handlebars in order not to damage the coat of varnish of the tank (location 2). If attached, separate the legshields from the holding plates.
In assembling take care not to clamp the cable controls — correctly fasten the handlebars (ES 125/1 and 150/1).
After removing the fuel tank (Fig. 150), the rubber parts can be subjected to inspection.
When the front rubber parts are worn, they should be turned through 90° as a first remedy. If the rear rubber parts are damaged, they must be replaced by new ones.
On no account should the elastic mounting be changed into a rigid one.

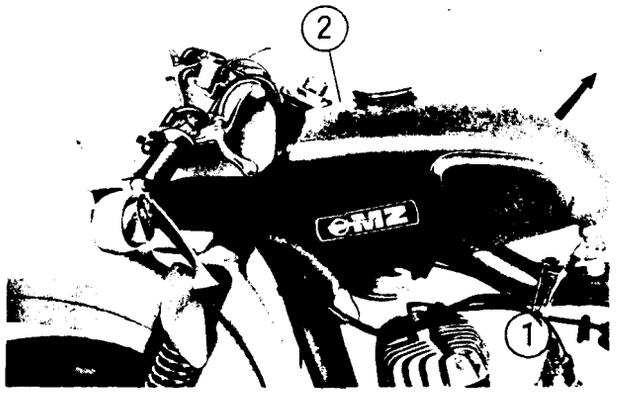


Fig. 150. Removing the fuel tank

7.3.1. Fuel Shut-off Cock

The condition of the fuel shut-off cock effects a significant influence on the proper function of the engine. Insufficient fuel supply may also lead to pistion seizing.

The fuel passes through two strainers in the cock.

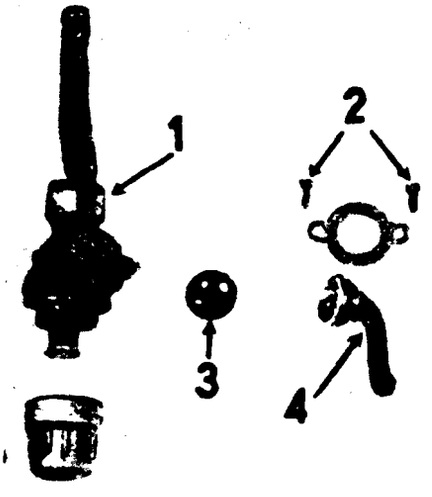


Fig. 151. Fuel filter cock dismantled
(1) Union nut
(2) Retaining screws
(3) Rubber packing
(4) Actuation lever

The first one becomes accessible after unscrewing the fuel shut-off cock from the fuel tank, the second one after loosening the lower plastics screw joint and the fastening screw beneath it. It is advisable, to clean the strainers thoroughly after every 5,000 km of road operation or once a year.
Another source of troubles may be the rubber packing under the actuating lever of the fuel shut-off cock; the holes in the rubber may be clogged or closed by swelling or by too tightly fitting fastening screws. Actuating lever and rubber packing can be removed after loosening the two fastening screws arranged laterally to the actuating lever.
On the occasion of repairs in the fuel shut-off cock, the fuel feed hose leading to the carburetter should also be inspected. If this hose has become brittle, leaks may occur in the connections.
Then the fitting of a new fuel supply hose having a size of 5 × 8.2 mm is required.

7.4. Brakes

The two bearing bolts (1) must firmly fit in the cover, otherwise the brake tends to block.
The two bearing bolts and the cam spindles (2) must be lubricated with high melting-point grease (clean them every 10,000 km or once a year). In continuous braking, temperatures up to 150 °C may occur for a short time!
Before removing the brake shoes, mark them for identification so that they can be re-fitted to their original place where they have run in.
Clean all parts thoroughly, remove abraded particles, chamfer the leading side of the shoe.
When exchanging the brake shoes (that are capable of being restored to proper working conditions) it should be noted that brake shoes that have already been reworked are ready to be fitted (provided they were machined in a special device at their circumference), whereas brake shoes that are non-reworked at their outside have to be returned in a lathe. For this purpose, they are mounted on the brake backing plate by means of the return spring, the brake backing plate is centred in its bore and the shoes turned down to such a degree that the difference between the diameter of the brake ring and the diameter of the brake shoe is at least 0.6 mm.

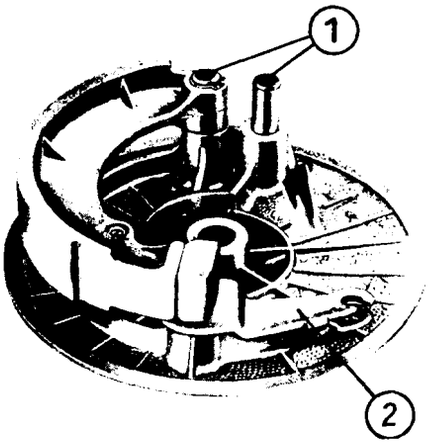


Fig. 152. Front brake cover, one brake shoe removed

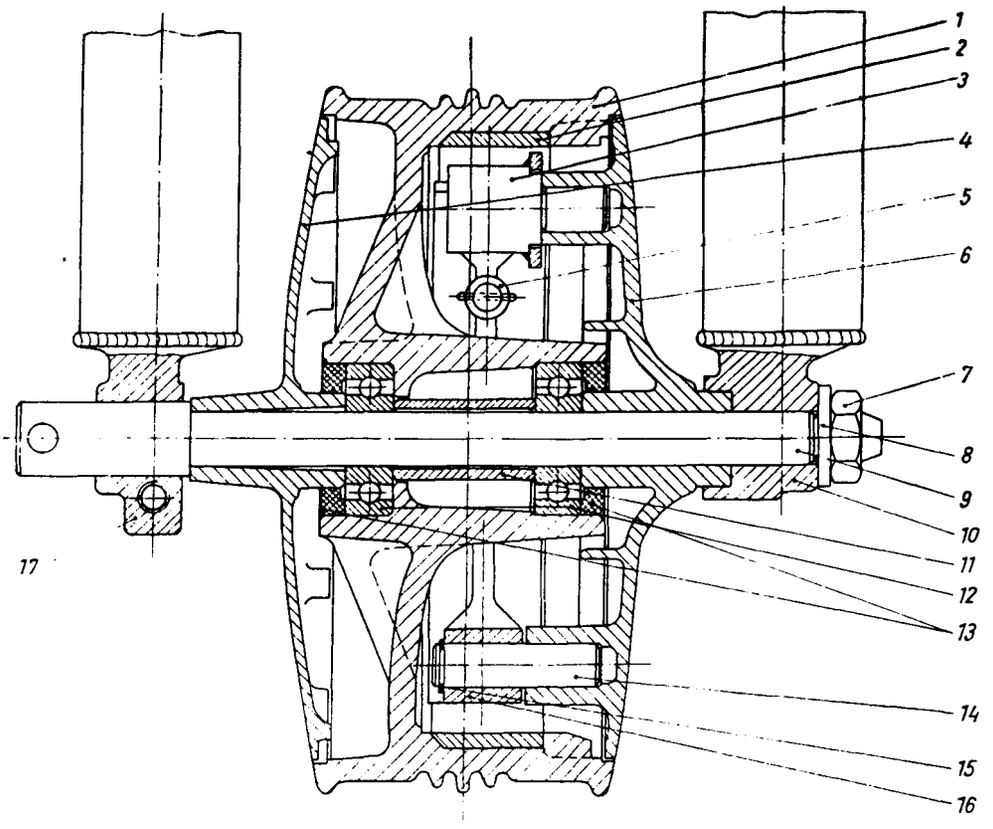


Fig. 153. Sectional view of front wheel hub

(1) Wheel body with cast-on brake ring (2)
(3) Brake lever
(4) Wheel body cover
(5) Return spring for brake shoe
(6) Brake holder
(7) Hexagon nut M 14 × 1.5
(8) Washer
(9) Axle
(10) Axle holder right-hand side
(11) Spacing sleeve
(12) Ball bearing 6302
(13) Rubber sealing ring
(14) Anchoring bolt
(15) Lock ring 12
(16) Brake shoe
(17) Axle holder left-hand side

7.5. Replacement of the Foot-rest Tubes

For replacing one of the foot-rest tubes, use a socket wrench (width over flats 13) to loosen the clip and pull out the tube.
When fitting take care that the recess in the foot-rest tube engages with the nose at the frame. This is of particular importance at the left-hand side. If the foot-rest tube is allowed to turn, the prop stand drops during riding.

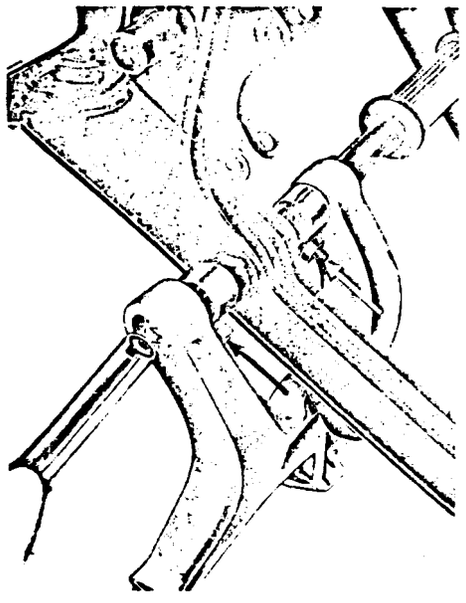


Fig. 154. Prop stand

7.6. Checking and Changing the Secondary Chain

To remove the secondary chain for inspection, open the chain connecting link, and attach an old (but clean) chain to it. The locking spring must be placed on the connecting link. Then draw out the chain to be checked until the connecting link is accessible.
Re-insert the checked chain in the inverse order.

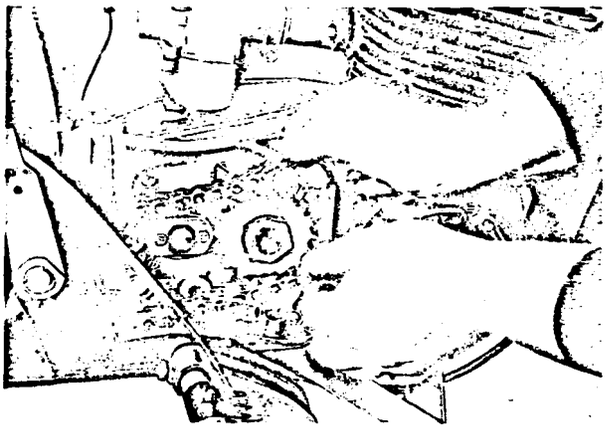


Fig. 155. Pulling out the chain

If the backlash between chain rollers and pins is excessive, a new chain must be used. The damage due to chain breakage is more expensive than a new chain.

A gearbox sprocket worn to such an extent (as shown in Fig. 156 where it is compared with a new part) must also be replaced. It would cause premature wear of the chain.

Fig. 156. A new (left) and a worn pinion

To fit the new chain either attach it to the old chain, as shown in Fig. 155, or draw it through the chain protective hoses by means of a wire hook.

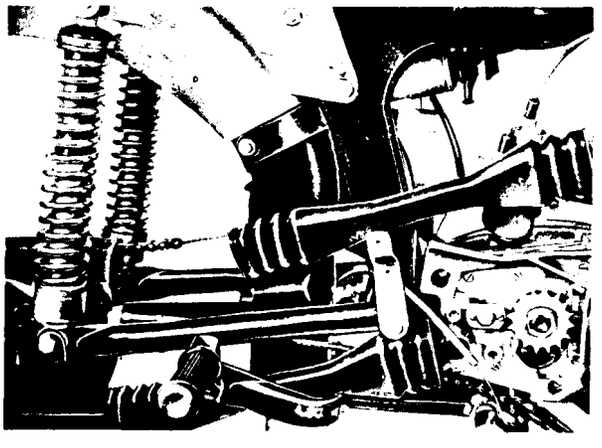


Fig. 157. Fitting the chain

To insert the connecting link, press the end links together by means of a pair of pointed pliers and insert the link from the rear.

Fig. 158. Fitting the connecting link

Only use original chain links, the pin diameter of the various chain makes is different. A connecting link inserted in the chain sleeves where it has too much play causes the chain to "mount" the sprocket at this point – this may also lead to chain breakage.

The spring clip at the connecting link must fit in this way!

The internal profile of the chain protective hoses guides the chain; as a consequence, the "whipping" of the chain increasing the rate of wear is thus reduced to a minimum. To avoid resistance to sliding in the profile, the chain must be lubricated with GL 60 gear oil or antifriction bearing grease after every 2,000 km of road operation.

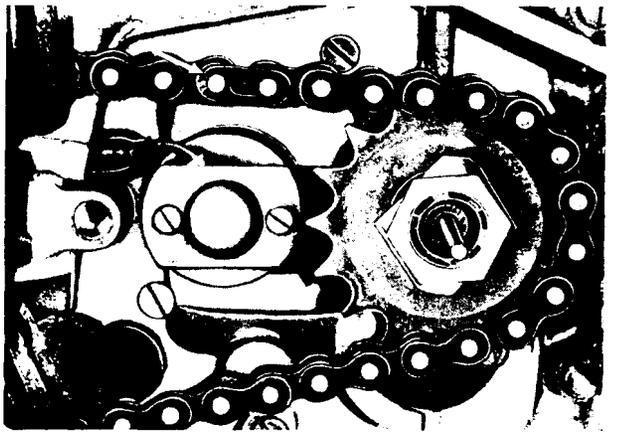


Fig. 159. Correct fit of the spring

Place the vehicle on its prop stand without load and check the chain over one full revolution of the chain. Apply an intermediate piece (1) 20 mm ∅, as demonstrated in the illustration to the foot-rest for the pillion rider and rear wheel swing.

The chain shows the correct tension, when the lower chain protection hose with chain can be pressed to (1).

Adjustments are made by means of the chain tighteners (also observe the text for Fig. 169).

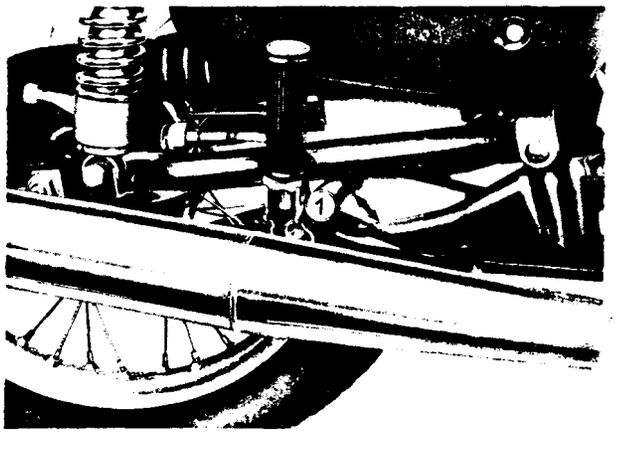


Fig. 160. Adjusting the chain sag

7.7. Adjusting the Clutch

Before opening an engine because of a slipping clutch, check that the specified play is present between clutch thrust bolt (threaded stud) and push rod (Fig. 3, observe the sectional view of the engine).

Loosen the lock nuts and screw down the thrust bolt (1) until the stop is just felt. Then slacken back the thrust bolt for three quarters of a revolution, retain it and tighten the lock nut. Due to wear of the set of disks, the distance is not enlarged but becomes smaller.
Because of the sliding (scraping) motion of the clutch worm, the use of molybdenum sulphide is advisable. Either apply MoS_2 powder to the clutch worm (2) by means of a brush or add this substance to the lubricant in the form of a suspensate and lubricate through nipple (3).

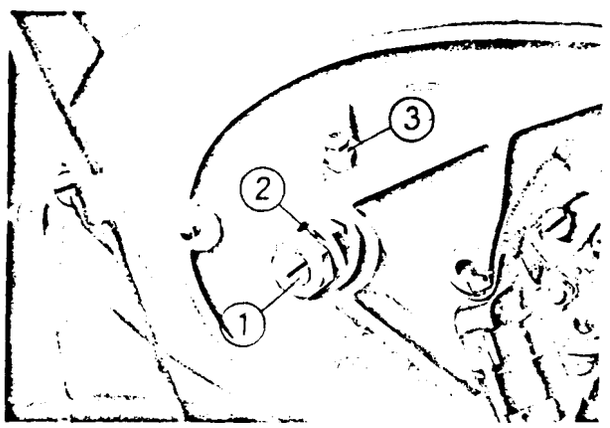


Fig. 161. Clutch worm

7.8. Removing and Dismantling the Rear Wheel Drive

The elastic connection between rear wheel drive and rear wheel is effected by the damping rubber member (A). In the case of severe distortions of, or fissures in, the openings for the rear wheel dogs (indicated by sudden impacts during moving off or gear-shifting), this member must be replaced.

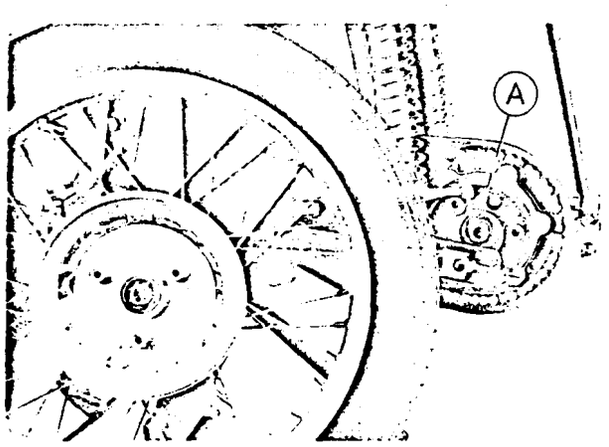


Fig. 162. Rear wheel drive

(2) lubricating nipple for the speedometer drive. Here, use gear oil (GL 60) as lubricant. An addition of graphite or MoS_2 is advisable.
In vehicles from the 1973 model, the speedometer drive is self-lubricating: provided with "Ceritol + k 2" antifriction bearing grease.
Do not provide the speedometer shaft (3) with too ample a supply of lubricant, otherwise the lubricant will get into the speedometer.

Properly tighten the nut (1) but due not use undue force not to distort the chain cover of plastic.

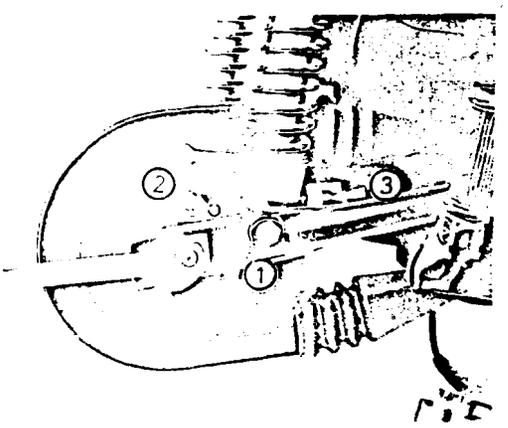


Fig. 163. Loosening the nut at the flange bolt (1)

Use two narrow screw-drivers to remove the circlip from the 6004 ball bearing.
During assembling, do not forget to fit the cover plate between circlip and ball bearing, otherwise the grease filling (high melting-point grease) would escape and leave the bearing dry.

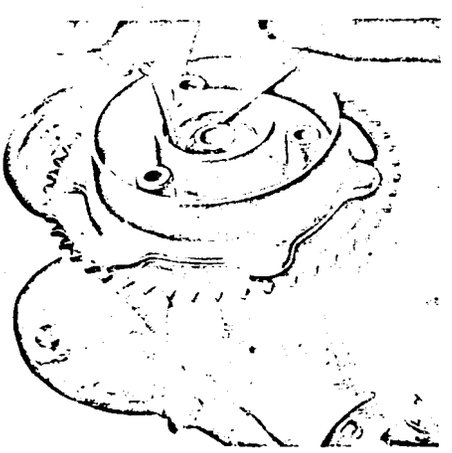


Fig. 164. Removing the circlip

Use a screw-driver to lift the engaging hook of the hooked circlip from the bore in the helical wheel and pull off the latter.

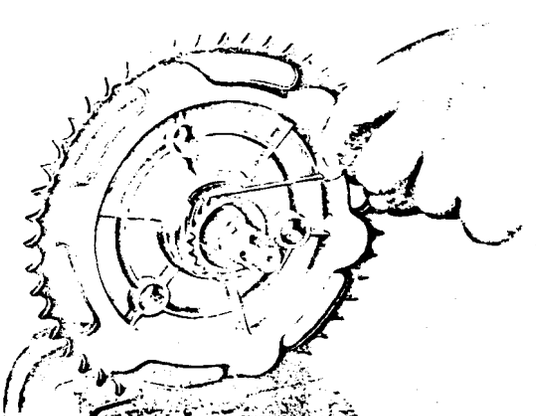


Fig. 165. Removing the helical gear

In order that the first thread is not distorted when driving through the flange bolt, screw the nut down until it is flush with the bolt.
The 6004 bearing (20×42×12) will come out together with the bolt in almost all cases.
Sprocket and damping body were cast together and, therefore, should be replaced as one complete part.

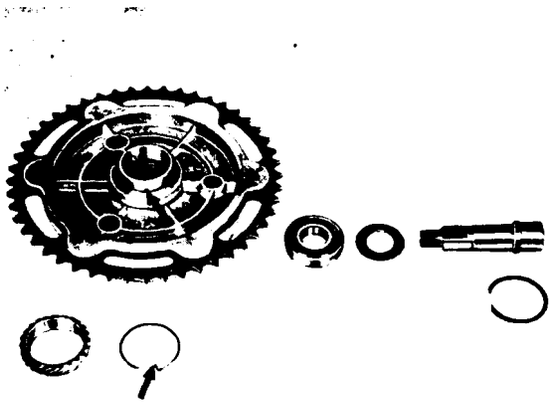


Fig. 166. Dismantled rear wheel drive

7.9. Speedometer Drive

When the grease nipple (from the 1973 model a countersunk screw BM 6 × 8) is unscrewed, the bearing bushing becomes accessible and can be withdrawn together with the pinion.
The check nut at the speedometer shaft should only be tightened by hand (the drive shaft can be clamped in the speedometer).

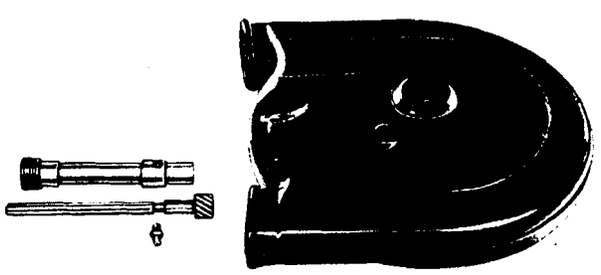


Fig. 167. Replacing the speedometer pinion

7.10. Replacement of the Wheel Bearings

For replacing the wheel bearing, the H 8-820-3 expanding mandrel should be used. The M-8 screw must be slackened back until the tapered pin not longer contacts it.
After having driven out the bearing, tighten the screw, as a consequence, sleeve and pin will be separated and the bearing can be withdrawn from the former.

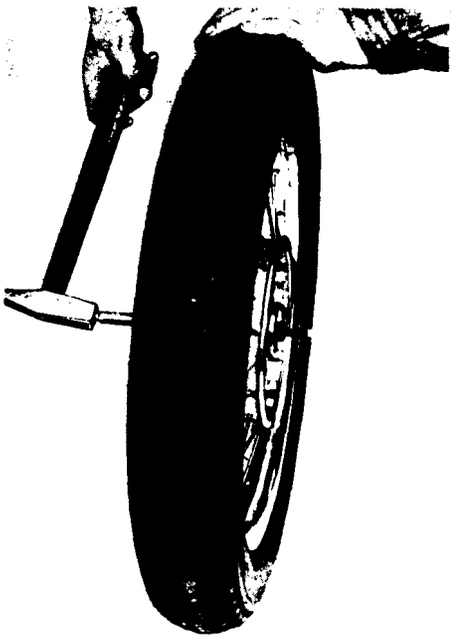


Fig. 168. Dismantling the wheel bearing

7.11. Inspections Required in the Case of Poor Road-holding

An inadequate load distribution when transporting luggage is of great influence.
The rear luggage carrier to be fastened to the saddle carrier should only be loaded with l i g h t - w e i g h t small luggage. For holiday luggage and similar loads, side luggage carriers fitted to each side of the rear motor-cycle part are required.
The track keeping of the two road wheels can be checked by means of a measuring rod or by sighting.
The rod must contact the rear wheel at two points while, at the front wheel, the same distance between rod and two points must be present (to allow for the different tyre widths).
A good road-hugging quality is dependent upon proper tyre fitting (observe the control line!), correct tyre inflation pressure, perfectly true-running wheels (no vertical or lateral amount out of true).

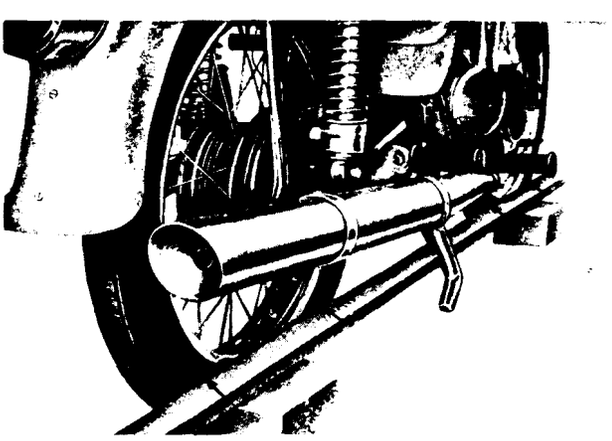


Fig. 169. Aligning the wheels

The tendency to flutter of the handlebars may be due to an inbalance of the wheels, besides loose steering bearings, worn down wheel bearings and loose swing-

arm bearing pins. It may be the rear wheel that causes these troubles in the front fork.
To balance a wheel statically, it must be free to move with ease, or it must be removed from the vehicle and with its knockout spindle placed on two prisms. When the wheel has come to rest, the lightest point (on top) is provided with such an amount of lead wire (the illustrations shows a piece of lead clamped to the wheel) which is required to remove the inbalance. In order that the weight cannot work loose, it is wrapped in insulating or adhesive tape. After a flat, the wheel should be still in balance; for this purpose, the valve location at the tyre is marked by a colour dot so that you are in a position to find the original location.

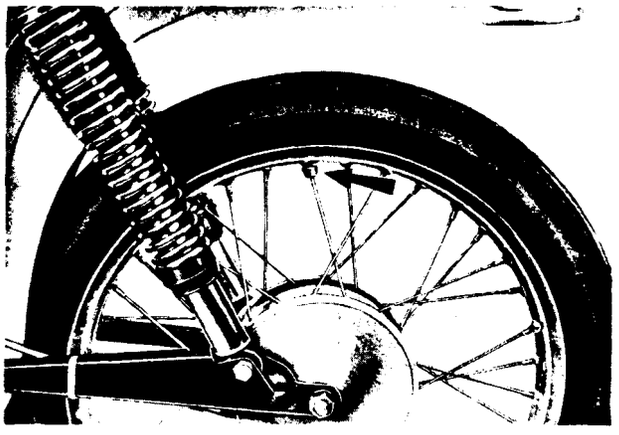


Fig. 170. Balancing the front wheel

Noise may be emitted from the chassis by loose screwed connections between frame and saddle carrier. The two screws (see arrows) must be precision screws, i.e. they must fit in the tapped holes without chattering. Therefore, screws with rolled-on threads are unsuitable because their shank diameter is smaller than that of the thread.
When the two bore-holes are distorted because the motor-cycle has been operated with the saddle carrier loose for a longer period, the latter must be placed in its original position and clamped by means of a screw.

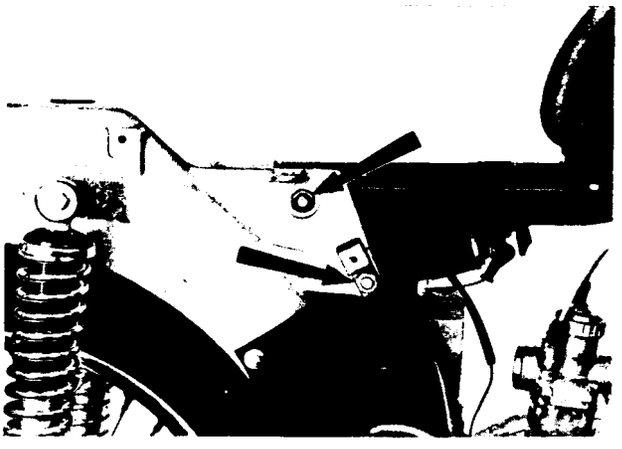


Fig. 171. Fastening the saddle carrier

The second tapped hole must be finish reamed until it is restored to proper condition. Produce an oversize screw and fit it in place (a threaded bolt with two nuts will also be suitable). After having tightened the new screw with a torque of about 49 Nm (5 kp-m), prepare the second screwed connection in the same manner.

7.12. Repairing the Spring-loaded Suspension Units

All that has to be done for this purpose is the replacement of defective suspension unit parts and the lubrication of the adjusting sleeves in the rear spring-loaded suspension units.
The shock-absorbers must be replaced completely and sent to a workshop for regeneration. It is not possible for you to restore the shock-absorber to proper condition yourself. If oil is lacking, the required amount can be topped up (using special wrench 05-MW 82-4), in most cases, however, the sealing of the piston rod will be defective – so that the shock-absorber must be sent to a specialist for regenerating.

7.12.1. Shock-absorber Marking

The marking is located on top of the lower fastening eye.
Example: A 22 - 120 - 56/8 MV 1.50/1 or, from June 1978, A 22 - 120 - 56/8 1.50/1

Where the meaning is as follows:

A 22	design
120	rated stroke in mm
56	damping power in the direction of pull in kp
8	damping power in the direction of compression in kp
OV (MV)	German abbreviation for "without adjustment" (with adjustment)
1.50/1	number of manufacturer

From June 1978, the letters OV or MV are omitted. "With adjustment" is identified by "M".

The following shock-absorbers are used:

	ES 125/1 and 150/1	TS 125 and 150
front	A 22-120-56/8 OV	a component of the telescopic fork
	A 22-120-56/8 (from June 1978)	
rear	A 22-100-76/8 MV (until April 1970)	
	A 22-100-94/8 MV (until May 1973)	
	A 22-100-88/8 MV (from June 1973, can be used in pairs in older vehicle designs)	A 22-100-88/8 MV
	A 22-100-88/8 M (from June 1978)	A 22-100-88/8 M (from June 1978)

7.12.2. Removal of the Shock-absorbers

Clamp the lower eye of the suspension unit in a vice. Press down the protective sleeve (8) and remove the two backing-ring halves (1). Now, the parts (8), (9), and (11) can be removed.

7.12.3. Common Faults in Shock-absorbers

1. The shock-absorber is inactive, although there is no visible oil leakage (foreign particles between the diaphragms of the piston valve).
2. The damping action fails to start smoothly but starts jerkily. The spring-loaded suspension units are said to "stamp" (insufficient amount of damping fluid or bottom valve leaky).
3. Damping liquid leaks.

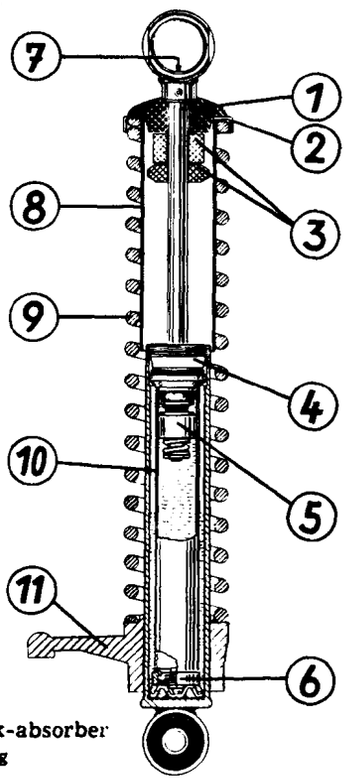


Fig. 172. Design of the Shock-absorber
(1) Halves of the supporting ring
(2) not applicable
(3) Stop rubber pads
(4) Threaded piece with radial seal ring AC 10 × 19 × 7
(5) Piston with non-return valve (top) and damping valve (bottom)
(6) Bottom valve with backing ring
(7) Marking of tolerance group
(8) Protective sleeve
(9) Compression spring
(10) Piston tube
(11) Adjusting sleeve

7.12.4. Filling the Shock-absorbers with Fluid

Using the 05-MW 82 special wrench, unscrew the threaded member [(4) in Fig. 172] and pull out the damping device. Clean all parts in benzine and pour in new oil. Tighten the threaded member with a torque of 49 Nm (5 kp-m).

7.12.5. Mating Shock-absorbers

To ensure good road-holding properties, the shock-absorbers of one and the same axle must show equal damping values.
The marking of the tolerance group is located at the upper face of the piston rod [(7) in Fig. 172].

The yellow colour dot means positive deviations, the green colour dot negative deviations from the rated value of damping power. In shock-absorbers of a more recent design, the colour marking "yellow" is omitted for a positive deviation of the damping power; the negative deviation will be marked "green" now as before.
Always mate yellow with "yellow" or "green" with "green".

8. Cable Controls

The cable controls of a motor-cycle are frequently exposed to external influences such as rain, dirt and lye. In the case of motor-cycles which are ridden every day and frequently parked in the open, the interior of the cable controls is subjected to great frictional stresses so that, eventually, the control lever offers resistance to pulling and control efforts are increased.
Service life of cable controls can be improved and ease of control ensured by protecting the cable controls from water and dirt and lubricating them.
The simplest manner of sealing is by applying a film of water-repellent grease such as Ceritol to the projecting end of the cable and to the slot in the adjusting screw at the control lever.

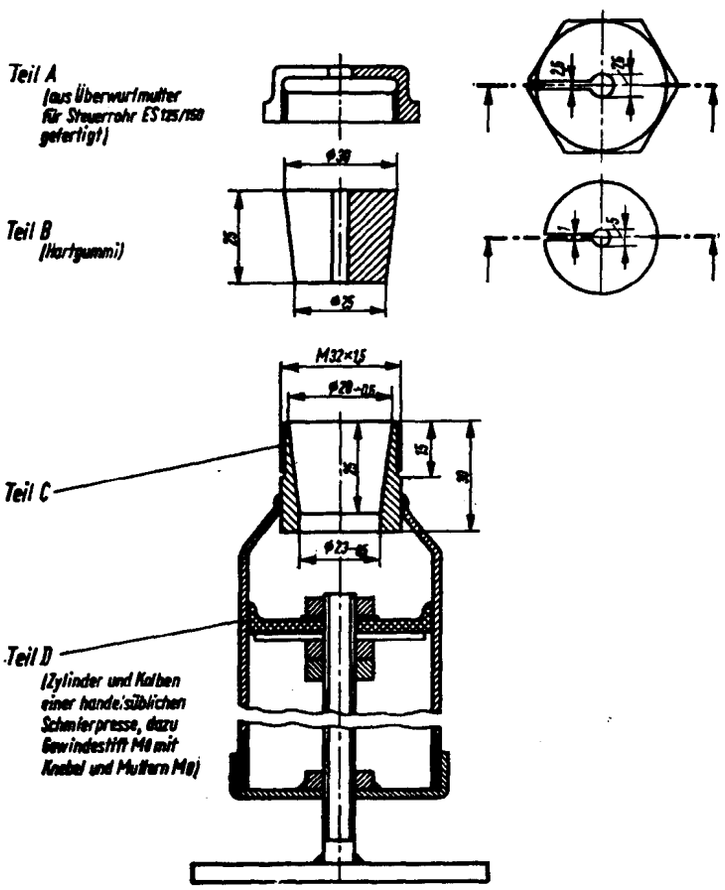


Fig. 173. Device for lubricating cable controls

Teil A (aus Überwurfmutter für Steuerrohr ES 125/150 gefertigt)	Part A (made of union nut for control tube of ES 125/150)
Teil B (Hartgummi)	Part B (hard rubber)
Teil D (Zylinder und Kolben einer handelsüblichen Schmierpresse, dazu Gewindestift M 8 mit Knebel und Muttern M 8)	Part D (cylinder and piston of a commercial lubricating gun and M 8 threaded pin with grip and M 8 nuts)

Fitting a rubber gaiter, Part. No. **05-44-050**, as a means of protection, is another possibility of extending the service life of cable controls. The interior of the gaiter must be filled with a water-repellent grease.
For lubricating the cable controls, use the device shown in Fig. 173.
As a lubricant, either a mixture of gear oil and gear grease, prepared in the mixing ratio of 1 : 3, or a mixture of Ceritol + k 3 and fuel, mixing ratio of 1 : 1. should be used.
The cable controls are clamped at one end of their sheaths in the tapered rubber cap and, together with this rubber cap, screwed to the lubricating device by means of union nut (Fig. 174).

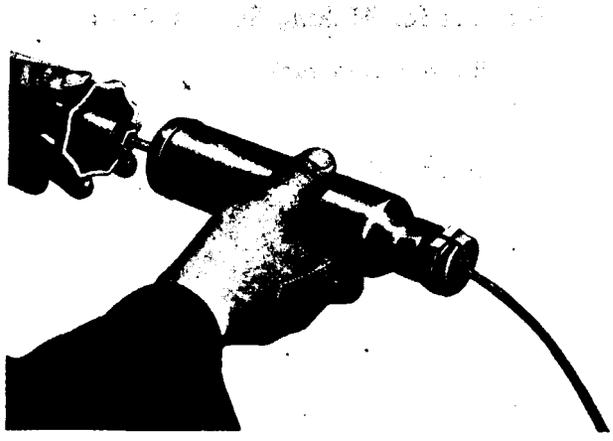


Fig. 174. Cable control inserted in a lubricating device

9. List of Special Tools

9.1. Engine

		Drawing
05-MV 197-0	Engine assembling fixture	none
02-MW 39-4	Armature puller	1.
05-MW 45-3	Gearbox sprocket-holder	2.
11-MW 15-4	Push pin for clutch compression springs	3.
01-MW 22-4	Holder for loosening the nut at the clutch shaft	4.
12-MW 5-3	Holder for loosening the nut at the drive pinion	5.
12-MV 25-4	Puller for pinion on the crankshaft	6.
22-50.010	Drift for gudgeon pin	7.
11-MW 3-4	Drift for fitting sleeves	8.
22-50.012	Casing separating screw[1])	9.
22-50.011	Pusher for crankshaft[1])	10.
11-MW 7-4	Drift for 6303 and 6004 bearings	11.
22-50.411	Drift for 6303 bearing and 22 × 47 packing ring	12.
11-MV 60-3	Fitting device for small-end bush	13.
11-ML 8-4	Setting gauge for gear-shift detent axle	14.
22-50.412	Support for piston	15.
02-MW 33-4	Guide mandrel for inserting the gudgeon pin	16.

9.2. Cycle Parts

05-MW 26-4	Centring bolt for fixing the swing arms	17.
13-MV 26-4	Sleeve for fitting the sealing rings on swing-arm bearing bolts	18.
H 8-820-3	Expanding mandrel for wheel bearing	19.
05-MW 82-4	Special wrench for loosening the lock nut (spring-loaded suspension unit)	20.
19-MW 22-1	Combined assembling spanner for telescopic fork	21.
22-51.403	Fitting sleeve for radial seal ring (telescopic fork)	22.
22-51.006	Extractor for steering bearing	23.

9.3. Electrical Equipment

29-50-801	Ignition setting gauge	none

[1]) Can be replaced by 22-50.430; 22-50.435; 22-50.437 (see Supplement).

Fitting a rubber gaiter, Part No. [illegible], as a means of protection, to ensure possibility of extending the service life of cable controls. The interior of the gaiter must be filled with a water-repellent grease.
For lubricating the cable controls, use the device shown in Fig. 175.
As a lubricant, either a mixture of gear oil and gear grease, prepared in the mixing ratio of 1 : 1, or a mixture of Castrol + 3:1 and fuel, mixing ratio of 1 : 1, should be used.
The cable controls are clamped at one end of their sheaths in the tapered rubber cap and, together with this rubber cap, screwed to the lubricating device by means of union nut (Fig. 176).

Fig. 176. Cable control inserted in a lubricating device

9. List of Special Tools

9.1. Engine

		Drawing
06-MV 197-0	Engine assembling fixture	none
02-MW 20-4	Armature puller	1.
06-MW 45-3	Gearbox sprocket-holder	2.
11-MW 15-4	Push pin for clutch compression springs	3.
04-MW 22-4	Holder for loosening the nut of the clutch shaft	4.
12-MW 5-3	Holder for loosening the nut at the drive pinion	5.
12-MV 28-4	Puller for pinion on the crankshaft	6.
22-00.010	Drift for gudgeon pin	7.
11-MW 3-4	Drift for fitting sleeves	8.
22-00.048	Casing separating screw	9.
22-00.011	Pusher for crankshaft¹)	10.
11-MW 7-4	Drift for 6302 and 6204 bearings	11.
22-00.411	Drift for 6203 bearing and 52 × 47 packing ring	12.
11-MV 60-3	Fitting device for small-end bush	13.
11-ML 6-4	Setting gauge for gear-shift detent axle	14.
22-00.412	Support for piston	15.
04-MW 23-4	Guide mandrel for inserting the gudgeon pin	16.

9.2. Cycle Parts

06-MW 26-4	Centering bolt for fitting the swing arms	17.
12-MV 20-4	Sleeve for fitting the sealing rings on swing-arm bearing bolts	18.
H 6-430-3	Expanding mandrel for wheel bearing	19.
06-MW 60-4	Special wrench for loosening the lock nut (spring-loaded suspension unit)	20.
18-MW 23-1	Combined assembling spanner for telescopic fork	21.
22-01.408	Fitting sleeve for radial seal ring (telescopic fork)	22.
22-01.009	Extractor for steering bearing	23.

9.3. Electrical Equipment

24-03-001	Ignition setting gauge	

¹) Can be ordered by [illegible]

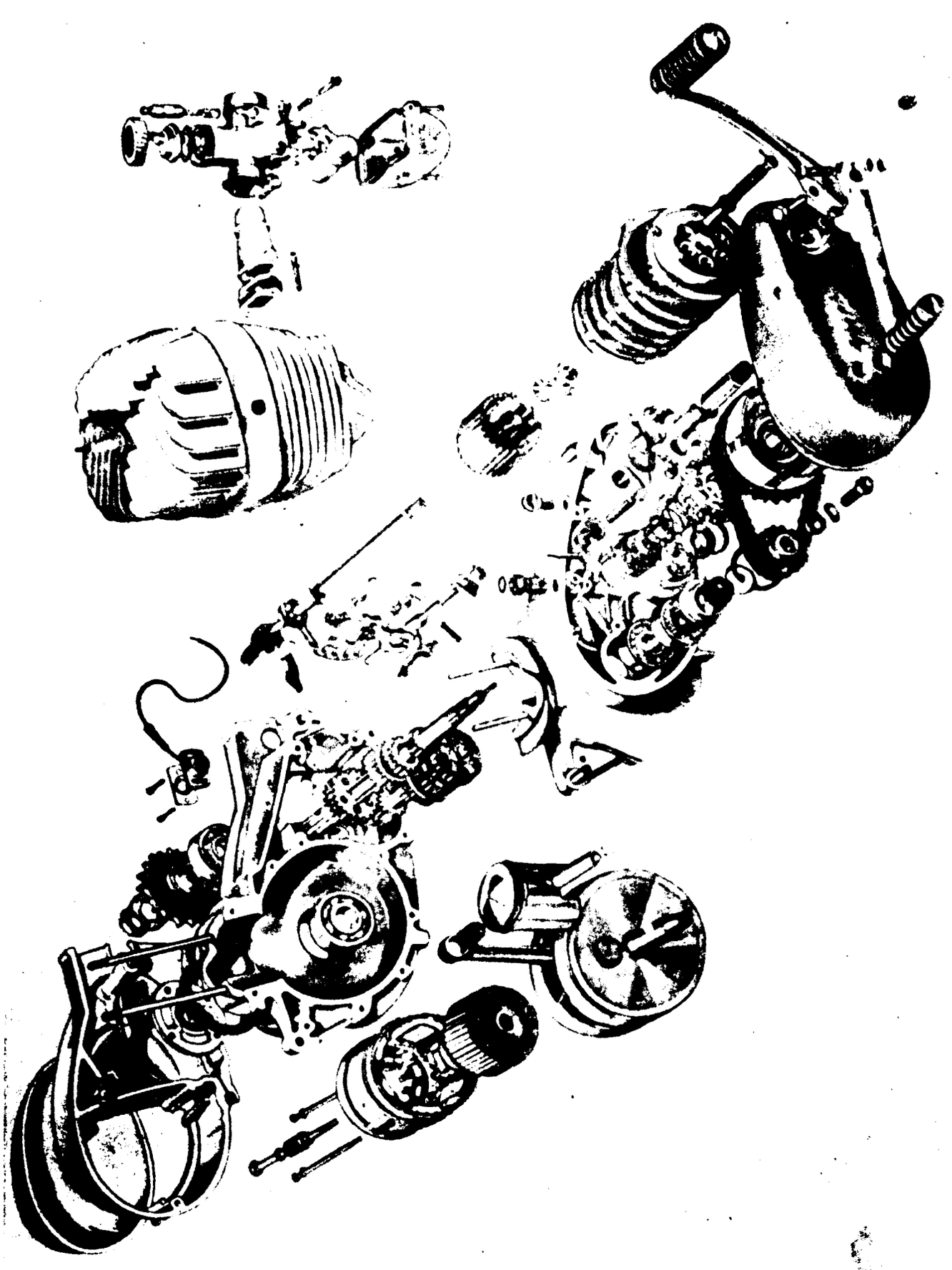


Fig. 1. Exploded view of the engines MM 125/3 - 150/3 (with revolution counter drive)

1. Technical Data

		MM 123/3	MM 150/3
1.1.	**Engine**		
	Connecting-rod bearing	needle bearing on top K 15 × 19 × 20 FKI	
	Crankshaft main bearing	2 ball bearings 6204 TN W C 4 f (20 × 47 × 14) TGL 2981 1 ball bearing 6304 S C 4 f (20 × 52 × 15) TGL 2981	
		lubrication by fuel-oil mixture 50 : 1	
1.8.	**Capacities**		
	Telescopic fork	230 cm^3 of damping liquid for each fork member	

2. Fuel, Lubricants and Fluids

2.2. Engine Oil

The two-stroke engine oil is added to the fuel in a mixing ratio of

1 : 50

This means that, for example, 0.20 l of engine oil are added to 10 l of fuel.

2.5. Damping Fluid

The shock-absorber oil must be mixed with molybdenum disulfide oil suspension (Molykote, Fimol or the like) in the mixing ratio of 45 : 1.

3. Disassembly of the Engine

The sprocket wheel on the crankshaft is provided with a M 26 × 1.5 thread (arrow-head) and one screw M 10 × 25 is used to press it on the tapered end of the crankshaft.

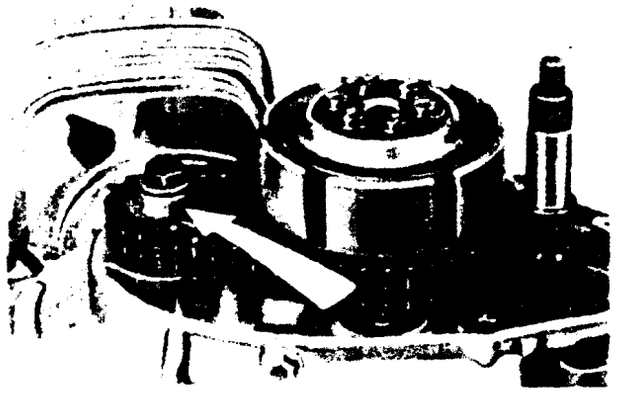


Fig. 2. Primary drive

The sprocket wheel can be removed from the crankshaft by means of puller 12-MV 32-4. For this purpose, the puller must be properly tightened!

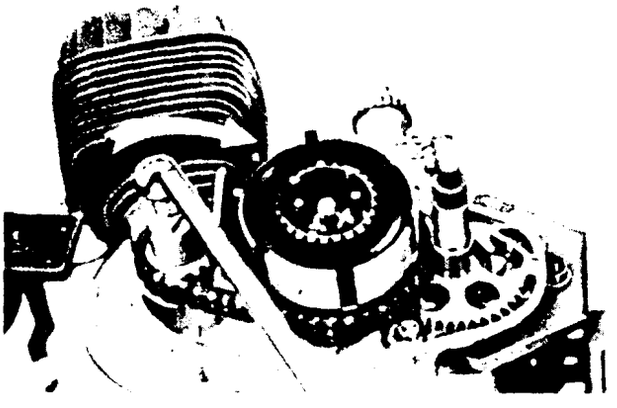


Fig. 3. Dismantling the primary drive

In the case of the changed engine, the pulling of the right-hand casing half by means of the assembling bridge 22-50.430 (1) and the extracting sleeve 22-50.435 (2), which must be completed by the extracting screw 22-50.437 (3), is possible.
Before screwing the assembling bridge in place (arrow-heads), unscrew the clamping members of the assembling device (4) or turn them away (5).

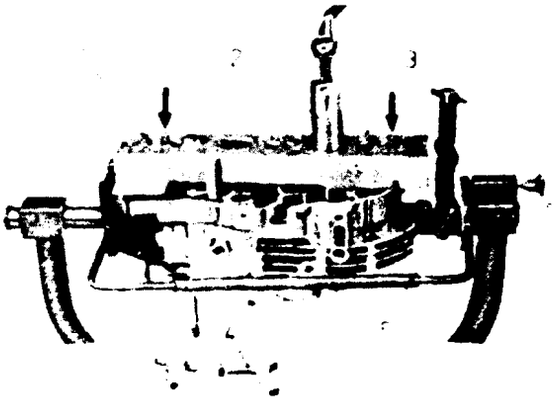


Fig. 4. Pulling off the right-hand casing half
(1) Assembling bridge
(2) Pulling sleeve
(3) Pulling screw
(4) Rear clamping device
(5) Front clamping device

For pushing out the crankshaft, the assembling bridge **22-50.430** is screwed to the left-hand casing half (arrow-heads). For this purpose, use the two front fastening bore-holes for the dynamo cover. The 22-50.435 extracting sleeve is again used as pressure tool.

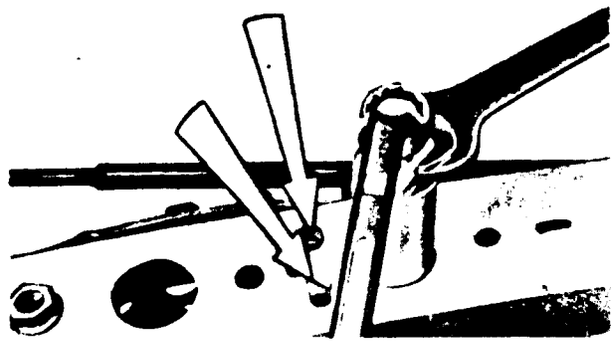


Fig. 5. Pressing out the crankshaft

After heating the two casing halves to a temperature of about 100 °C, the crankshaft bearings can be driven out by means of suitable mandrels. As to the bearings of the left-hand casing half, use the mandrel and place it against the internal rings.
The packing ring carrier (B) is **not** removed. Press the shaft seal ring, D 22 × 30 × 7 at the clutch side, towards the outside, after having removed the circlip 30 × 2.

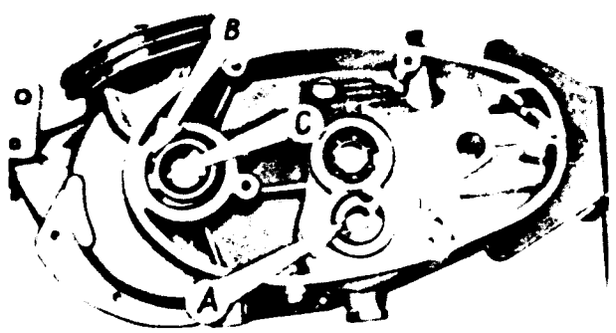


Fig. 6. Dismantling the ball bearings
(A) Separating plate for bearings of the layshaft
(B) Seal ring carrier with lock ring
(C) Seal ring D 20 × 30 × 7

For changing the packing ring, the engine need not be dismantled!

When the crankshaft bearings have been left on the crankpins during the dismantling of the crankshaft, they can be pulled off, as is shown in the Figs. 7 and 7a, by means of the ball-bearing extractor 22-50.431 and the rings (1) 22-50.432 (regarding the engines MM 125/2 – 150/2) and (2) 22-50.434 (regarding the engines MM 125/3 – 150/3) on the side of the dynamo. The clamping pieces (4) have to be pressed between crankshaft and bearings by means of a vice or the two screws M 8 × 100.

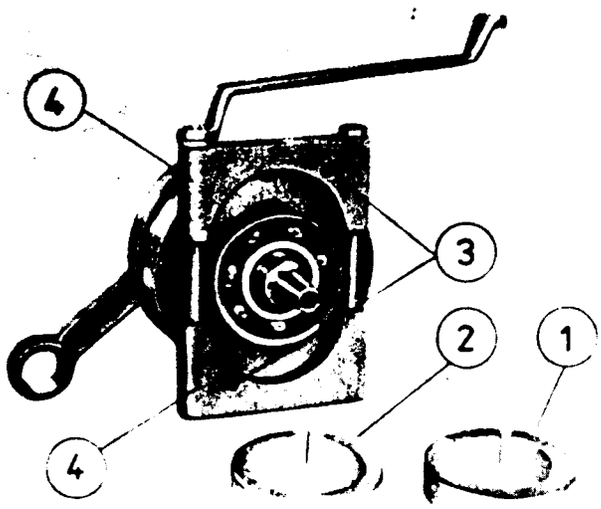


Fig. 7. Applying the ball-bearing extractor
(1) Ring 22-50.432 for bearings 6303 and 6204
(2) Ring 22-50.434 for bearing 6304
(3) Holes for pressing-off screws
(4) Clamping pieces

Subsequently, the bearing can be pressed off against the crank plate by alternately and uniformly tightening two M 8 × 50 screws having a pin at the end of the screw.

Notice! The ball-bearing extractor must not be allowed to turn when pulling the bearings otherwise the M 8 × 50 screws engage with the bore-holes in the crank plates.

Fig. 7a. Pressing-off the crankshaft bearings
(1) Pressing-off screws M 8 × 70 with hardened pin

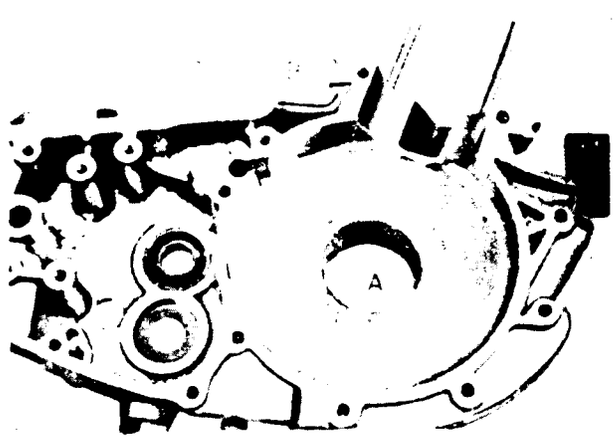


Fig. 8. Lubricating channel, left-hand side
(A) Oil outlet
(B) Oil collecting groove
(T) Separating disk

The lubricating channels in the left-hand and right-hand casing halves must always have free passage. The separating disk (T) made of rubber is to be placed into the recess in the casing separating area at the oil collecting groove (B) when the engine is assembled. The disk separates this oil collecting groove into a left-hand and a right-hand part. In this way, it ensures that all crankshaft bearings are properly lubricated even when the engine is passed through fairly oblique positions.

4. Assembling the Engine

Mounting the crankshaft bearings at the side of the clutch

In contrast to the old mounting of the crankshaft, the left-hand casing half must be pre-assembled in such a way that the two crankshaft bearings at the side of the clutch (mated – selection with similar bearing clearance) are fitted into the casing that is heated to a temperature of about 100 °C.

Bearing of the Gudgeon Pin

In the new design, the gudgeon pin is mounted in a needle bearing. Crankshafts for replacement or as spare-part will be delivered with adapted needle bearing. The three possible dimensional variations (grey, white, black) of the gudgeon pin will fit to this assembly. If, after a longer service life, the clearance of the gudgeon pin becomes excessive, needle bearings with other dimensional variations can be fitted.

Take into consideration: The oil-free gudgeon pin must be capable of being turned, without any clearance and without jamming, in the also oil-free needle bearing.

Regarding the adjustment of the gear

Our experiences have shown that the dogs of the gear-shift member must engage with the segment lever as far as up to half the thickness of the material. The dimensions given in the text for Fig. 35 in the Repair Manual for TS 125/150 are, therefore, extreme values and must not necessarily be correct in the case of any gearbox.

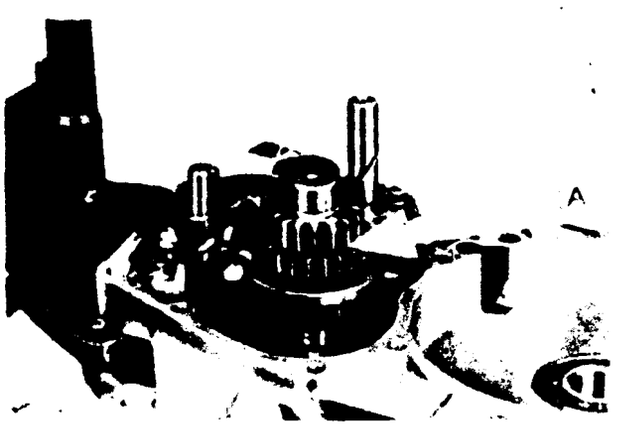


Fig. 9. Checking the distance between teeth in the 4th speed
A = 0.2 mm

If the setting gauge 11-ML 8-4 for adjusting the gear-shift detent axle is not available and the gear-shift detent axle is to be adjusted by means of the "block measure" 13 mm, the distance (A) of 0.2 mm between gear-shift wheel 1st/3rd speed and the fixed gear of the 4th speed on the layshaft must be checked with the fourth speed in engagement. If necessary, the gear-shift detent axle must be re-adjusted even when the measure of 13 mm will be changed as a consequence.

Notice! Carry out measurements only with the gear-shift detent axle locked by means of a lock nut.
Any change in the gearbox adjustment with the engine not opened is not advisable.

Fig. 10. Arrangement of the revolution counter drive
(1) Bearing bush
(2) Shaft with pinion
(3) Double wheel
(4) Bearing bolt for double wheel
(5) Locking plate

Mounting the crankshaft bearing 6304

The bearing at the side of the dynamo is fitted in the same way as in the former engines, but with the help of the 12-MW 31-4 drift. Compensation of the sealing cap is effected in the same way as in the former design.

Regarding the primary drive

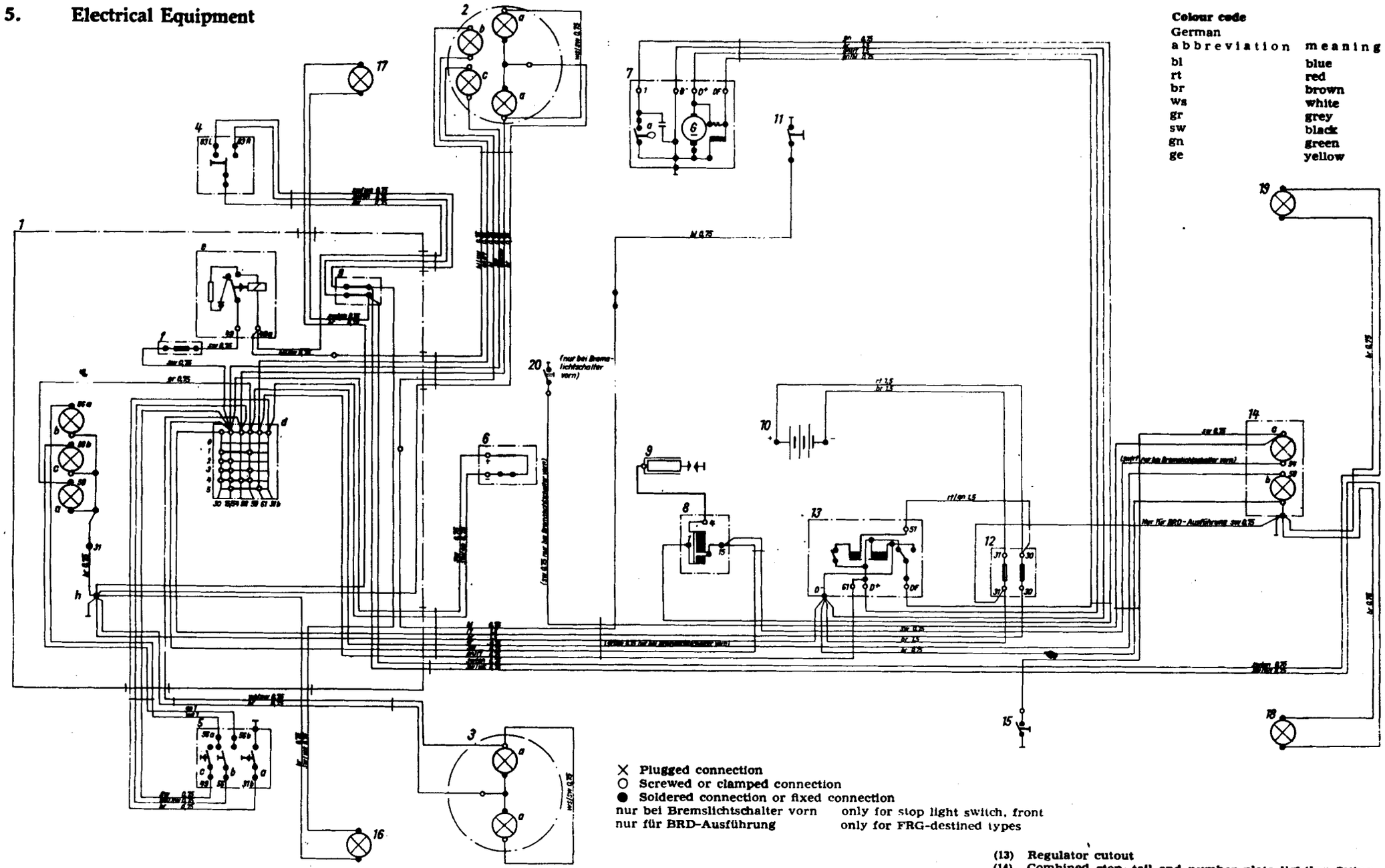
From January 1978, the engines MM 125/3 – 150/3 in the form of the de luxe models are provided with revolution counter drive. Older engines and engines of the standard design **cannot** be equipped with this drive.
The double wheel (3) is only accessible when the clutch drum is removed.

Observe when mounting:

- Press the bearing bolt (4) for the double wheel in place in such a manner that the bolt, measured from contact area for the double wheel at the gearbox casing, project for 29 ± 0.2 mm into the compartment for the primary drive.
- Mount the double wheel (3) when having provided it at the bearing area **and** at the teeth with oil.
- Fit the shaft (2) with grease.

Regarding the cylinder

From 1978, the cylinder is only provided with the marking of the nominal size, in contrast to the information given as an explanation to Fig. 66 in the Repair Manual for the TS 125/150. Month and day of manufacture are no longer stamped in it.



Colour code

German abbreviation	meaning
bl	blue
rt	red
br	brown
ws	white
gr	grey
sw	black
gn	green
ge	yellow

× Plugged connection
○ Screwed or clamped connection
● Soldered connection or fixed connection
nur bei Bremslichtschalter vorn — only for stop light switch, front
nur für BRD-Ausführung — only for FRG-destined types

Fig. 11. Wiring diagram for TS 125/150 de luxe

(1) Headlamp
(1a) Parking light
(1b) High-headlight beam
(1c) Passing beam
(1d) Ignition-light switch
(1g) Receptacle contact strip 2-pole
(1h) Ground point
(2) Speedometer
(2a) Speedometer illumination
(3) Revolution counter
(3a) Revolution-counter illumination
(4) Flasher switch
(5) Combined dimmer switch
(6) Horn
(7a) Contact breaker
(8) Ignition coil
(9) Sparking plug
(10) Battery
(11) Idling indicator switch
(13) Regulator cutout
(14) Combined stop, tail and number plate lighting fitting
(14a) Stop lighting fitting
(14b) Combined tail and number plate lighting fitting
(15) Stop light switch, rear
(16) Flashing-light direction indicator, front, left
(17) Flashing-light direction indicator, front, right
(18) Flashing-light direction indicator, rear, left
(19) Flashing-light direction indicator, rear, right

7. Cycle Parts

7.2.1.3. Replacement of the Swing-arm Bearing Pin

Since April 1975, the swing-arm bearings have been mounted in rubber bushes in the place of the former slide bearings. The new bearing is free from maintenance, and older vehicles can be provided with it. For this purpose, a swing-arm bearing bolt of the new design (solid material, not hollow) and a complete swing-arm with the rubber bearings pressed in place are required.

Important! When tightening the nuts of the swing-arm bearing bolt with 70^{+10} Nm (7^{+1} kp-m), the swing-arm must be in its position "fully sprung out".

Replacement of the rubber bearings with the 22-50.445 assembling device

- Pressing out the internal tubes (1) and (2) with the help of the mandrel (3) in a mandrel press in one pass.
- Cutting up and pressing out the rubbers (4) and (5).
- Pressing the new rubbers (4) and (5) in place, using the short collar of the mandrel (6) and approaching from outer ends of the swing-arm. In this operation, place the intermediate ring (7) between table of the mandrel press and swing-arm.
- Apply soap solution to the rubbers (4) and (5) — no oil! The mandrel (3) — slip the internal tube (1) or (2) on the cylindrical end prior to this operation — with its tapered end ahead must then be pressed in, in one pass, until the inner tube uniformly projects from both sides of the swing-arm tube.

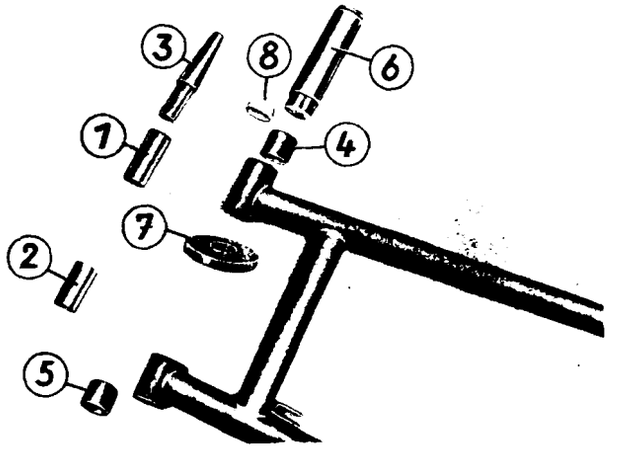


Fig. 12. Fitting the rubber bearings
(1) Internal tube
(2) Internal tube
(3) Guide mandrel
(4) Rubber bush
(5) Rubber bush
(6) Pressing-in mandrel
(7) Intermediate ring
(8) not applicable

7.2.2.2. Telescopic Fork

Dismantling the telescopic fork members

Remove the protective caps or protective bellows from the slide tubes. Then pull the compression springs out of the guide tubes and pour out the damping liquid.

After externally cleaning the telescopic fork members, loosen the fastening nut (Fig. 15/1) for the supporting tube, using an L-handled socket wrench (width over flats 10), and then remove the supporting tube together

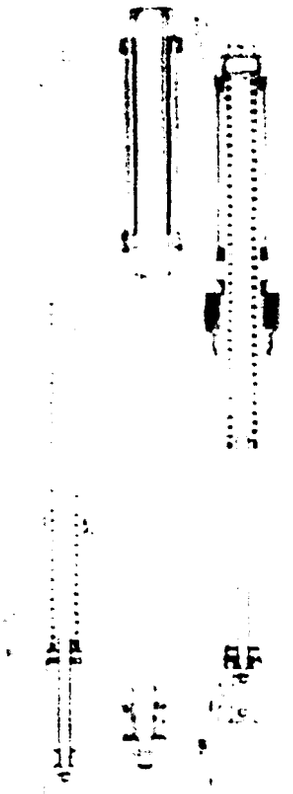


Fig. 13. Telescopic fork with aluminium slide tubes

with the washer (Fig. 15/2). If, during loosening or tightening the nut, the supporting tube also starts turning, then use a screw-driver, put it through the socket wrench and retain the supporting tube in place.

Fig. 14. Loosening the fastening nut for the supporting tube

The guide tube (A) must be pulled out of the slide tube (B) and the parts (3), (4), (5) removed. Put the supporting tube (6) into the guide tube.

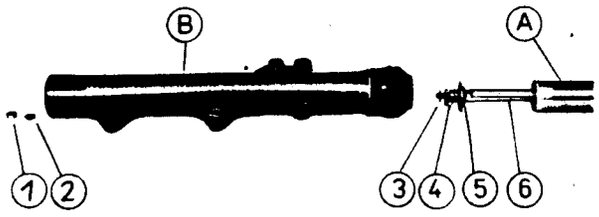


Fig. 15. Dismantling the slide tube
(a) Guide tube
(b) Slide tube
(1) Nut M 6
(2) Corrugated washer 6
(3) Sealing washer
(4) Compression spring
(5) Disk (old design) or cup for end stop
(6) Supporting tube

Remove the circlip 32 × 1.6 (1) out of the guide tube by means of a screw-driver. In this operation insert the screw-driver into the groove at the external diameter of the throttle.

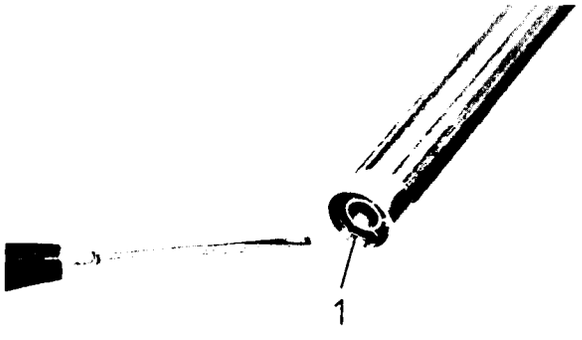


Fig. 16. Dismantling the throttle mounting
(1) Circlip 32 × 1.6

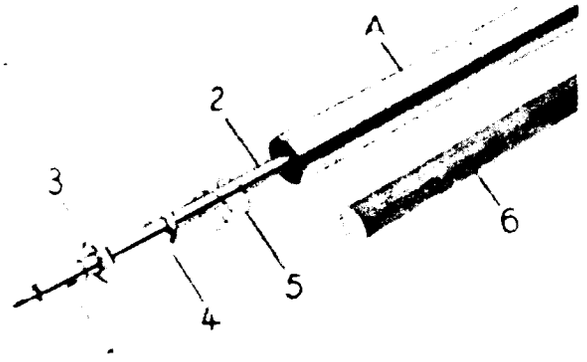


Fig. 17. Removing the throttle valve
(1) Circlip 32 × 1.6
(2) Supporting tube
(3) Throttle
(4) Valve plate
(5) Valve spring
(6) Piece of round timber 22 mm in diameter, 600 mm long
(A) Guide tube

Remove the parts (3), (4) and (5). For a clearer demonstration, the supporting tube (2) is here shown in the withdrawn condition.

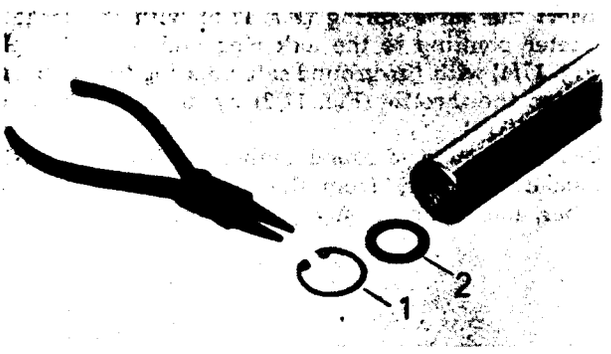


Fig. 18. Removing the thrust washer
(1) Circlip
(2) Thrust washer

Remove the lock ring (1) and the thrust washer (2). Use a piece of round timber (Fig. 17/6 about 600 mm long and having a diameter of 22 mm, push the supporting tube downwards (fitting direction of the telescopic fork) out of the guide tube.

Mounting the telescopic fork members

Clean parts which are fully serviceable and in perfect working order have only to be used. The guide tube must not show any ridges or any damage to the chromium plating; it may be distorted for maximum 0.05 mm. When distortion are larger, do not straighten the tube but use new parts.
Check the sealing lip of the seal ring D 35 × 47 × 7 ST for wear and the spring for the sealing lip for sufficient tension. In the case of doubt, use new seal rings for mounting.
Press the seal ring in place. Do not strike against it, this may cause the spring of the seal ring to jump off.

Fig. 19. Fitting the seal ring
(1) Drift 11-MW 7-4
(2) Seal ring D 35 × 47 × 7 St

The piston ring of plastic (arrow) should not show any ridges in its sealing area. The damping bore-hole must be free from burr. Do not change the diameter of the hole!
Insert the valve spring (Fig. 17/5) with the large diameter pointing to the lock ring and the valve plate (Fig. 17/4) with the ground side pointing to the throttle. Fasten the throttle (Fig. 17/3) by means of the circlip (Fig. 17/1).
Using the piece of round timber, push the supporting tube downwards, from the upper end of the guide tubes, and retain the supporting tube.

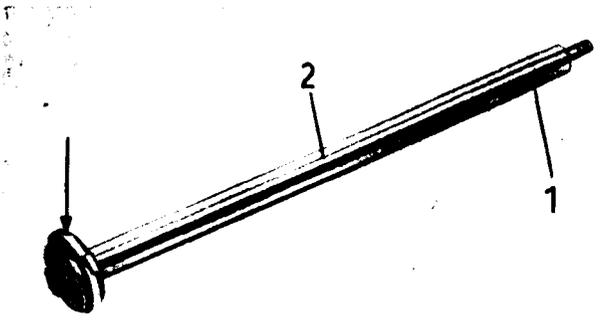


Fig. 20. The supporting tube
(1) Damping bore-hole
(2) Supporting tube
(arrow-head) Seal ring of thermoplastic material

Turn over the guide tube. Disk and cup for end stop (1), compression spring 19 mm in diameter (2), and packing plate (3) must be put in place, then the guide tube slipped on and fastened by screws.

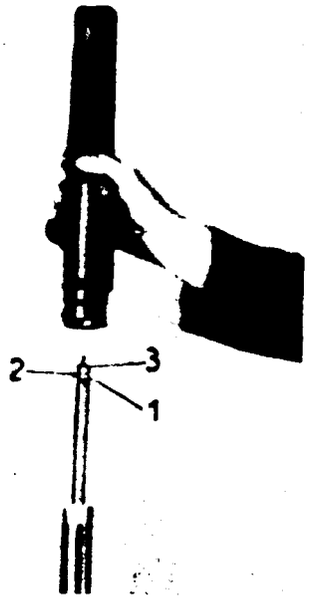


Fig. 21. Connecting the slide tube and the guide tube

Put the protective bellows and protective cap in place. The collar of these parts must be engaged with the groove (A).

Notice! The vent hole in the protective bellows always must point to the rear.

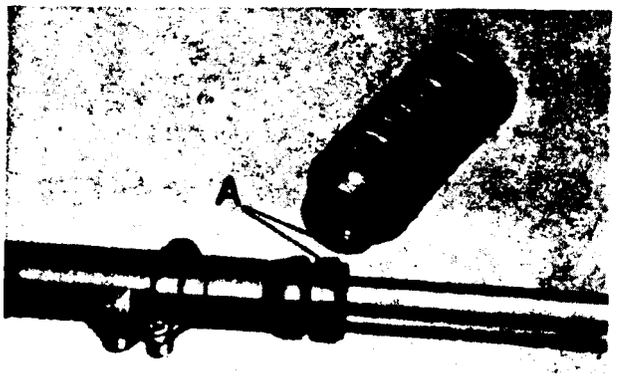


Fig. 22. Fitting the protective bellows

Oil levels and capacities

The oil level can be checked by means of a piece of wire to be introduced down to the bottom of the telescopic fork, the wire has a diameter of 4 mm.

Normal capacity: 230 cm^3 (oil level 350 mm) in each member of the fork

Maximum capacity: 250 cm^3 (oil level 370 mm) in each of the two members of the fork

Compression spring

For each of the two members of the fork, 1 helical spring with 78.5 turns and 4 mm wire diameter.

Fig. 23. Checking the oil level in the telescopic fork

9. List of Special Tools

9.1. Engine

		Drawing
22-50.430	Assembling bridge[1])	1.
22-50.431	Ball-bearing extractor	2.
22-50.432	Ring for bearings 6303 and 6204 (engines MM 125/2 – 150/2)	3.
22-50.434	Ring for bearing 6304 (engines MM 125/3 – 150/3)	4.
22-50.435	Pulling sleeve[1])	5.
22-50.437	Pulling screw for pulling sleeve[1])	6.
89-99.305	Puller 12-MV 32-4 for sprocket wheel on crankshaft	7.
89-99.304	Drift 12-MV 31-4 for bearing 6304	8.

9.2. Cycle Parts

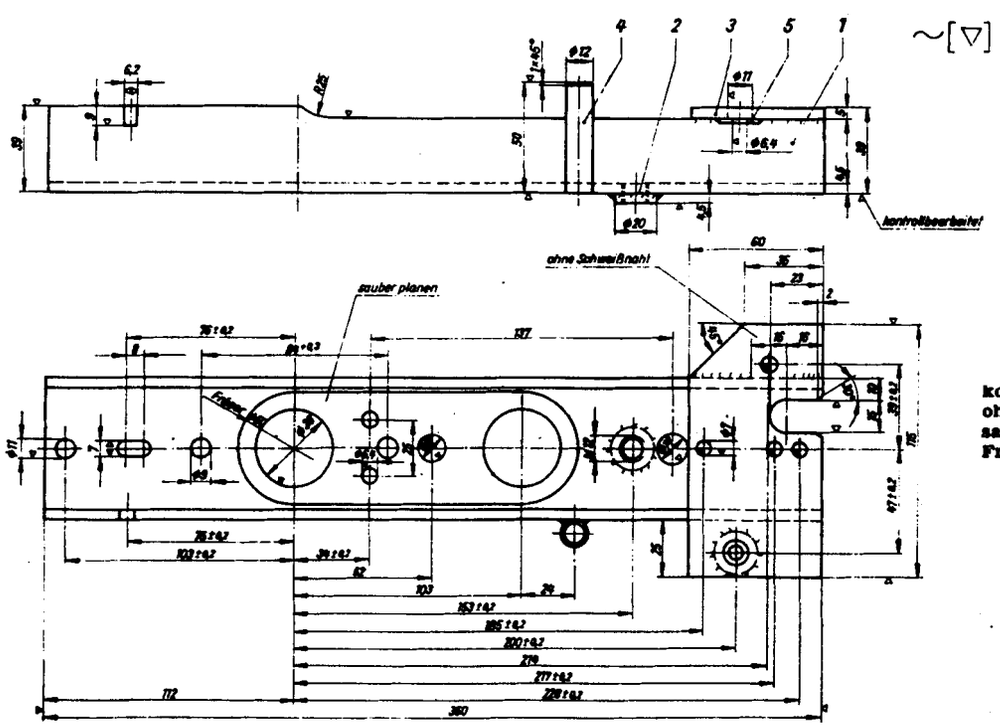
22-50.445	Assembling fixture for rubber bearing of swing-arm	9.

10. Drawings of the Special Tools

1. Assembling bridge 22-50.430

Weld seam: △2.5 SG (CO_2) II B TGL 14904/3-10 Mn S/5, ∅ 1.2 TGL 7253

No.	Quantity	Description	Material/Standard	Rough Size	Remarks
1	1	Basic body	U-steel 6 1/2 St 38 b-2 TGL 0-1026	350 long	
2	1	Washer	St 38 b-2k TGL 0-1026	∅ 20 × 8	
3	1	Plate	St 38 b-2 TGL 0-1026	5 × 60 × 115	
4	1	Bolt	St 38 b-2 TGL 0-1026	∅ 12 × 55	
5	1	Disk	R 5.8 TGL 0-440		

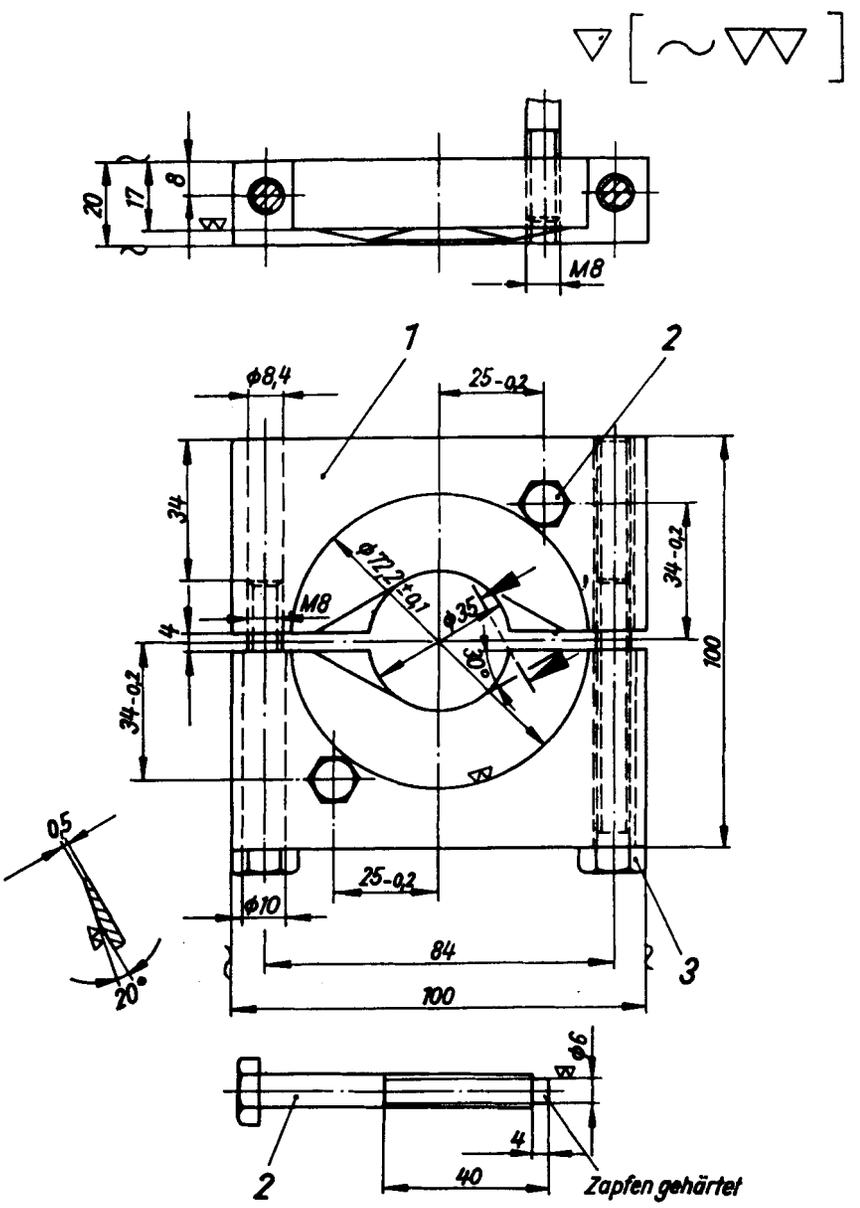


kontrollbearbeitet	control-machined
ohne Schweißnaht	without weldseam
sauber planen	to be faced properly
Fräser	cutter

[1]) Replacing: 22-50.012 separating screw
22-50.011 pusher for crankshaft

2. Ball-bearing extractor 22-50.431

No.	Quantity	Description	Material/Standard	Rough Size	Remarks
1	1	Puller	C 15	20 × 100 × 105	carbo-nitrated
2	2	Hexagon-head screw M 8 × 70	TGL 0-931		
3	2	Hexagon-head screw M 8 × 100	TGL 0-933		

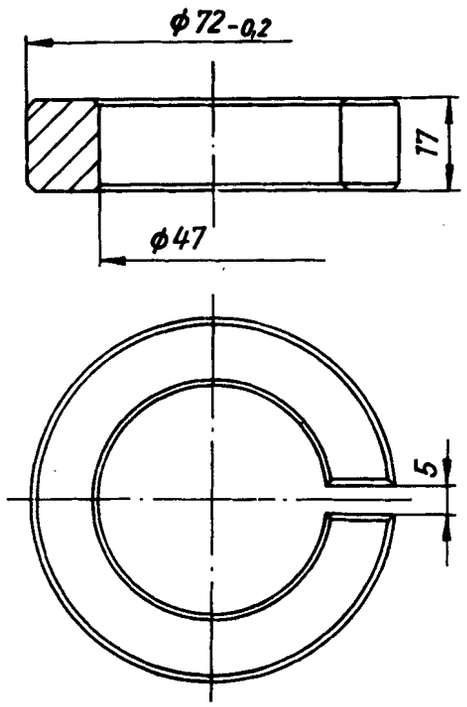


Zapfen gehärtet pin hardened

3. Ring for bearings 6303 and 6304 22-50.432

all chamfers 1 × 45°

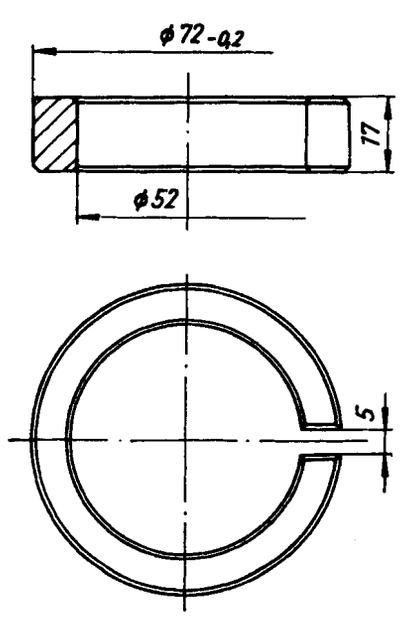
No.	Quantity	Description	Material/Standard	Rough Size	Remarks
	1	Ring	St 38 b-2 TGL 0-1026	Ø 75 × 20	



4. Ring for bearing 6304 22-50.434

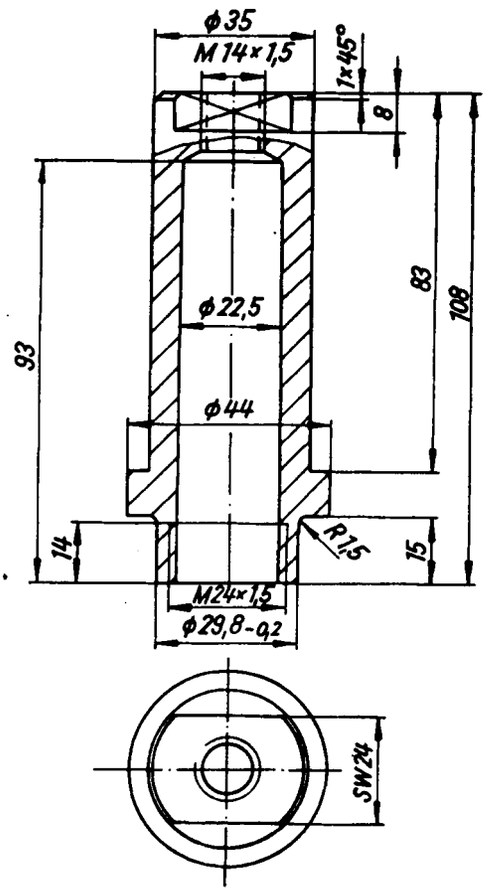
all chamfers 1 × 45°

No.	Quantity	Description	Material/Standard	Rough Size	Remarks
	1	Ring	St 35 hb TGL 9013	Ø 76 × 12 × 22	



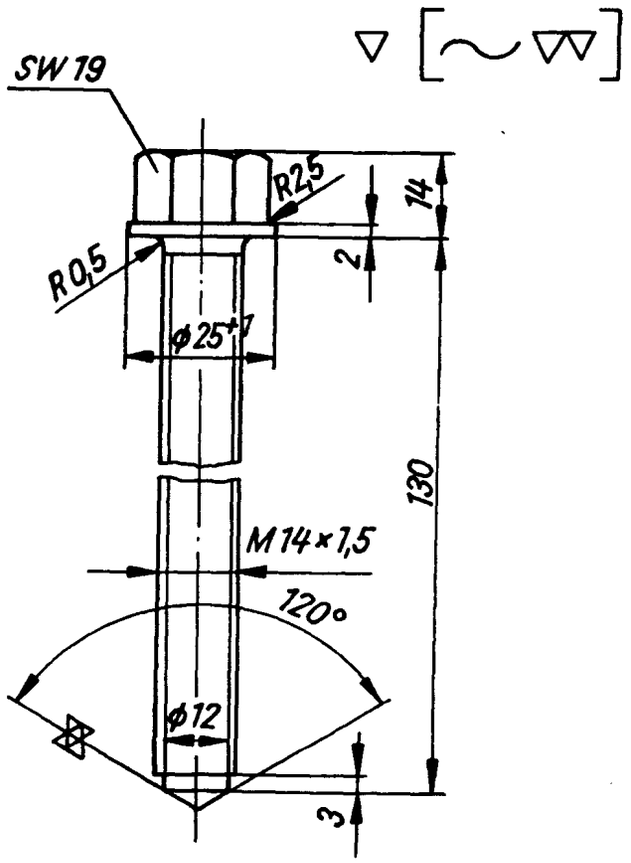
5. Pulling sleeve 22-50.435

No.	Quantity	Description	Material/Standard	Rough Size	Remarks
	1	Sleeve	C 45	Ø 45 × 112	



6. Pulling screw for pulling sleeve 22-50.437

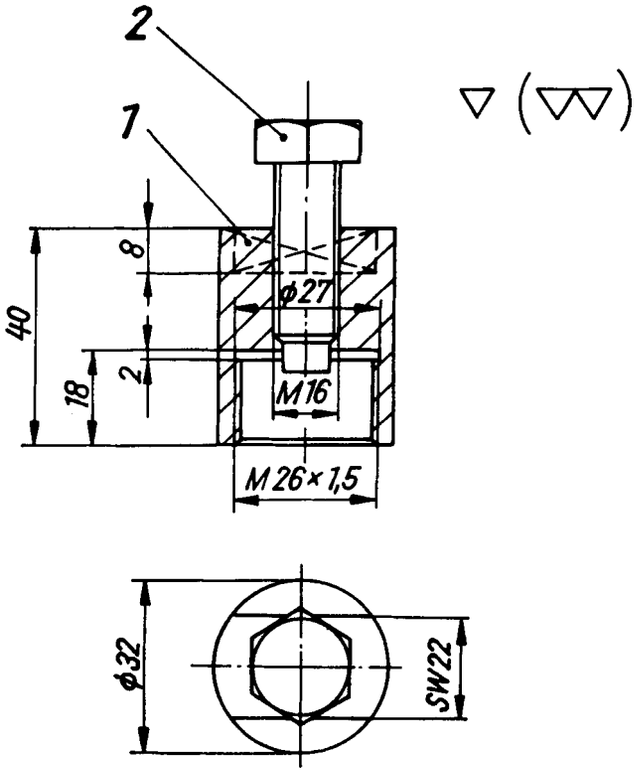
No.	Quantity	Description	Material/Standard	Rough Size	Remarks
	1	Screw	C 60 K	∅ 26 × 169.5	



7. Puller 12-MW 32-4

degreased, electro-galvanised

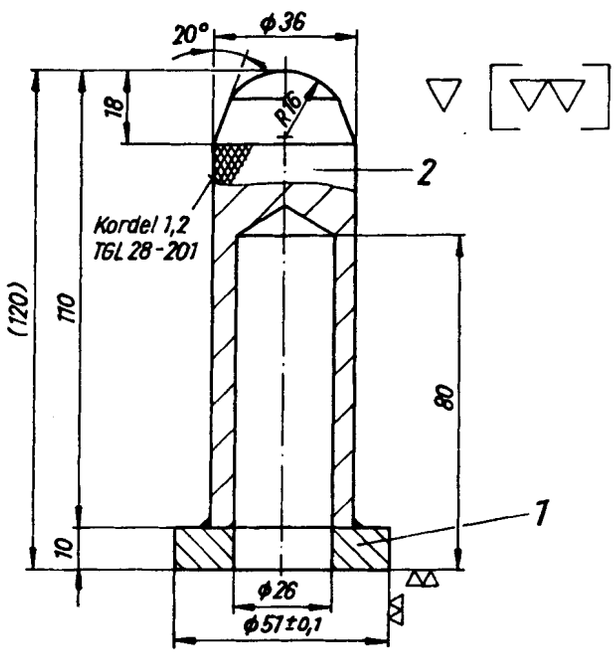
No.	Quantity	Description	Material/Standard	Rough Size	Remarks
1	1	Puller	St 38 b-2, TGL 0-1026	∅ 36 × 45	
2	1	Screw M 16 × 60	TGL 0-561		pin hardened



8. Drift 12-MV 31-4

immersed, hardened all radii without dimensions $R = 1$ mm

No.	Quantity	Description	Material/Standard	Rough Size	Remarks
1	1	Shaft	C 15	∅ 30 × 112	case-hardened
2	1	Ring	C 15	∅ 56 × 12	case-hardened



Kordel to be knurled

9. Assembling fixture 22-50-445

No.	Quantity	Description	Material/Standard	Rough Size	Remarks
1	1	Supporting disk	St 38 b-2 TGL 0-1026	Ø 70 × 20	
2	1	Guide mandrel	C 45	Ø 25 × 110	nickel-plated
3	1	Pressing-in mandrel	St 38 b-2 K TGL 0-1026	Ø 32 × 125	nickel-plated