REPAIR MANUAL

for the MZ Motor-cycle

ETZ 250

with 201 illustrations

and

29 drawings of special tools

VEB MOTORRADWERK ZSCHOPAU

Betrieb des IFA-Kombinats Zweiradfahrzeuge

The ETZ 250 MZ Motor-cycle is a product from VEB Motorradwerk Zschopau, Betrieb des IFA-Kombinats Zweiradfahrzeuge

This Repair Manual was written by a group of engineers in the employ of the manufacturer.

fv

VEB FACHBUCHVERLAG LEIPZIG

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Preface

In the high latitudes of Finland, in the parching heat of Africa, and 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:

The safety of the driver depends on the reliability of the mechanic and his excellent workmanship.

Finding the actual cause of the trouble ensures that no material is wasted and labour costs are restricted to a minimum.

From these items, three advantages result:

1. no retouching work,
2. short times of inoperation and
3. low repair costs!

Good workmanship in repairs largely depends on the use of the special tools and means recommended by MZ. We should like to underline that especially self-service workshops and amateur constructors should bear this in mind to avoid considerable additional expenditure of labour and material.

Our authorised MZ-Workshops may purchase the special tools from the MZ Spare Sales Department - for amateur constructors and the like, however, there is only the possibility of constructing them with the help of the sketches given in Section 8.2.

We hope this Reference Book offers the required information to the staffs 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 to each and all.

VEB MOTORRADWERK ZSCHOPAU
Betrieb des IFA-Kombinats Zweiradfahrzeuge
Service Department

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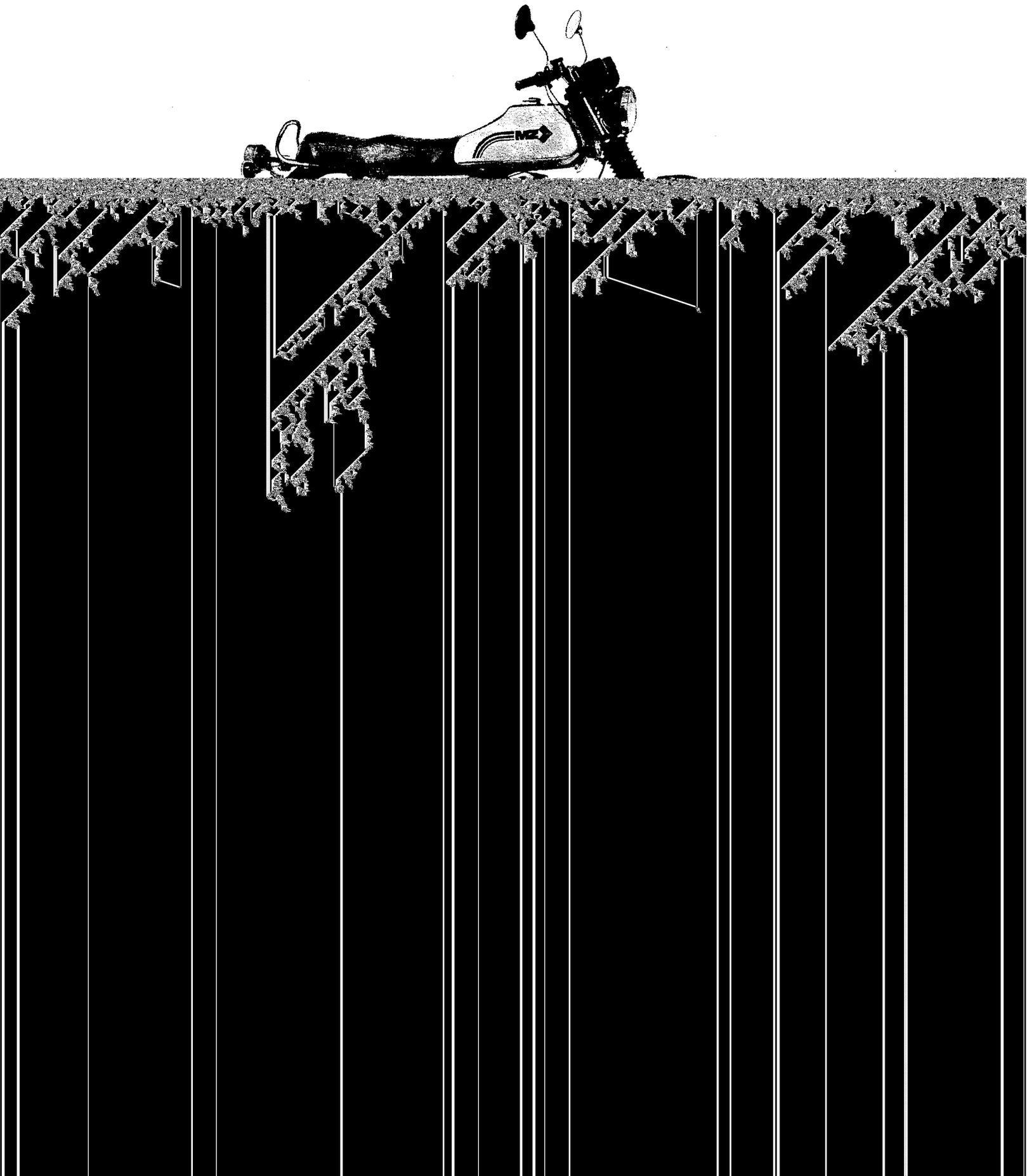
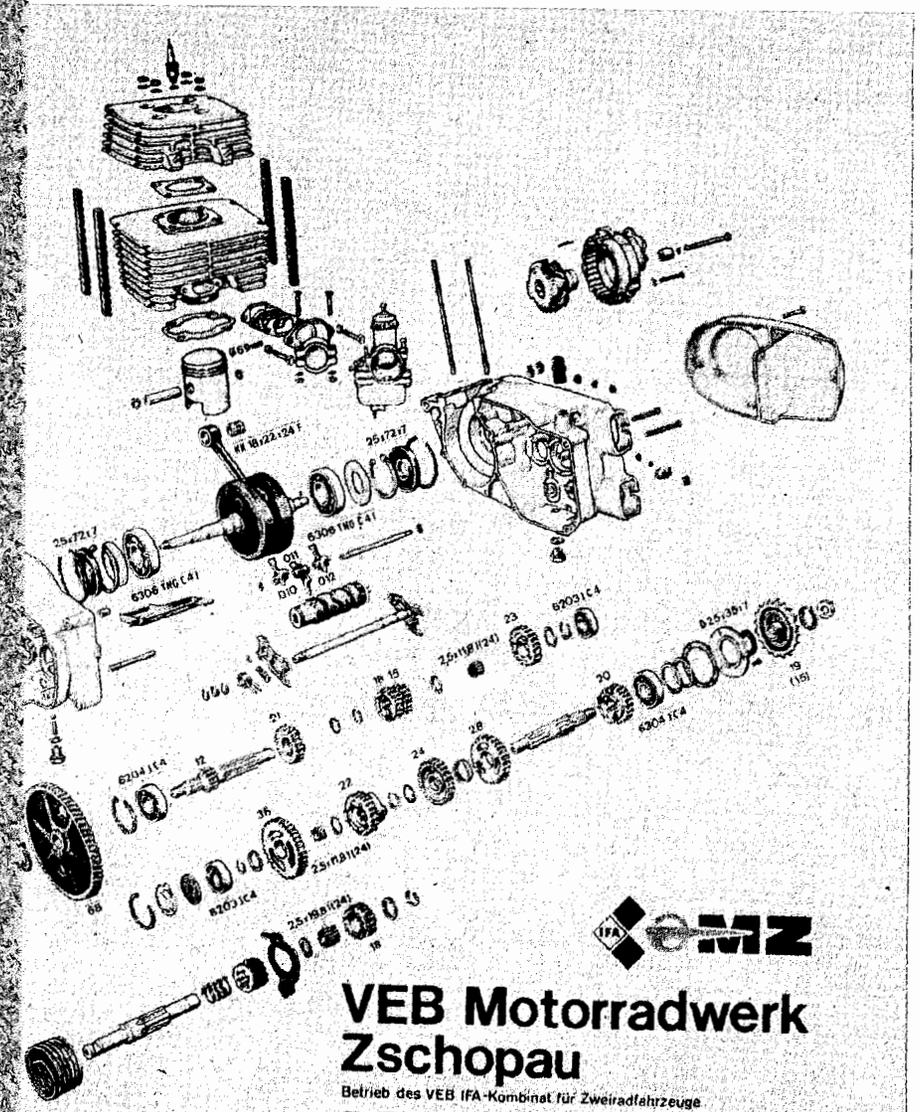




IFA MZ

VEB Motorradwerk Zschopau

Betrieb des VEB IFA-Kombinat für Zweiradfahrzeuge

DDR·9360 Zschopau

1. Technical Data

1.1. Engine

Engine type	EM 250
Cycle	two-stroke reverse scavenging
Cooling system	air-cooled (relative wind)
Number of cylinders	1
Stroke / bore	65 mm / 69 mm
Swept volume	243 cm^3
Ratio of compression	10.5 : 1
Compression volume of cylinder head (when assembled)	about 26 cm^3
Maximum output (at about 5,500 rpm)	15.5 kW (21 hp)
Maximum torque (at about 5,200 rpm)	27.4 Nm (2.8 kpm)
Lubrication	petroil lubrication 50 : 1 (or, for selected export countries, by means of oil proportionating pump)
Connecting-rod bearings	cage-type needle bearings for big end and gudgeon pin
Crankshaft main bearings	2 bearings 6306 C 4 f 1 bearing 6302 C 3 f
Timing angle	
Induction	155° crank angle
Transfer	123° crank angle
Exhaust	180° crank angle

1.2. Carburetter

	BVF 30 N 2-5
Transfer port	30 mm
Main jet	130
Needle jet	70 (with cross bore)
Partial-load needle	C 6 with 5 notches
Needle position from top	3 to 4 [1] (4th for running-in period)
Starting jet	90
Slow-running jet	45
Float valve	20
Slow-running air screw	about 1 revolution open
Throttle-valve, valve opening	5 mm

1.3. Electrical Equipment

Ignition	battery ignition
Ignition timing	$3.0_{-0.5}$ mm before T.D.C. ≙ 22° 15' -2° crank angle
Contact breaker points gap	$0.3^{+0.1}$ mm
Sparking-plug	M 14-260
Electrode gap	0.6 mm
Dynamo	12 V, 210 W, three-phase current
Rectifier	silicon semi-conductor in three-phase bridge circuit
Regulator	single-system regulator, temperature-compensated, positive-regulating
Battery	12 V, 9 Ah
Ignition coil	12 V, miniature ignition coil
Headlamp	light opening 170 mm in diameter, asymmetrical passing beam
Stop, tail and number-plate lighting fitting	light opening 120 mm in diameter

1) Besides the driving habit, the sparking-plug appearance is decisive for the setting.

Horn	under the fuel tank
Direction indicator	4-lamp flashing-light system
Switches	
Ignition-light switch	in instrument pod
Switch combination at handle-bars	dimmer switch, direction indicator system, electric horn, by-pass light signal
Stop-light switch	in rear-wheel hub and front-wheel hub or brake master cylinder
Electric bulbs	
Headlamp	12 V, 45/40 W (twin-filament) TGL 11 413
Parking light	12 V, 4 W cap Ba 9 s TGL 10 833
Stop light	12 V, 21 W cap Ba 15 s TGL 10 833
Direction indicator	12 V, 21 W cap Ba 15 s TGL 10 833
Tail light	12 V, 5 W cap Ba 15 s TGL 10 833
Charging control light	12 V, 2 W cap Ba 7 s TGL 10 833
Idling indicating light	12 V, 2 W cap Ba 7 s TGL 10 833
High-beam headlight indicator	12 V, 2 W cap Ba 7 s TGL 10 833
Control of direction indicator	12 V, 2 W cap Ba 7 s TGL 10 833
Speedometer illumination	12 V, 2 W cap Ba 7 s TGL 10 833
Fuses	
Main protection (2 fuses)	fuse link 16 A
Direction indicator system	fuse link 4 A
Dynamo (line DF)	miniature fuse 2 A

1.4. Gearbox

Clutch	on the left-hand end of crankshaft - in oil bath (5 friction disks with cork portions)
Gear-shift system	foot-operated
Number of speeds	5
Gear ratios	
1st speed	3.0 : 1 ≙ 12 : 36
2nd speed	1.865 : 1 ≙ 15 : 28
3rd speed	1.333 : 1 ≙ 18 : 24
4th speed	1.048 : 1 ≙ 21 : 22
5th speed	0.87 : 1 ≙ 23 : 20

1.5. Power Transmission

Transmission	
Engine - gearbox	2.43 : 1
by helical gears	28 : 68 teeth
Transmission	
gear - rear wheel	19 : 48 teeth ≙ 1 : 2.52 (solo operation 15 : 48 teeth ≙ 1 : 3.2 (side-car operation)
by roller chain	0.8 B-1-130 TGL 11 796 (12.7 mm x 7.75 mm x 8.51 mm, 130 rollers) for solo operation 0.8 B-1-128 TGL 11 796 (12.7 mm x 7.75 mm x 8.51 mm, 128 rollers) for side-car operation
Total gear ratio	
1st speed	18.406 : 1
2nd speed	11.453 : 1
3rd speed	8.181 : 1
4th speed	6.428 : 1
5th speed	5.335 : 1

1.6. Cycle Parts

Frame	central tubular frame (welded rectangular section)
Engine suspension	top at cylinder head and rear at casing
Steering angle	63 degrees
Castor	95 mm

Type of springing	
front	telescopic fork with oil-hydraulic damping, spring deflection 185 mm
rear	suspension units with spring load and oil-hydraulic damping, spring pre-load adjustable, spring deflection 105 mm
Wheels	wire-spoke wheels with non-offset spokes
Rim size	
front	1.60 x 18
rear	2.15 B x 18
Tyres	
front	2.75 - 18
rear	3.50 - 18
Tyre inflation pressure	
solo: front	150 kPa (1.5 kp/cm^2)
rear	190 kPa (1.9 kp/cm^2)
with permissible total load:	
front	170 kPa (1.7 kp/cm^2)
rear	250 kPa (2.5 kp/cm^2)
Brakes	
front	drum brake, diameter 160 mm width of lining 30 mm actuation by cable control or hydraulic single-disk fixed saddle brake brake disk diameter 280 mm
rear	drum brake, diameter 160 mm width of lining 30 mm actuation by linkage

1.7. Weights

Weight unladen (with fuel and tools)	151 kg (design with drum brake, front) 153 kg (design with disk brake, front)
permissible total weight	330 kg

1.8. Capacities

Gearbox	1,000 cm^3 of gear oil SAE 80
Fuel tank	17 l of fuel-oil mixture, including 1.5 l of reserve
Oil reservoir for oil proportionating system	1.3 l
Telescopic fork	230 cm^3 of damping fluid per member

1.9. Dimensions, Measured Values, Diagrams

Maximum speed	125 to 130 km/h depending on load, weather conditions and sitting position
Acceleration from 0 to 80 km/h	6.6 s
Fuel consumption	3.5 to 5 l/100 km

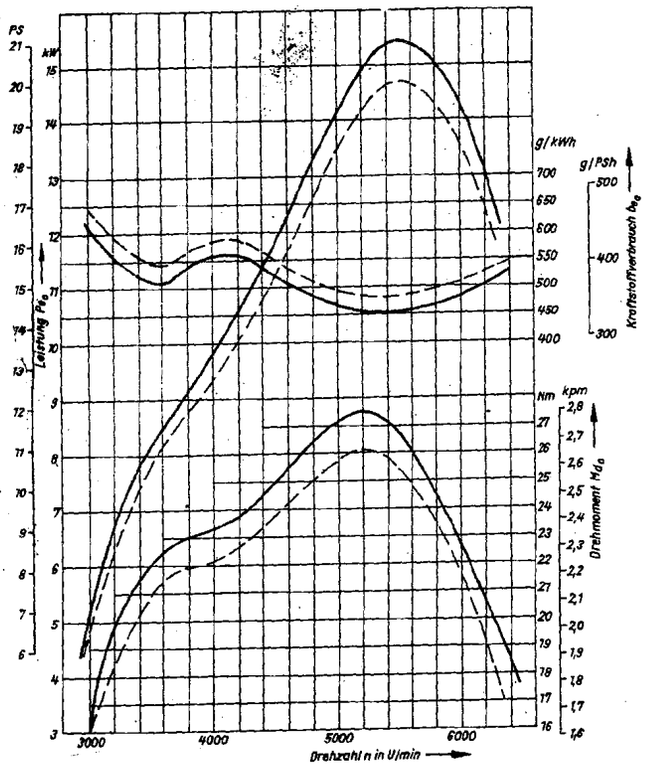


Fig. 4
Full load characteristics of the engine EM 250

Drehzahl in U/min = speed in rpm
Drehmoment = torque
Kraftstoffverbrauch = fuel consumption
Leistung = output

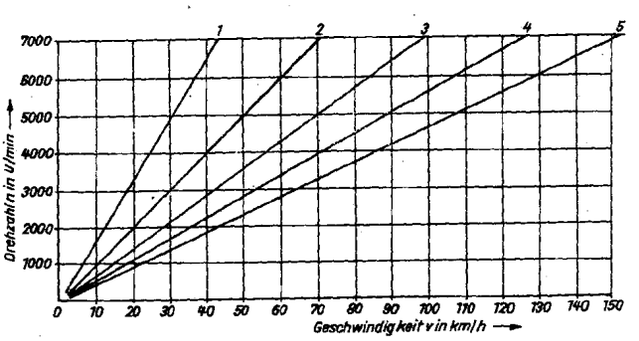


Fig. 5
Speed/gear diagram
ETZ 250 - Solo

Geschwindigkeit v in km/h = speed v in km/h

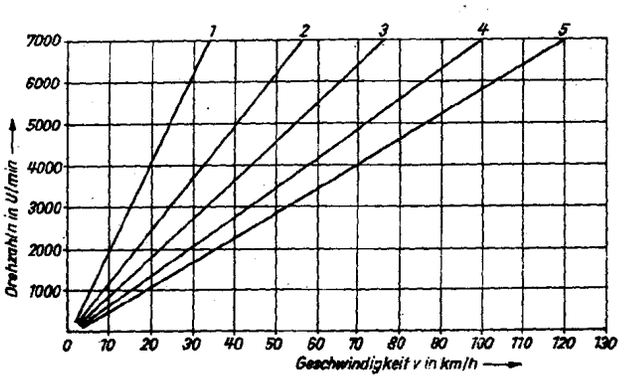


Fig. 5a
Speed/gear diagram
ETZ 250 - side-car design
Geschwindigkeit v in km/h = speed v in km/h

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.

2.2. Two-stroke Engine Oil for Fuel-Oil Mixture

Engine oil is added to petrol in the RATIO of 1 : 50
(e.g. 0.2 litres of engine oil are added to 10 litres of fuel).
The mixing ratio of 1 : 50 also applies to the running-in period.
The two conrod bearings, the cylinder liner and the 6306 crankshaft main bearings as well as the piston are provided with oil by this simple and reliable system of petroil lubrication. Experiences gathered in the course of many years have shown that it is advisable to use
TWO-STROKE ENGINE OIL MZ 22
in the GDR. This additive-type oil meets the following 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 dissolving them. Wear reducing and corrosion preventing properties. Contains lead-separating agents preventing whisker formation in sparking-plugs.

FOR MZ MOTOR-CYCLES IN OPERATION IN COUNTRIES OTHER THAN THE GDR it is also advisable to use only tow-stroke engine oils which possess these properties (e.g. Shell 2 T, Castrol 2 T, Aral 2 T, Mixol "S", LT-2T, etc.).

2.3. Oil Capacity of Gearbox

For gearbox and primary drive, an amount of 900 cm³ of "GL 60" gear oil is required. This is an additive-type gear oil which is uitable for the lubrication of change-speed gearbox and axle drives. It is an ageing-resistant refined lubricating oil with additives for an increase of the load-bearing capacity and a reduction of wear.

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

viscosity at 50 °C	53 to 68 cSt (corresponds to 8 °E roughly)
pour point maximum	- 25 °C
flash point	180 °C
water content	0.1 %

In countries other than the GDR, engine oil SAE 30 or 40 or gear oil SAE 80 with similar properties should be used.

2.4. Lubricants for Cycle Parts

The following lubrication points of the cycle parts must be lubricated with "Ceritol +k2" or "Ceritol +k3" antifriction bearing grease:

Steering bearing, wheel bearings, bearing for rear wheel drive, secondary chain, brake cams and brake shoe bearings, foot-operated brake shaft and speedometer drive (the two latter items only when being mounted or repaired).

This antifriction bearing grease has a drop 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 Oil - Telescopic Fork

As damping liquid, a mixture of

45 parts of shock-absorber oil and
1 part of molybdenum disulphide

should be used.

Shock-absorber oil viscosity:

8 to 11 cSt at 50 °C corresponds to
1.65 to 1.92 °E at 50 °C.

2.6. Shock-absorber Oil - Suspension Units

Shock-absorber oil WITHOUT ADDITIVES of the above viscosity is only used. The damping values of the telescopic fork and the spring-loaded suspension units are based on this viscosity. Springing and roadability will be impaired if shock-absorber oils of a different viscosity will be used.

2.7. Lubricant for Contact Breaker

"Unterbröl" special oil for contact breaker, viscosity 700 to 1,300 cSt at 50 °C.

2.8. Brake Fluid

For the disk brake, the brake fluid known as "Karipol grün" or - in countries other than the GDR - brake fluid SAE 70 R 3 or SAE J 1703 (for disk brakes) have to be used.

3. Disassembly of the Engine

The abbreviation "WoF" used below means width over flats of the tool (spanner) required.

3.1. Preliminaries

It is advisable, before starting the disassembling operations, to disconnect the battery and to remove it. During the repair period, it can be serviced. When the motor-cycle is kept in the workshop, the two fuses must be removed from the fuse strip under the right-hand panelling.

During the following work, the oil is allowed to drain from the gearbox (remove the oil drain plug (2) and unscrew the lower fastening screw (1) of the clutch cover).

NOTE: The gear-shift mechanism detent screw (3) does not serve for draining oil!

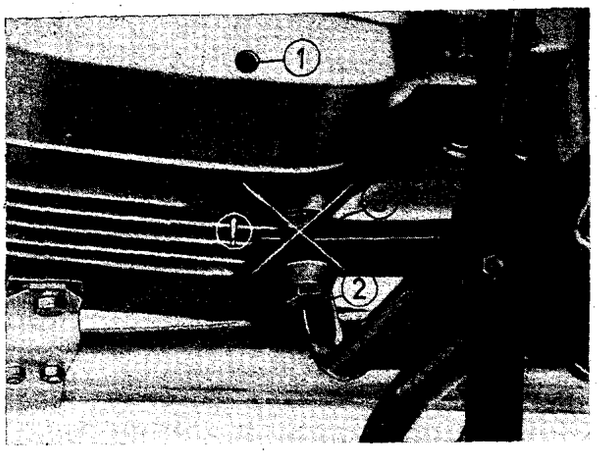
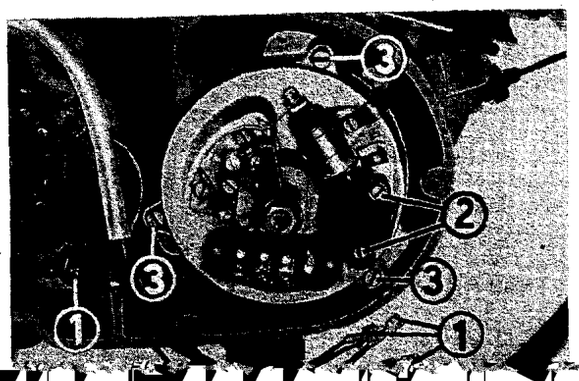


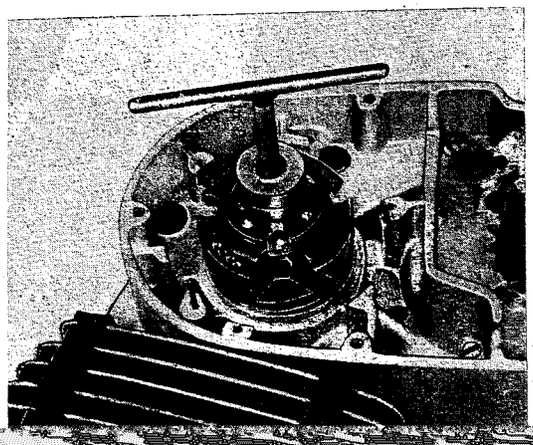
Fig. 6. Draining the lubricant from gearbox and clutch

Fig. 7. Right-hand side of motor-cycle

After having pulled off the cables (1), unscrew the brush holder (2). After loosening the fastening screws (3), the stator can be removed. Using a box spanner (WoF 13), loosen the fastening screw of the cam of the dynamo. Sense of rotation of the spanner is opposite to the running direction of the engine. Then, the cam can be pulled off when slightly shaking the fastening screw (thread M 7).



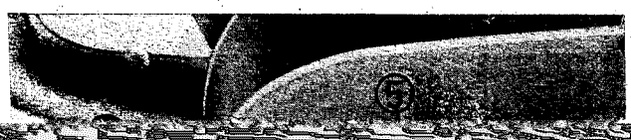
Extractor 02-MW 39-4(1) loosens rotor from cone of crankshaft (apply a blow with your hand on handle in the direction of rotation of engine). For the amateur constructor, a M 10 x 100 mm hexagon-head screw will do good service.



Pull the carburetter together with induction socket from the stud bolts at the cylinder, turn to the left and pull out of the induction tube (rubber).

3.1.3. Unhooking the Clutch Cable Control and Replacement

Remove protective cap (rubber) from casing of cable control holder (2), push along Bowden cable and take out the plug-type nipple.
Unscrew casing for cable control holder (2) from clutch cover (WoF 19) and push along cable for 5 cm, now the nipple (4) of the Bowden cable can be unhooked from the tie rod.
In the "deluxe model", the drive shaft for speedometer must be unscrewed before removing the engine



Demounting the engine:

- Remove two nuts (WoF 13) (1) with washers from the studs of the cylinder head. Prop the engine from below;
- Unscrew the two fastening screws (2) from the rear engine shoes (WoF 13);
- After lowering the engine, draw it out in forward direction.

Replacement of cylinder:

The cylinder head, the cylinder and the elastic engine suspension can be changed in the position shown in Fig. 12.
For the replacement of the cylinder, the electric horn (1) and the fuel tank must be removed. For changing the fuel tank, see Section 5.4.

3.2. Dismantling the Engine

3.2.1. Preliminaries

3.2.3. Dismantling the Clutch and Primary Drive

Screw the clutch puller (1) fully on the thread of the clutch (2). The spindle (3) presses the clutch from the cone of the crankshaft. Pull the clutch from the internal driver. Remove corrugated washer (5) and thrust washer (4), remove drive gear with internal driver (3) and needle bearing (2) and spacer (1) from the crankshaft (see Fig. 21).

Pull off the drive gear with 68 teeth by means of puller (1) 05 MW 45-3.

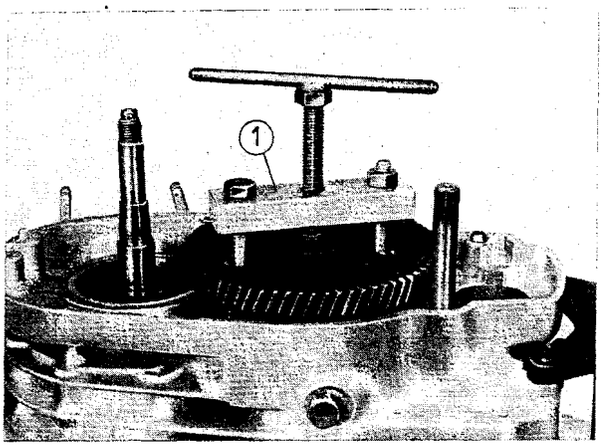
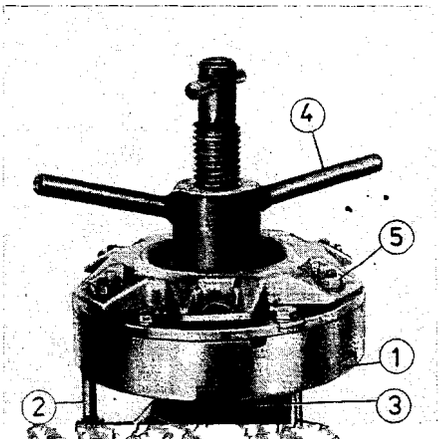


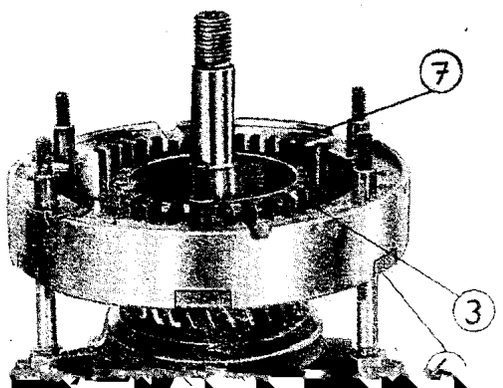
Fig. 16. Pulling the drive gear

Move the lock-lever (1) out of the drum cam (2), unhook tension spring (3) and remove it from guide bolt (4). Remove wire

3.2.6. Demounting and Mounting the Clutch

The assembly device 05-MW 150-2 (Fig. 18) enables the dismantling and assembling of the clutch. To facilitate work, it is clamped in a vice. Fig. 20 shows the mounting position.
For dismantling or checking the clutch, it must be so positioned that the pressure plate (1) is not put on the propping screws (2) (Fig. 18).

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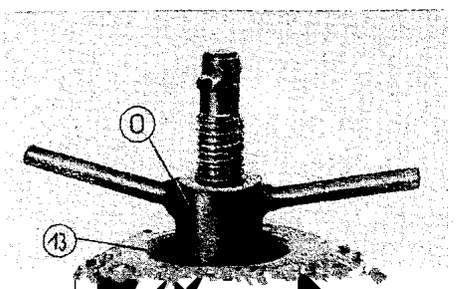
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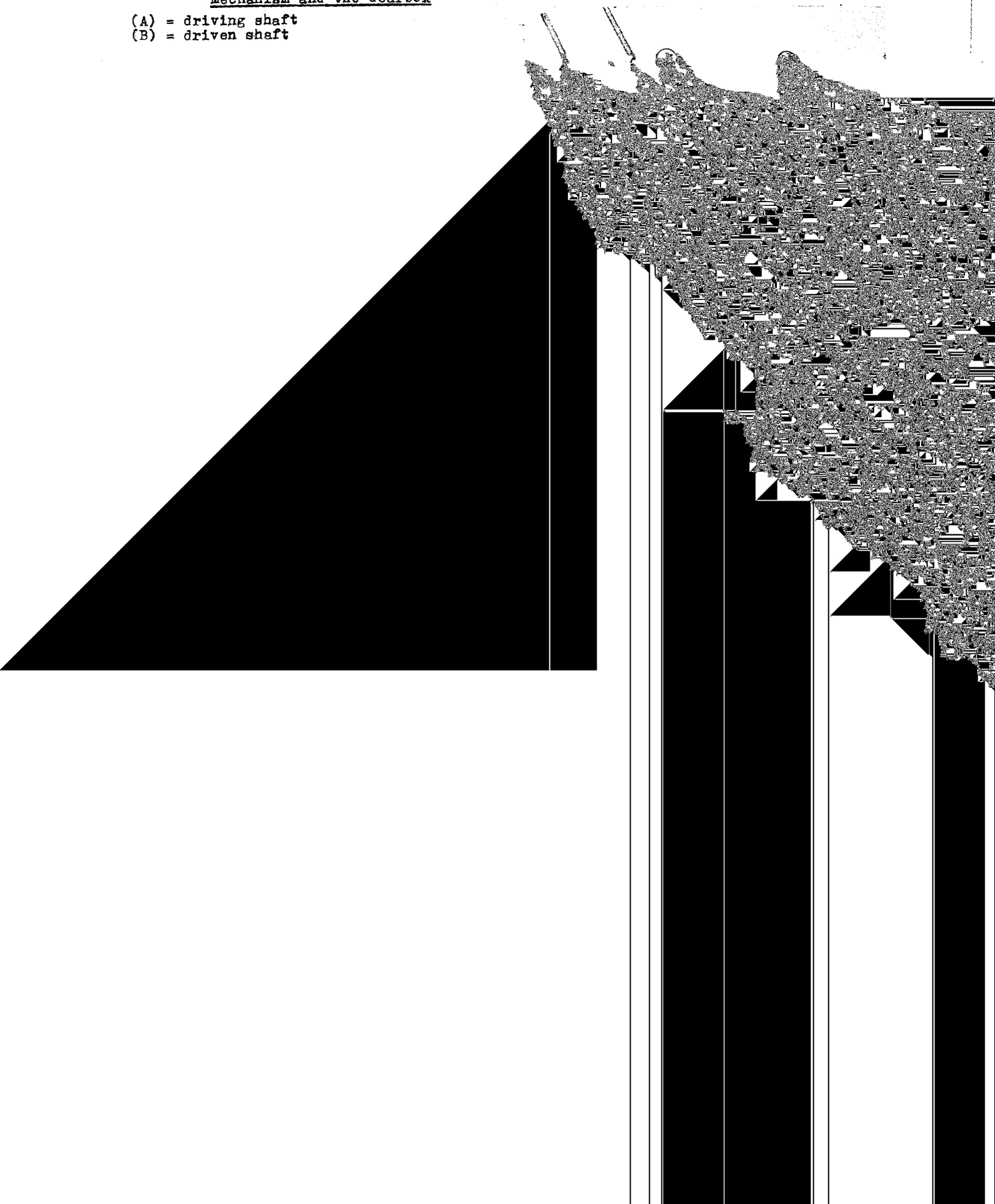
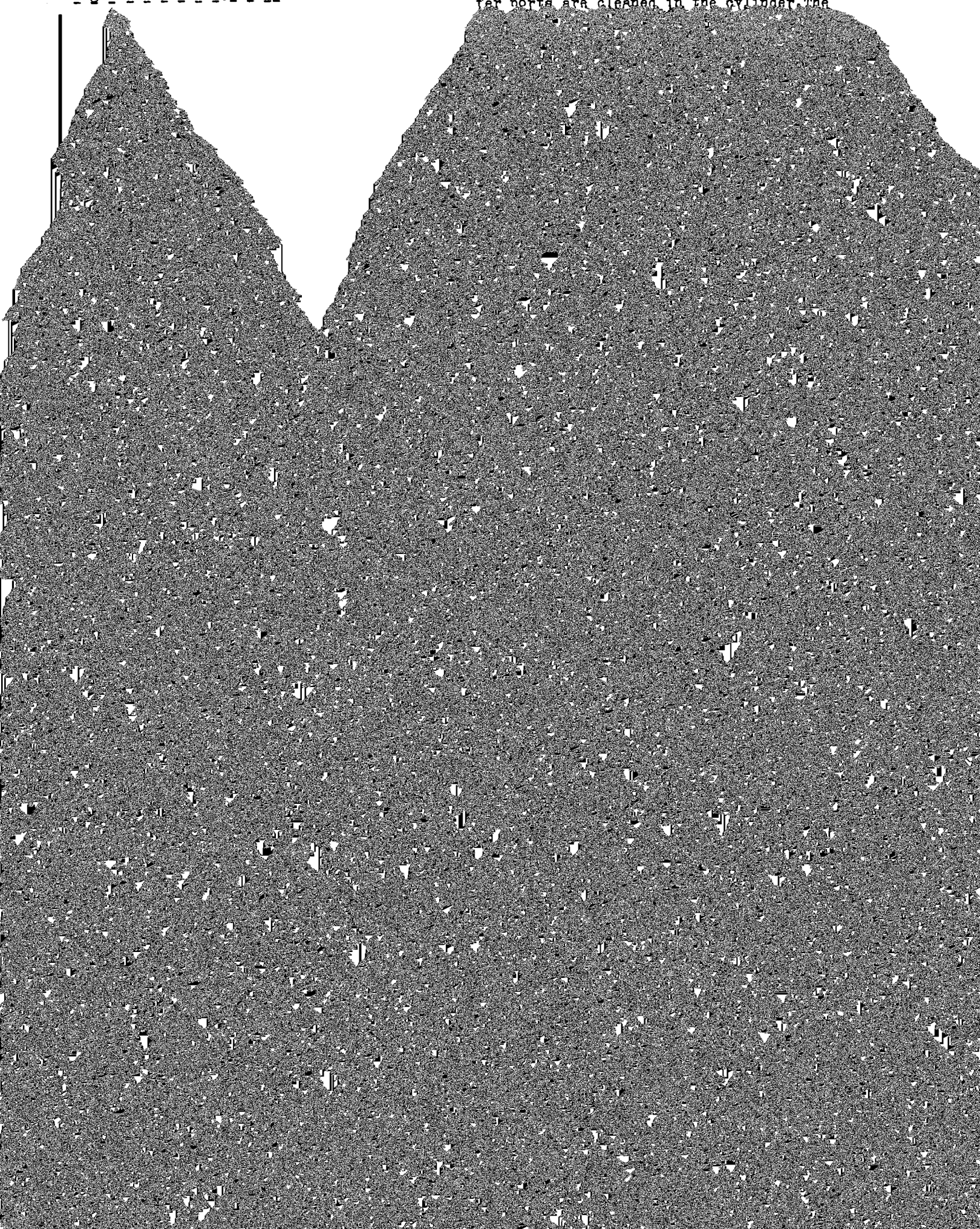
3.2.10. Dismantling the Gear-shift Mechanism and the Gearbox

(A) = driving shaft
(B) = driven shaft



Right-hand housing half:

Coked spots in the exhaust duct and transfer ports are cleaned in the cylinder. The



3.4.1.1. Primary Drive

If there is excessive backlash between the drive gear (28 teeth) riveted to the clutch driver and the drive gear (68 teeth) to the gearbox, noise will be emitted when the engine is idling and in load change.

In new condition, the backlash is 0.036 mm to maximum 0.131 mm.

If the backlash is more than 0.25 mm, a new pair of spur gears must be mounted.

The radial play of the bearings 6306 and 6203 must be taken into account when measuring the backlash. The spur gears must be checked for damaged teeth.

3.4.1.2. Inevitable Wear on Kick-starter

3.4.2. Gears, Shafts and Selector Forks

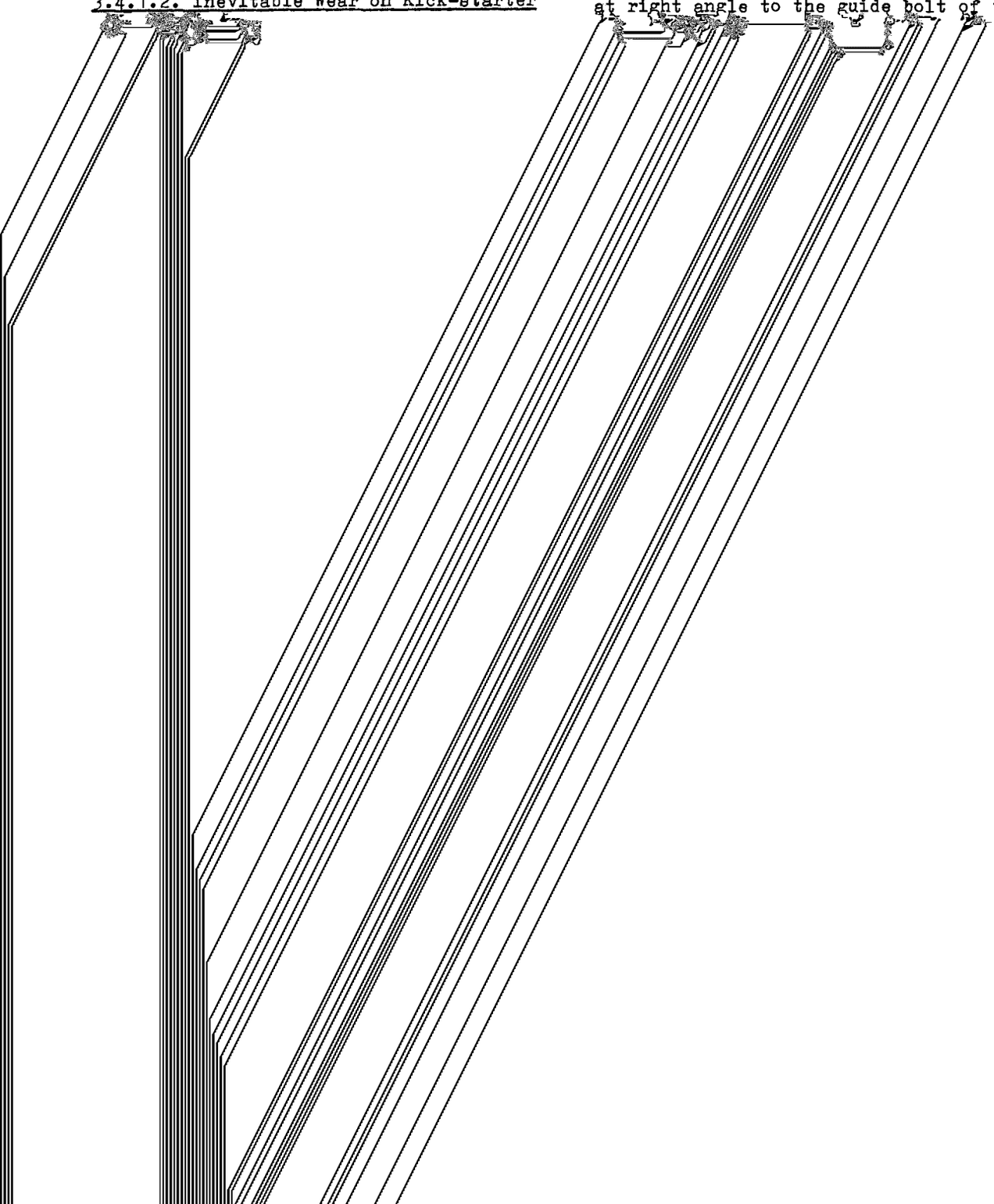
The relief cuts in the claws at the control gears (on both sides) and the counter gears are arranged at an angle of 3°.

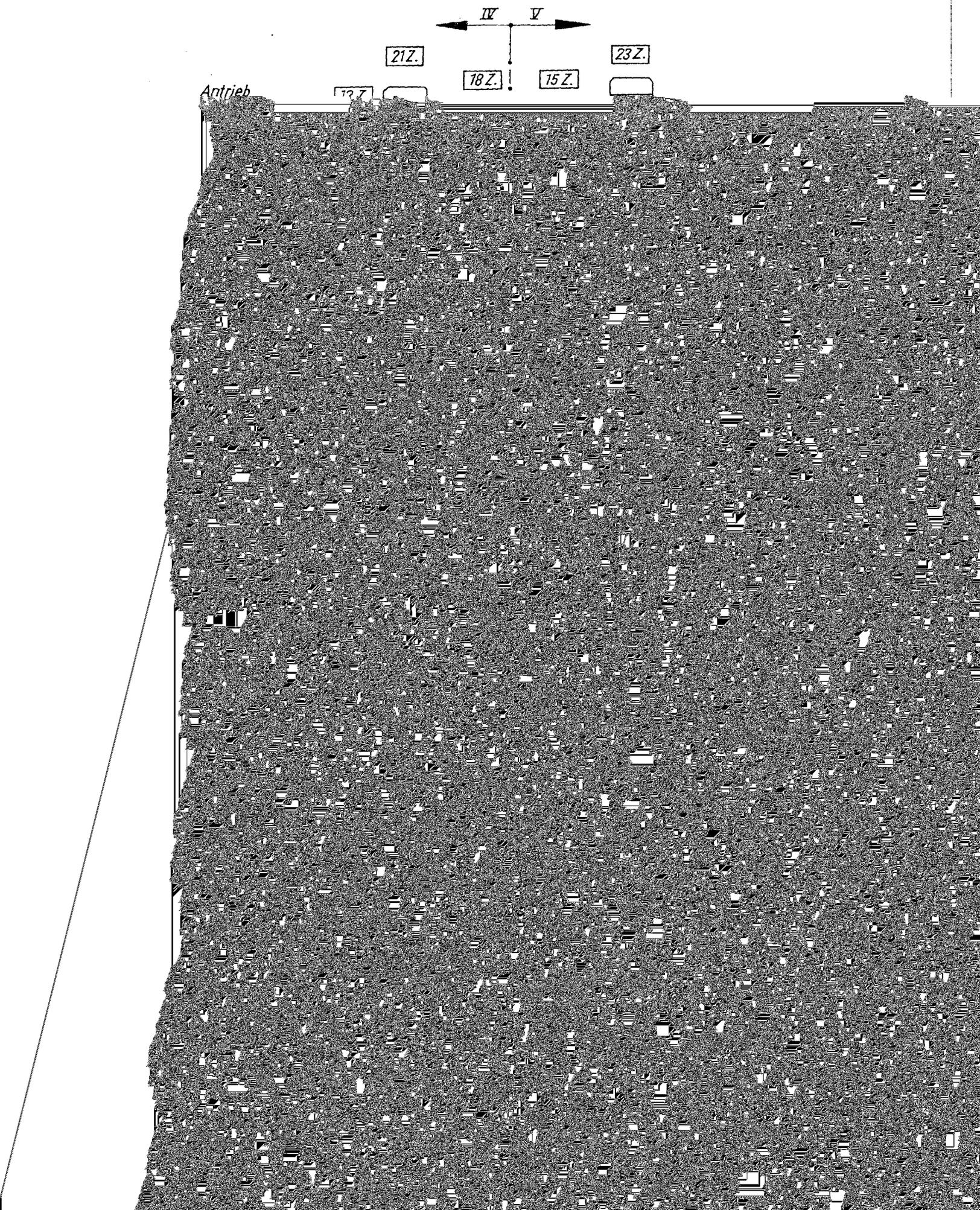
In the engaged condition (gear engaged), due to the wedge effect of the relief cuts, a force is produced which is designed to retain control gear and toothed gear (loose gear) in mesh.

Not only the gear-shift detent lever (1) (Fig. 17) keeps the various gears in the engaged state but also the wedge effect of the relief cuts contributes to this end.

When the claws of the control gears are heavily worn, the bearing surface becomes smaller and the gears jump out of engagement.

The selector forks must be checked for their angular condition; they must be perfectly at right angle to the guide bolt of the




IV
V
21Z.
18Z.
15Z.
23Z.
Antrieb

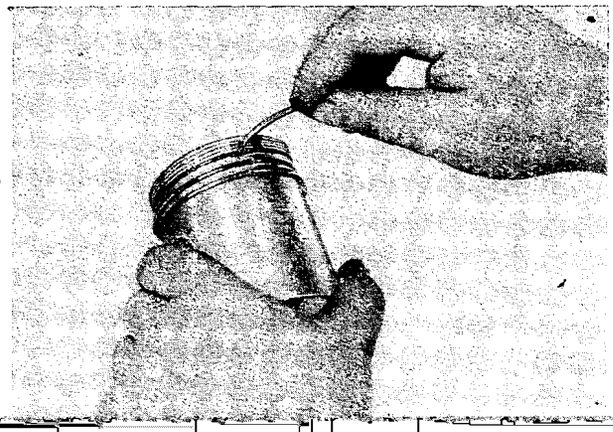
Replacement of the cylinder can be effected by mounting a new cylinder with piston or by regenerating the dismantled cylinder (this is more economical); for this purpose, the cylinder is reground after a new piston (taking the specified mounting clearance of 0.04 mm into consideration).
Pistons of the following oversizes are available:
69.50 mm; 70.00 mm; 70.50 mm; and 71.00 mm.

3.4.3.2. Control Measurement of Piston and Cylinder

In the new condition of piston and cylinder, the mounting clearance between cylinder liner and piston is 0.04 mm.
The wear limit is about 0.09 mm. Then a new or a replacement cylinder must be mounted because the noise increases with increasing mounting clearance (especially with load changes and when the engine is unloaded).
The nominal size of the piston is measured 30 mm above the piston lower edge. Only a

3.4.3.4. Piston Rings

Before used pistons are employed again, the piston rings and ring grooves must be subject to special care.



Before fitting the piston rings, the state of wear must be checked. For this purpose, the piston ring is inserted in the cylinder liner, about 10 mm below the upper edge of the cylinder, and then the ring gap is measured. In new condition of the piston rings, the gap should be 0.2 mm.
When the ring gap is more than 1.6 mm, piston and cylinder are unserviceable.

When the arresting pins in the piston are loose (face of the pins is bright), or if they are missing, a new piston with cylinder (which may be ground) have to be mounted.

NOTICE: The edges of the ports must be chamfered otherwise awkward noise will be produced with the engine unloaded! Therefore, slightly chamfer the ports of newly ground cylinders!

3.4.3.5. Cylinder Head

When the cylinder head has become leaky - indicated by the oiled up upper ribs of the cylinder -, the cylinder head can be refinished on a surface plate by means of fine emery cloth (grain 400) to a limited extent, performing motions in a circle, unless there is a new cylinder head available.

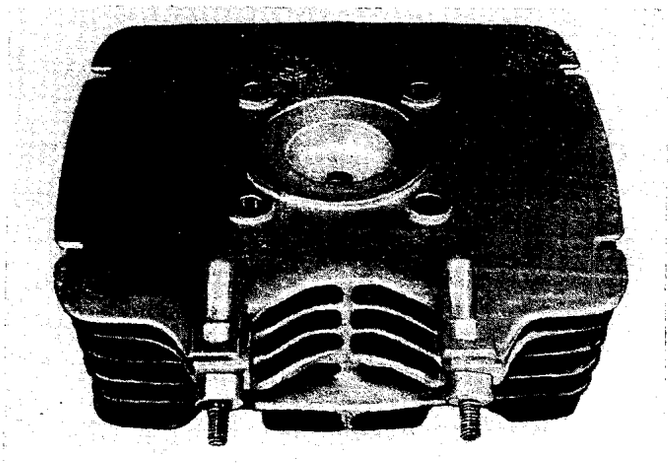


Fig. 42. Cylinder head - sealing surface and cumbustion chamber

When a cylinder head is leaky, an additional insertion of an aluminium shim is wrong. This will not be a remedy, the compression ratio will be changed and a further power reduction will be caused.

NOTICE: When demounting and mounting the cylinder head, take care that the fastening nuts are loosened and tightened uniformly and crosswise.

If this is neglected, the cylinder head will be subjected to particular stresses and become leaky.

3.4.3.6. Crankshaft

An inspection will show whether the collars of the sealing rings (1) are worn too much, whether the thread for fastening the clutch (2), the centring collar (3) and the thread for the anchor bolts (4), the cones for the clutch (5) and the anchor (6) are still in proper condition.

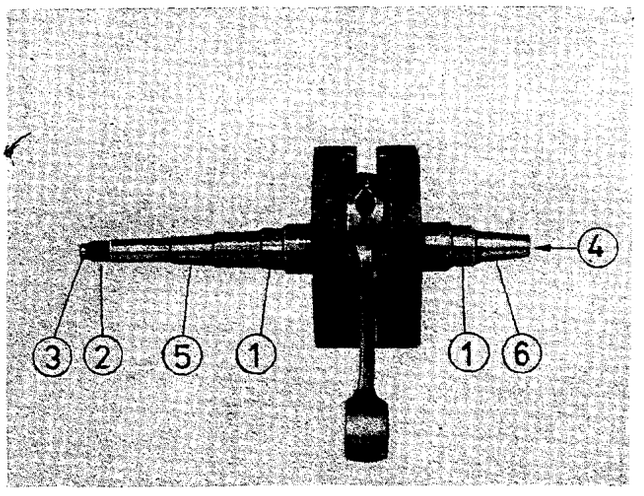


Fig. 43. Crankshaft

When defects found cannot be removed by refinishing, a new or a regenerated crankshaft must be mounted.

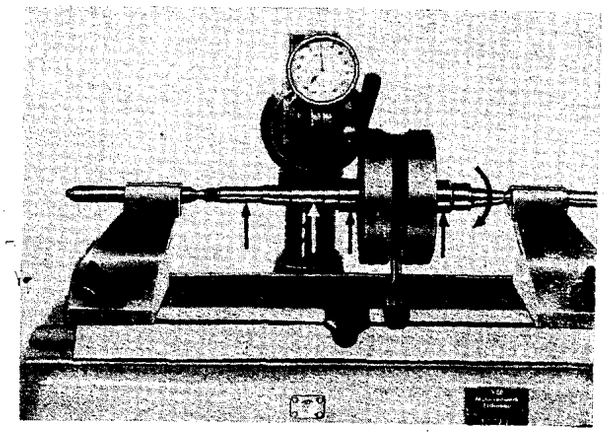


Fig. 44. Measuring the amount the crankshaft is out of true radially

Then the amount the crankshaft is out of true radially is measured at the points indicated in Fig. 44. For this purpose, the crankshaft is clamped between two fixed centres of a testing equipment or of a lathe.
The permissible amount is 0.03 mm. Greater values lead to ignition troubles at high rotational speeds, vibrating of the engine and leaky shaft seal rings.

The result is a poor engine output. A new crankshaft should also be tested because it may have been subject to transport damage.

Further checks in the case concern the
bearing seats and the grooves of the gear

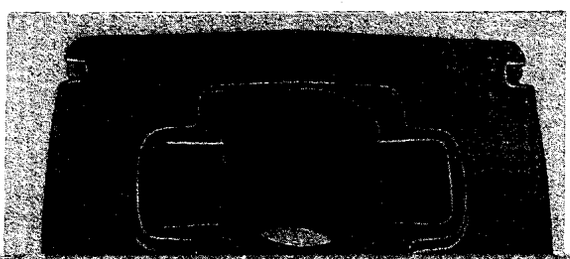
4. Assembling the Engine

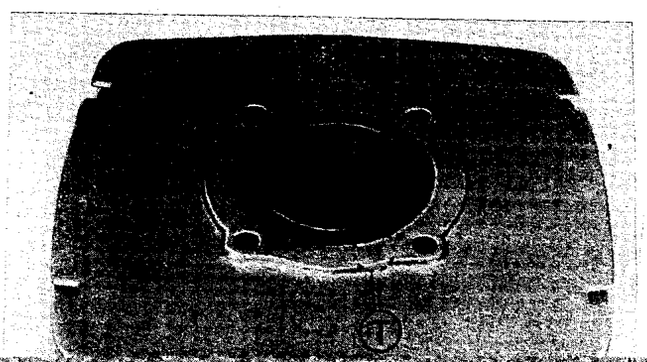
4.1. Preliminaries

It is taken for granted that all engine parts are properly cleaned Defective parts were identified and rejected. The parts that are further usable were prepared for re-fitting. Before describing the assembly of the engine, we below give some instructions regarding the selection and mating of various units of construction.

4.1.1. Selection of Piston and Cylinder

The cylinder of the ETZ 250 differs from the cylinders used so far. In the cylinder, four transfer ports are arranged. The induction duct has a guide nose for the piston rings. The piston can only be used in the 69.6 design with a curve adapted to the new cylinder.





Cylinder	Piston 69.6	
Marking (Tolerance group)	Nominal size in mm	Nominal size in mm
1 ≙ - 1	68.99	68.94
0	69.00	68.95
+ 1	69.01	68.96
+ 2	69.02	69.97

This Table gives piston and cylinder dimensions in new condition which were procured by our Department Spare Parts Sale or which were mounted in our works.

4.1.2. Regeneration of the Cylinder

Each cylinder can be ground out for maximum 2.00 mm related to the basic size (69.00 mm).

Pistons in the oversizes of 69.50; 70.00; 70.50; 71.00 are available.

The cylinder is ground in the cylinder grinding shop according to the available piston and taking the specified mounting clearance of 0.04 mm into account; it is delivered in the mated state.

4.1.3. Selection of the Needle Bearing for the Gudgeon Pin (New Parts)

Needle bearings can easily be selected with the help of the Table shown in Fig. 51. This is only possible for new parts (crankshaft. piston and gudgeon pin and needle bearing).

Pay attention to the fact that commercial packings of needle bearings are marked only with the mean dimensions (determined from upper and lower needle dimensional deviation). The bearings are not marked! Therefore, keep open packings separate.

When used gudgeon pin, piston and crankshaft are used further, then fit the needle bearing according to feel. (Colour marking canno be identified readily.) The gudgeon pin must be fitted without any clearance and it must be possible to turn it without jamming while the resistance offered to motion is just felt.

Kolbenbolzen $18^{+0,0025}_{-0,0050}$	Pleuelbohrung $= 22^{+0,007}_{-0,016}$											
	Kennzeichnung gelb +0,007 bis +0,004		Kennzeichnung schwarz +0,003 bis 0		Kennzeichnung grün -0,001 bis -0,004		Kennzeichnung weiß -0,005 bis -0,008		Kennzeichnung blau -0,009 bis -0,012		Kennzeichnung braun -0,013 bis -0,016	
Kennzeichnung Toleranz in µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm	Nadel-Abmaß µm	Radial-Spiel µm
grün +2,5 0	0 -2	1,5 bis 11	-2 -4	1,5 bis 11	-4 -6	1,5 bis 11	-6 -8	1,5 bis 11				
weiß 0 -2,5	0 -2	4 bis 13,5	-2 -4	4 bis 13,5	-4 -6	4 bis 13,5	-6 -8	4 bis 13,5	-8 -10	4 bis 13,5		
schwarz -2,5 -5,0			0 -2	2,5 bis 12	-2 -4	2,5 bis 12	-4 -6	2,5 bis 12	-6 -8	2,5 bis 12	-8 -10	2,5 bis 12

Fig. 51. Table for bearing selection (dimensions in mm)

Toleranz in µm = tolerance in µm
Nadel-Abmaß = dimensional deviation of needle

Kolbenbolzen = gudgeon pin
Pleuelbohrung = conrod bore
Kennzeichnung = marking
Radialspiel = radial play
bis = up to

grün = green
weiß = white
schwarz = black
gelb = yellow
blau = blue
braun = brown

4.1.4. Bearings and Sealing Rings

For the gearbox, bearings with plastic cage are used.

2 x 6204 J C 4,
1 x 6203 J C 4 and
1 x 6304 J C 4

The crankshaft main bearings 6306 must be used in the sorted group C 4 f and the supporting bearing of the crankshaft in the bearing bush (clutch cover) in the sorted group C 3 f. As clutch thrust bearing, a grooved ball bearing 16 005 is fitted.
The shaft seal rings D 25 x 72 x 7 must be resistant to fuel and oil (only use original shaft seal rings).
The needle bearing for the clutch driver should be selected according to the following Table when a new driver is mounted.

Clutch driver (marking)	Needle bearing (mean deviation in mm)
yellow	-1; -2; -3; -4
black	-3; -4; -5; -6
green	-5; -6; -7; -8; -9

4.1.5. Pre-assembly of the Gearbox

All drive gears and needles of bearings must be fitted with engine oil.

4.1.5.1. Completing the Drive Shaft (A)

- Slip on the drive gear for the 4th speed (1) up to the fixed wheel (2), mount (3) thrust washer and circlip (4);

NOTE: Pay particular attention to the proper fit of the circlips in the grooves. Checking by striking the shaft on hardwood, keeping the drive gear (1) in one hand.

- Slip the control gear for 4th and 5th speeds (5) on the dirve shaft; take care that the side with the 18 teeth points to the drive gear for the 4th speed (1);
- Place a hardened and ground spacer (6) against the collar (start of the grooves). Two of these spacers are required on the drive shaft and two on the output shaft. They are exchangeable.
  Slip on the drive gear for the 5th speed (7) and fit the 24 needles (8) (2.5 x 11.8), then mount the spacer (6) and the circlip (9) (take care that the circlip is well seated in the groove).

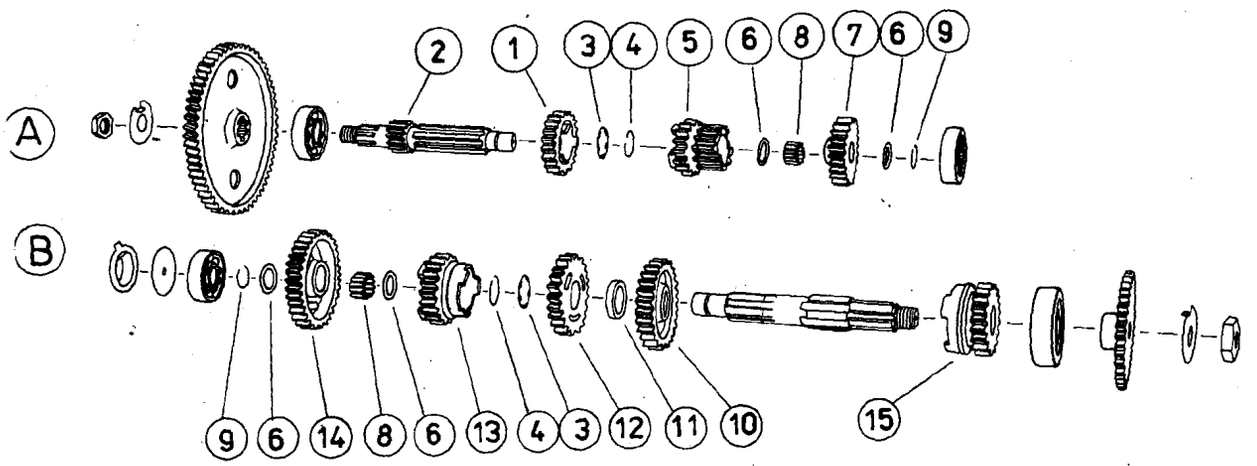


Fig. 52. Drive shaft (A) and output shaft (B)

4.1.5.2. Completing the Output Shaft (B)

- At first check the output shaft that the oil hole for the gears (window wheels) of 2nd and 3rd speeds are clean. The slip the gear for the 2nd speed (10) (28 teeth) on the shaft up to the collar of the groove piece, fit the spacer (11) and the gear for the 3rd speed (12) (24 teeth) is placed against the spacer;

NOTICE: Mount the gears (10) and (11) so that the flat side points to the spacer ring (11)!

- Put on the thrust washer (3) and the circlip (4);

- The control gear for the 1st and 3rd speeds must now be slipped on. The spacer (6) must be put against the collar of the groove piece and the gear for the 1st speed (14) (36 teeth) mounted. Fit the 24 needles of the bearing (8) (2.5 x 11.8) and mount the spacer (6) and the circlip (9);

- Put the control gear for the 2nd speed (15) on the opposite end of the output shaft.

4.1.5.3. Placing the Two Gear Shafts into the Assembly Container 29-50.011

- The pre-assembled gear shafts are placed into the assembly container. Flange-mounted gear shafts are not suited for the assembly container.

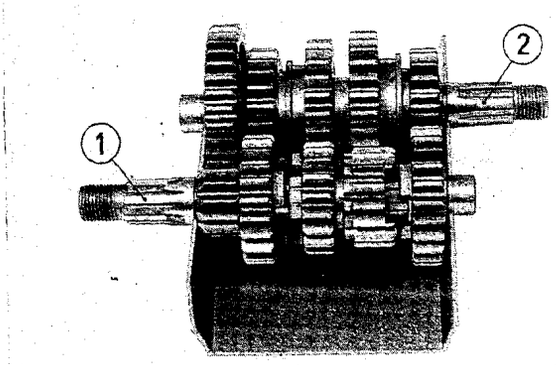


Fig. 53. Gearbox in assembly container
(1) Drive shaft
(2) Output shaft

- First insert the selector fork 011 (1) (central fork) into the control gear of 4th and 5th speeds (A = drive shaft). Then insert selector fork 010 (2) into the control gear for 1st and 3rd speeds and selector fork 012 (3) into the control gear of the 2nd speed (B = output shaft). Now the guide bolt (E) for the selector forks can be fitted (long collar pointing to the large gear for 1st speed (4), 36 teeth). Do not forget to fit the washers (5).
- Then the drum cam (C) is inserted into the guide bolt of the selector forks. The insulating disk (1) of the drum cam at the thin bearing pin must point to the side of the selector fork 012.
- Now the gearbox is ready for being mounted.

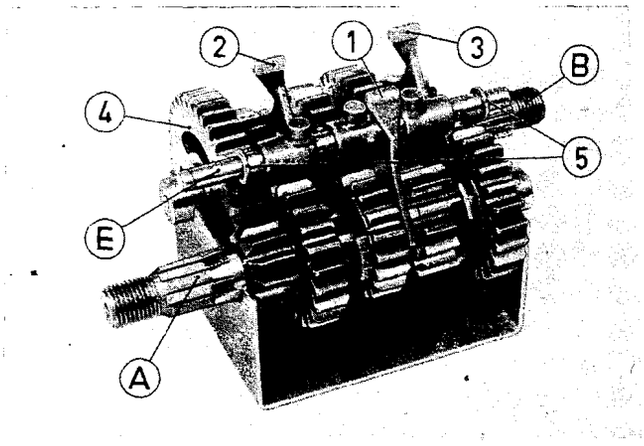


Fig. 54. Gearbox with selector forks

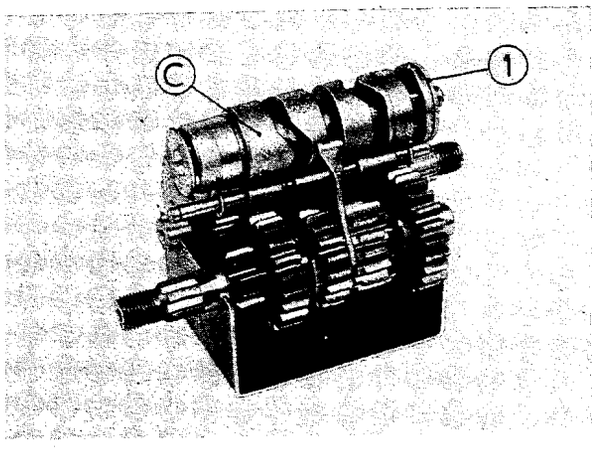


Fig. 55. Gearbox ready for being mounted

4.1.5.4. Preassembly of the Left-hand Housing Half

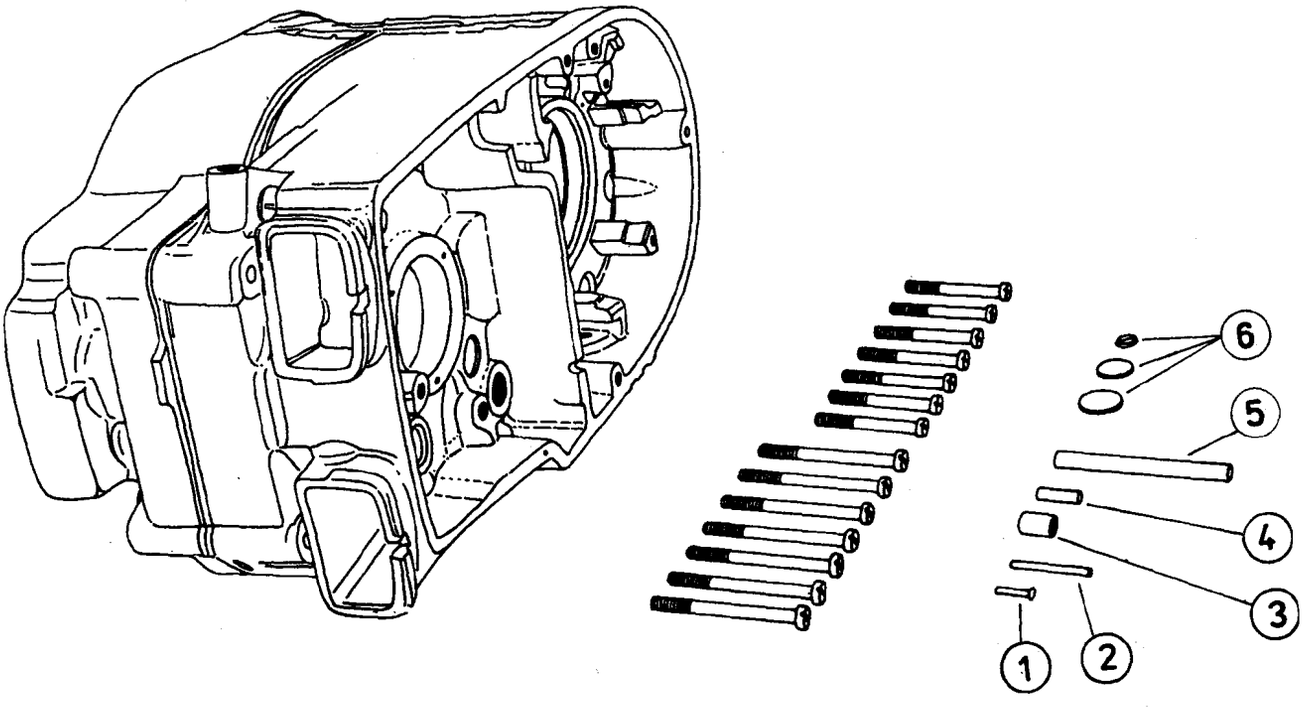


Fig. 56. Range of spare housings

If a spare housing, also known as casing, is used, it must be completed first. The parts shown in Fig. 56 must be mounted in the following way:

- Press the notched nail (1) for gear-shift detent spring into the left-hand casing half (clutch side);
- Press the notched pin (2) for fixing the position of the dynamo into the right-hand casing half;
- Press the fitting sleeve (3) and cylindrical pin (4) into the left-hand casing half at the clutch side;
- Press the cylindrical pin 8 x 80 (s), Fig. 57, for control stop, at a level of a = 57_{-1} mm measured from the sealing surface, into the cold casing;

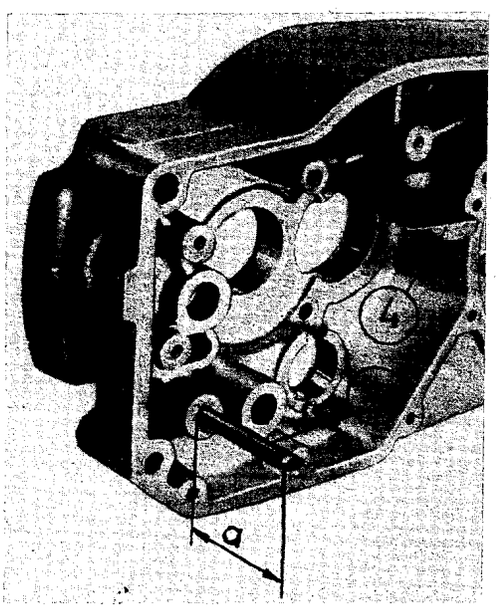


Fig. 57. Mounting the control stop and the oil guide plate

- Insert the oil guide plate (3 in Fig. 59) into the gearbox compartment and fit the locking plate at the clutch side, tighten the fastening nut M 6 and lock it;
- Press the closing plates (6) into the respective holes of the right-hand casing half from the dynamo side in such a manner that tightness is ensured.

When the old housing is further used, only the following operations have to be performed:

- Fit the inner circlip (1) for the crankshaft main bearing 6306 C 4 f (opening pointing to the oil hole - arrow-head a);
- Mount the circlip (2) for the gearbox bearing 6203 C 4 f (output shaft) into the housing. The opening of the circlip must point upward to the oil catch pocket (see arrow-head b);

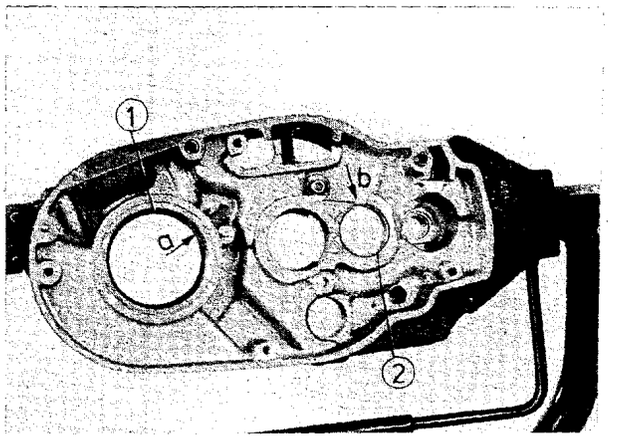


Fig. 58. Left-hand housing half

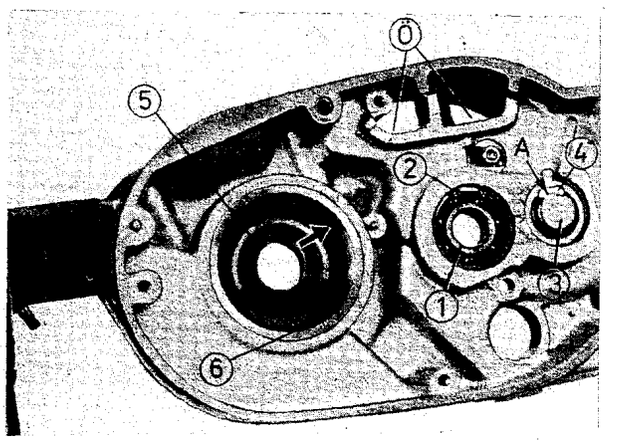


Fig. 59. Left-hand housing half - oil guide plate and gearbox bearing

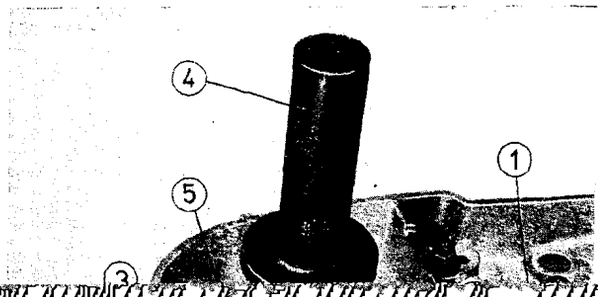
- Heat the casing half to about 100 °C; no rubber parts must be mounted in the casing half;
- Starting from the clutch side, insert the gearbox bearing 6204 J C 4 (1) for drive shaft up to the casing collar and mount the circlip (2) on the clutch side;
- Starting from the gearbox compartment, mount cap (3) and seal plate (4) as well as gearbox bearing 6203 J C 4 for output shaft in this order.
- Put the oil guide plate (5) for bearing 6306 C 4 f on the circlip (6) from the crankcase interior. The dot pressed into the outer edge of the oil guide plate points to the opening of the circlip and serves as lock against displacement (see arrow in Fig. 59);
- Mount the crankshaft main bearing 6306 C 4 f (3) by means of the fitting mandrel (1) (29-50.405). At the same time, the oil guide plate is centred with the taper collar of the fitting mandrel (2);

- Mount the foot-operated gear-shift shaft with control member (1), at the same time engage the control arm (2) with the drum cam (3);

  NOTICE: Do not damage the insulating disk of the drum cam!

- Put the separating plate into the oil pocket (4) of the crankcase;
- Heat the inner track ring of the gearbox bearing 6203 C 4 f and put it on the drive shaft (5);
- Slightly oil all bearings, shafts and bolts;
- Apply sealing compound to the sealing surfaces between the two housing halves; no sealing compound must get into the

- Use a drift 11 MW 3-4 and drife in the fitting sleeve to a depth of 26 to 28 mm in order that the two housing halves are centred;



- Press the shaft seal ring D 25 x 72 x 7 (1) in the clutch side by means of mandrel 29-50.409 (prior to this, oil the sealing lip; it points to the clutch!);
- Mount the wire circlip (2) to lock the shaft seal ring;
- Screw the gear-shift detent screw (3) in place together with packing ring, compression spring and ball;
- Put the gear-shift detent lever (4) on the projecting guide bolt (5), engage it with the drum cam (6) and hook the tension spring (7) on the notched nail (8) (Fig. 67);
- While the casing is still hot, use a rubber or plastic mallet to apply blows on the bearings to release them.

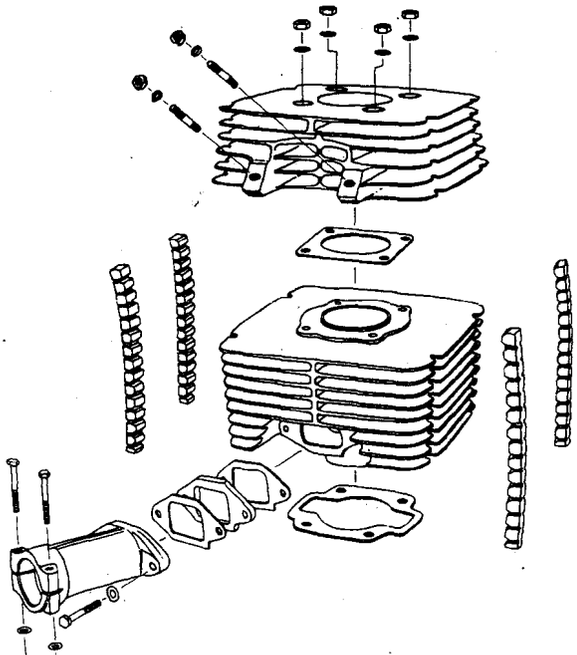
NOTICE: Do not beat on crankshaft ends this will impair the true running of the crankshaft (0.03 mm)!

- Check the drive shaft and output shaft for ease of moving; the two shafts must run freely opposite to each other;
- Put the foot-operated gear-shift lever on the gear-shift shaft and shift all gears.

4.4. Mounting Piston, Cylinder and Cylinder Head

On selection and mating of piston and cylinder, information has already been given in Section 4.1.1.

This Section only deals with the correct mounting of piston and cylinder and the adjustment of the ratio of compression.



Before assembling the cylinder check that bore (B) is closed. If this is not the case, insert a ball 4.5 mm in diameter, apply sealing compound to the threaded stud and screw it in place.

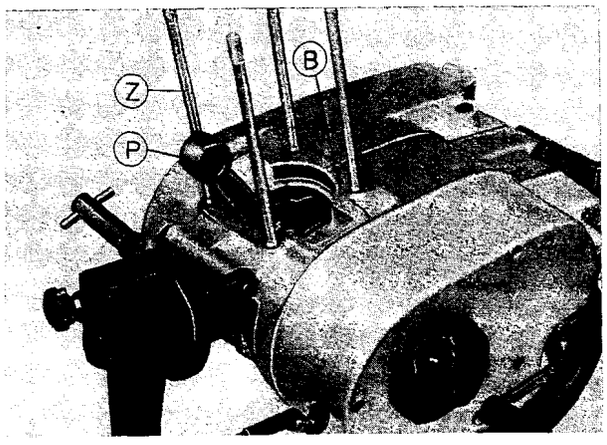


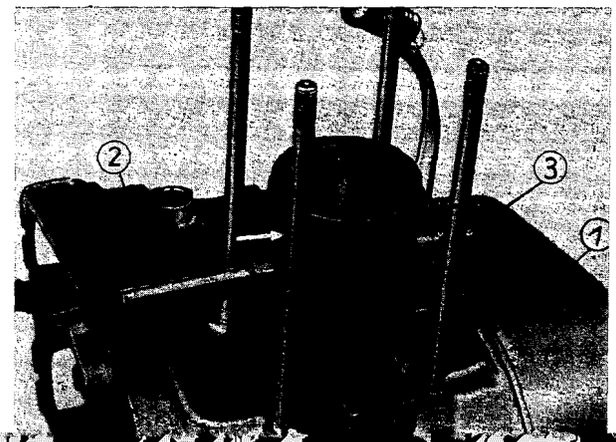
Fig. 69. Engine ready for mounting the cylinder

Check the cylinder studs (Z) for tight fit and apply engine oil to the needle bearing for the gudgeon pin and insert it into the small-end boss (P).

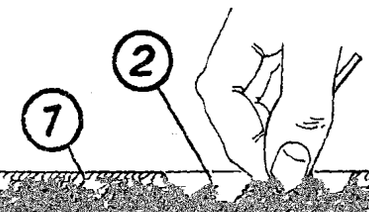
Close the crankcase with a clean cleaning rag until the cylinder is mounted in order that no foreign particles (lock ring for gudgeon pin) can get into the crankcase.

4.4.1. Piston and Cylinder

To facilitate mounting, the piston is heated to a temperature of about 40 to 50 °C on an electric boiling plate. Before mounting, make sure that piston and gudgeon pin show the same colour marking. While the piston is heated, place the cylinder foot gasket on the sealing surface of the casing.



Place the piston support (1) 22-50.412 on the casing and put the piston, which is heated, over the conrod with the arrow pointing to the exhaust port. The cold gudgeon pin (2) is put on the cold guide mandrel (3) 05-MW 19-4 and the mandrel with the taper ahead inserted into the piston. Thus, piston and conrod are aligned



After having determined the dimension of the gap, the new shim found in this way is placed over the centring collar (B) on the cylinder.

Mount the cylinder head and gradually tighten the nuts crosswise by means of a socket wrench with a torque of 26 Nm (2.6 kpm).

4.5.2. Clutch Driver (see Fig. 21)

4.5.3. Measuring and Adjusting the End Play of the Clutch Driver

The given end play is determined by means of the measuring device 05-ML 13-4. For this purpose, the measuring device is fitted without spring lock washer (5) and thrush washer (4) (Fig. 75). When moving the inner driver axially, the end play is indicated by the dial.
The end play of the drive gear with inner driver is 0.05 to 0.10 mm.

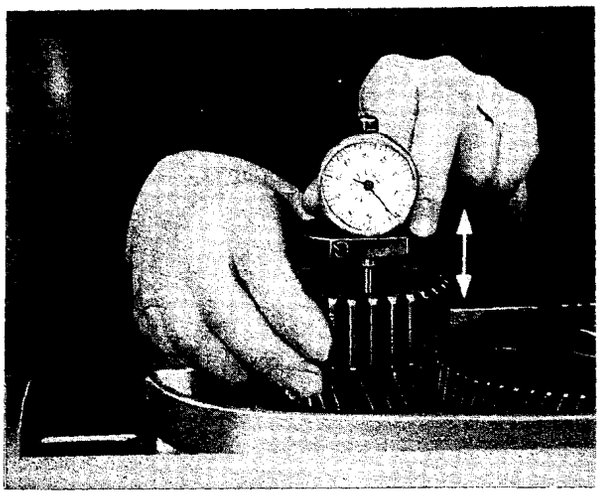


Fig. 76. Measuring the end play of the clutch driver

When the end play is greater than 0.10 mm, noise is emitted with unloaded engine which is caused by the helical teeth of the primary drive. The clutch driver is axially moved by changing loads. When the clutch is pulled while the vehicle is stationary and the engine running, this noise disappears (primary drive is stationary). The greater the end play of the clutch driver is set, the louder this noise will be. In the loaded condition of the engine, it is not present.

The end play is varied with the help of different spacing washers (1) (Fig. 75). When the end play is smaller than 0.05 mm, the spacing and thrust washers will be tarnished, and the clutch fails to interrupt the power flow from the crankshaft to the gearbox because the driver has got stuck. Under these conditions, the clutch may be torn from the cone of the crankshaft.

4.6. Mounting the Clutch

- Remove the oil from the two cones (clutch body and crankshaft) and check the surface appearance. When the full cone fails to bear, it can be ground in with the help of grinding paste. In this operation, protect the grooved ball bearing 16005 - clutch thrust bearing -, and carefully remove the remains of the grinding paste.

When, for checking, the clutch is put on the crankshaft end without spring lock washer (1) and clutch driver (2), the cone must fit already in such a way that the clutch cannot be removed by hand.

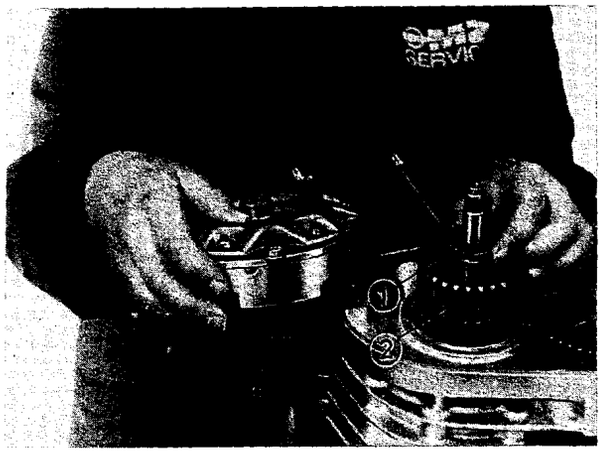


Fig. 77. Checking the cone of the clutch

- Mount the clutch. Due to its spring power, the spring lock washer under the clutch retains the thrush washer (4) in place (Fig. 75). The pre-tension of the spring lock washer is good when the clutch, which is being mounted (before tightening), slightly tilts in the cone.
- Before mounting the clutch cover, the clutch must be properly tightened with the help of a spacer tube (A).

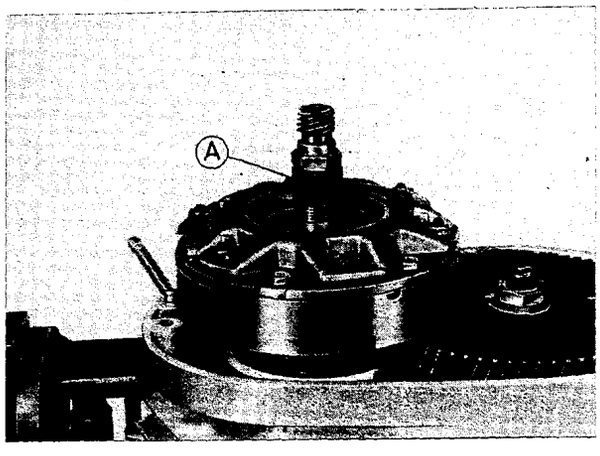


Fig. 78. Tightening the clutch

4.7. Completing and Mounting the Clutch Cover

4.7.1. Mounting the Kick-starter Assembly

The kick-starter sub-assembly is provided with a positive tracking for the dog of the kick-starter from the kick-starter wheel. In starting the engine, it restricts the transmission of a back-kick moment to the wheels and gears of the gearbox.

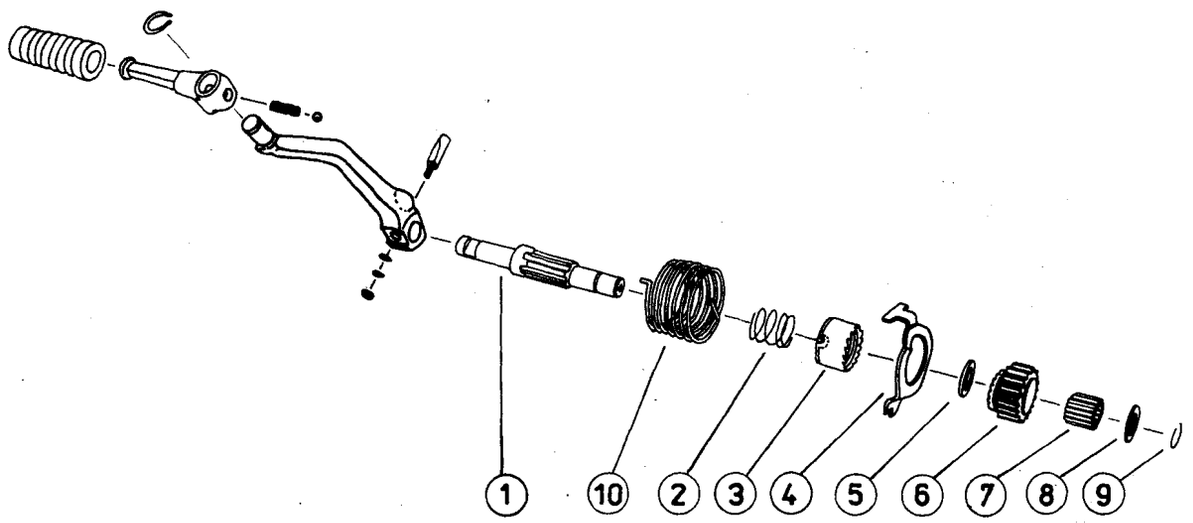


Fig. 79. Individual parts of the kick-starter sub-assembly

Mount the kick-starter shaft in the order of numbers demonstrated in Fig. 79.
Fit the dog (3) in the manner shown on the left of Fig. 80. The right part of Fig. 80 shows a kick-starter shaft mounted in the wrong manner.

Before fitting the 24 bearing needles (7) 2.5 x 19.8, the kick-starter wheel (6) is provided with grease and pushed on the kick-starter shaft (1) so that it contacts the thrust washer (5).

Finally, mount the kick-starter spring (10). The end of the spring must be pushed into hole (A) of the kick-starter shaft up to the stop. Fig 81 shows the kick-starter shaft ready for being mounted.

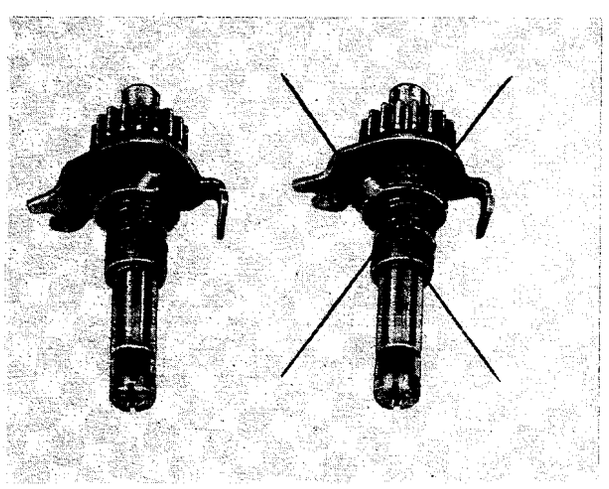


Fig. 80. Correct mounting of the dog (left)

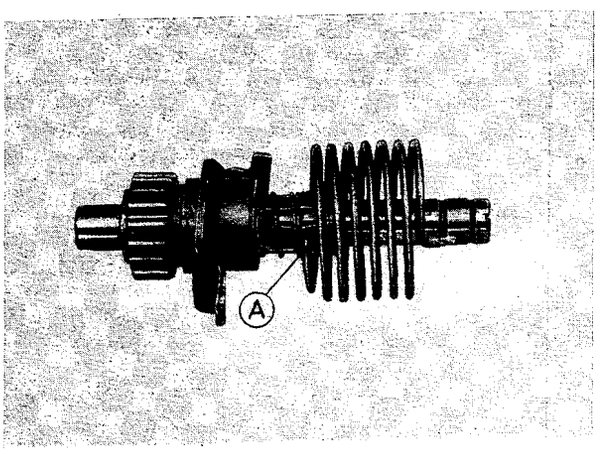


Fig. 81. Complete kick-starter shaft

The pre-assembled kick-starter shaft is now clamped at its bearing pin in a vice between copper jaws or wooden inserts, immediately below the kick-starter wheel, according to Fig. 83.

Insert the rubber rings for sealing the kick-starter shaft and foot-operated gear-shift shaft into the recesses provided in the clutch cover, slightly oil the parts and mount the clutch cover from above on the kick-starter shaft. At the same time, the spring end of the kick-starter spring is pressed into the hole (B) provided in the clutch cover.

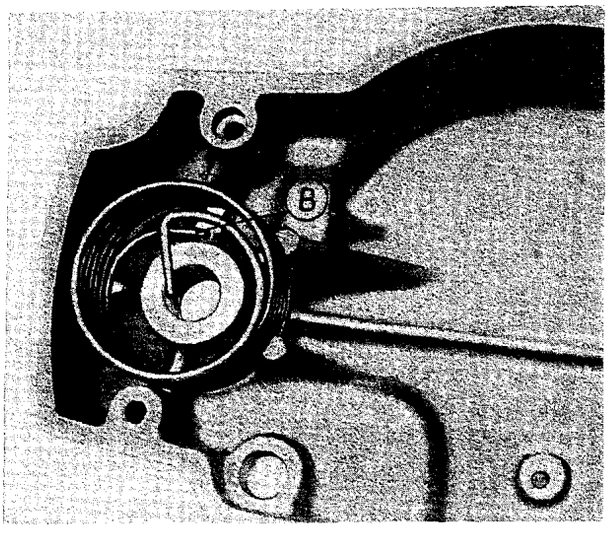


Fig. 82. Mounted position of the clutch spring

Turn the clutch cover through about 1 1/4 revolution anti-clockwise and put the splined bolt through the kick-starter lever meanwhile fitted and screw it together with the nut (Fig. 83).

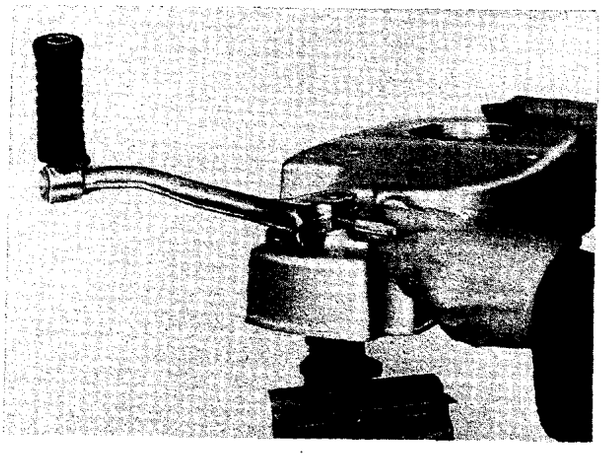


Fig. 83. Fastening the kick-starter lever

4.7.2. Mounting the Clutch Actuation Mechanism (see Figs. 21 and 87)

Push bearing bush (17) with supporting bearing 6302 of crankshaft (retained by circlip) from outside into the clutch cover, the markings (M) must point upwards, Fig. 85. Turn the pressure lever (16) from inside into the threaded worm of the bearing bush fully down and hook on the tie rod (19).

4.7.3. Mounting the Clutch Cover

After completing the clutch cover, the packing is placed on the cleaned sealing surface (without sealing compound) and the clutch cover mounted.
As shown in Fig. 84, the cam plate of the positive tracking is put with its nose (1) into the casing.

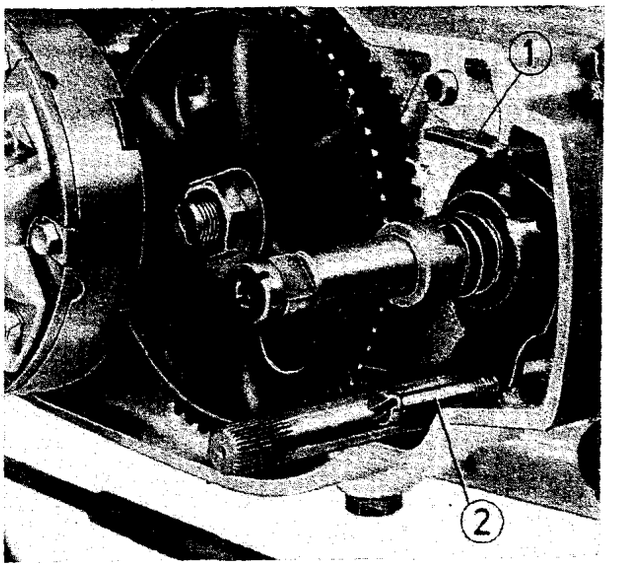


Fig. 84. Correct position of the cam plate

The casing screw (2) retains the cam plate at its lower end.
For the sake of clearness, the clutch cover is not shown in Fig. 84; this illustration does not show the mounted state.
By applying slight rebounding blows with a rubber mallet drive the clutch cover on to the sealing surface and, at the same time, turn the kick-starter shaft to the right so that the kick-starter wheel can engage with the gear of the 1st speed.
Using new packing rings, insert the 5 casing screws and tighten them uniformly and crosswise, thus, fastening the clutch cover.

4.7.4. Rough Adjustment of the Clutch

Before the clutch can be adjusted at the bearing bush of the clutch cover, the clutch must be tightened by means of the supporting bearing of the bearing bush in the clutch cover. Place the spring lock washer B 14 on the crankshaft end and tighten the drive gear for speedometer or, in the standard design, the nut M 14 x 1.5 (WoF 22) with a torque of 80 to 100 Nm (8 to 10 kpm).
Push the pipe (1) over the tie rod (Z), see Fig. 87. Pipe (1) and tie rod (Z) are connected through the bolt (2) 8 mm in diameter which is put through the hole for the cable control. Then turn the bearing bush (arrow a) (3) until the pipe (1) contacts the clutch cover. With this, the basic adjustment of the pressure member (D) with A = 11 mm is determined.

4.7.5. Clutch Fine Adjustment

Fine adjustment of the clutch is effected with the help of the adjusting screw of the clutch lever at the handle-bars.
The free play at the clutch lever should be

The lubricating oil collected in the oil catch pocket (4) passes through an oil hole (6) into the compartment between oil guide plate (7) and shaft seal ring. During engine operation, this free space is continuously filled up to the lower edge of the hole in the oil guide plate and in this way supplies the sliding point of shaft seal ring and crankshaft end.

After having supplied the shaft seal ring, the oil lubricates and cools the crankshaft main bearing.

4.10. Lubrication of the Gearbox

By the drive gear (68 teeth), a part of the oil from the clutch compartment is pumped up into the oil catch pockets of the left-hand casing half (O, Fig. 59). From this catch pockets, the oil flows on to the oil guide plate (L, Fig. 57) and through the holes in the oil guide plate directly on the teeth of the gearbox gears and from the rear catch pocket over the circlip which is open at the top into the oil catch plate of the drive shaft (arrow A, Fig. 59). Through the hole drilled in the drive shaft, the oil passes to the bearing of the loose wheels for the 2nd and 3rd speeds and lubricates them.

4.11. Assembling Faults

When the engine is assembled with the casing halves in a cold state, the bearing seats in the casing will be destroyed. Then the bearing external rings will rotate in the casing. The undue force applied in mounting the gearbox shafts and the crankshaft into cold bearing inner rings, that is to say, rings which are too cold for mounting and thus too narrow, leads to deformations in the bearings and, maybe, to an impermissible large radial eccentricity of these shafts.

From these defects result, for example, gear-shift errors of the gearbox, incorrect running of the engine because of hardly correct adjusted advanced ignition, premature wear of components and parts.

4.12. Mounting the Engine in the Cycle Parts

For mounting the engine in the cycle parts, proceed in the inverse order of the operations described in the Sections 3.1.1. to 3.1.4. Every repair of the engine entails the adjustment of the timing of ignition and of the carburetter. Further details of these adjustments are given in the Sections 6.5.3. and 7.1.4.

5. Cycle Parts

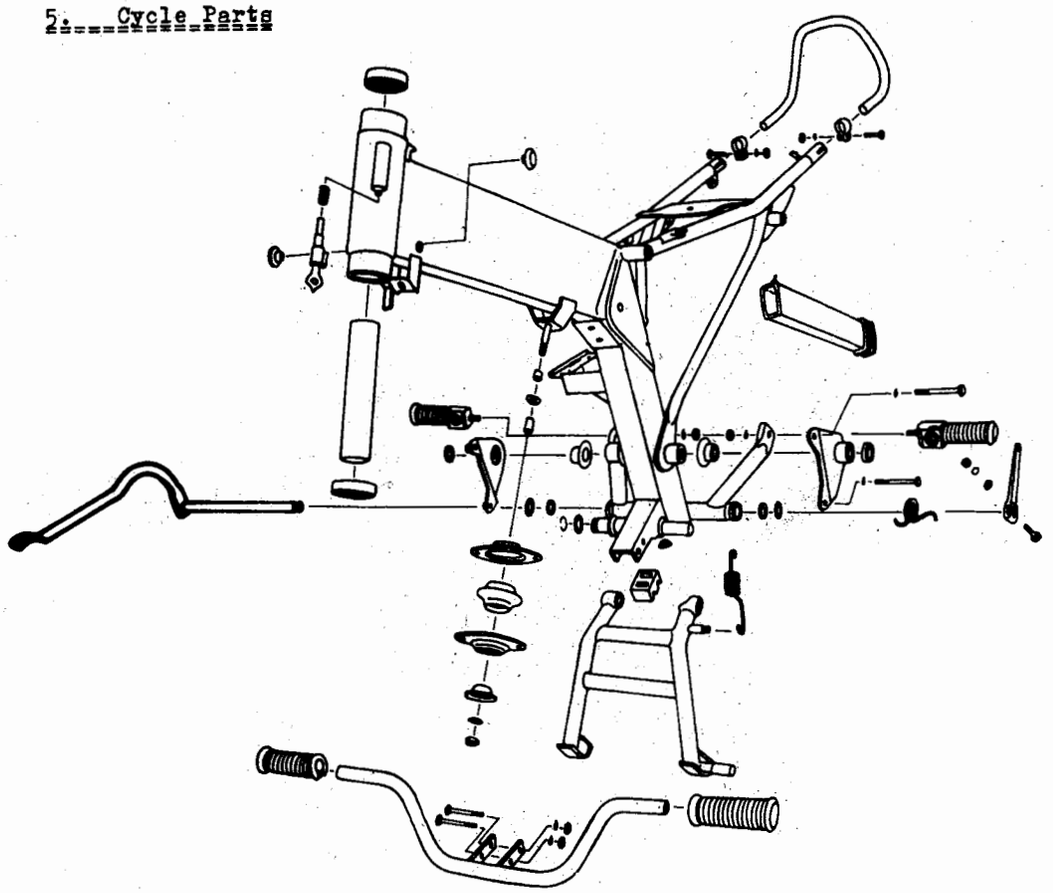


Fig. 89. Exploded view of cycle parts

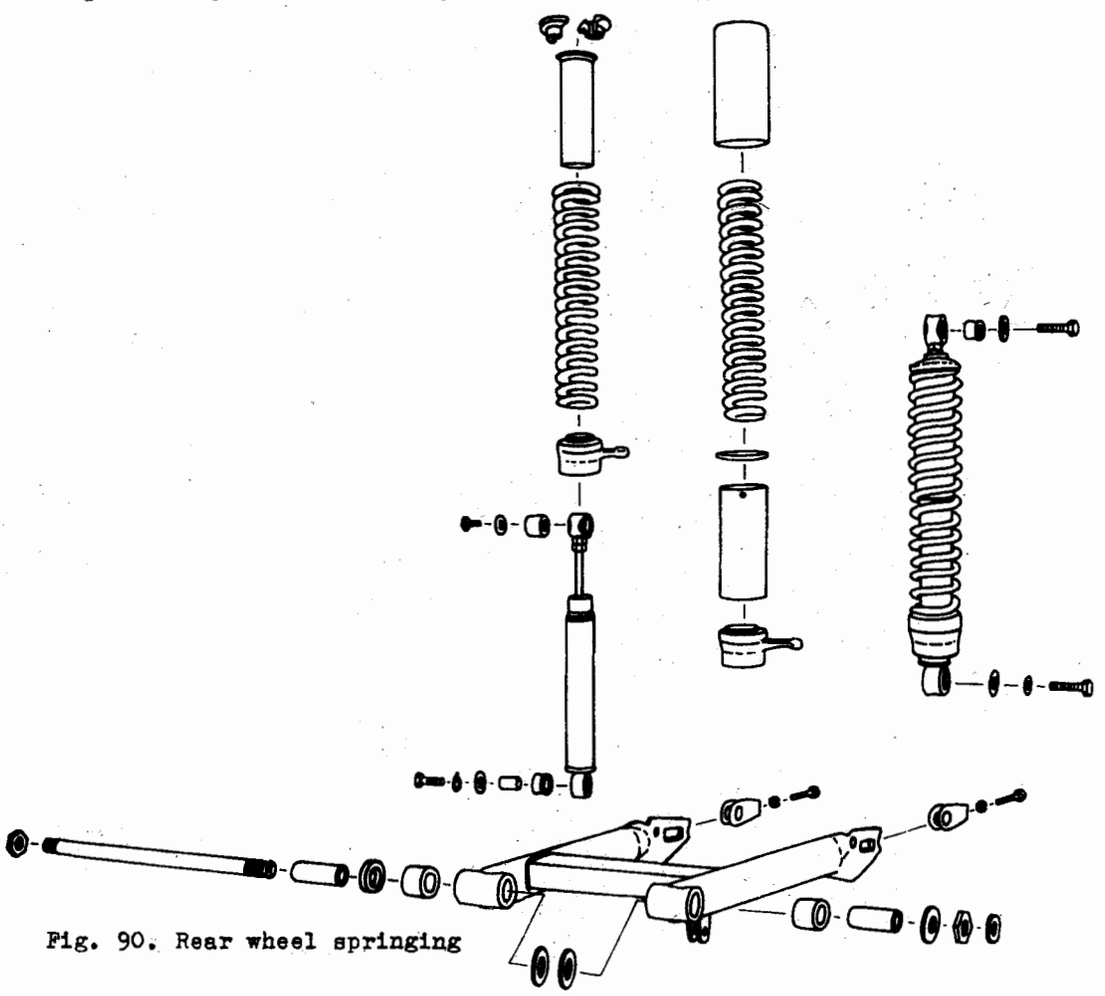
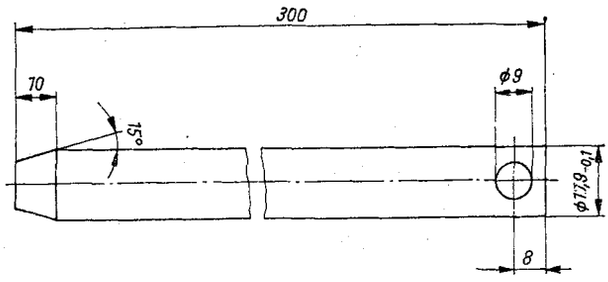


Fig. 90. Rear wheel springing

The general design, which has already been indicated in Figs. 1 and 2, is shown in full detail in the exploded view of the cycle parts in Fig. 89. Below further instructions for repairs and explanations of details of various sub-assemblies

After assembling, the swing-fork mounting is completely free from maintenance.

The rear-wheel swing-fork is delivered by our Spare Sales Department complete with the rubber elements pressed in place. For the use of the side-car, changed swing-



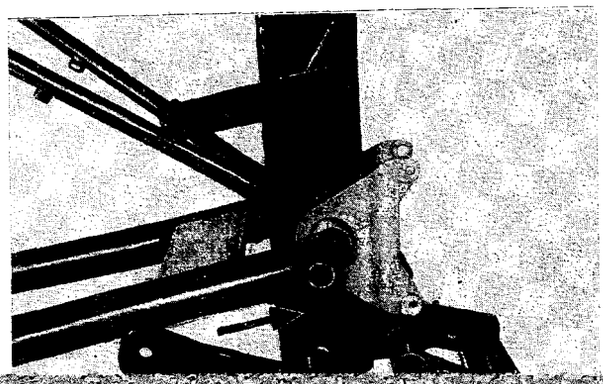


Fig. 93. Sketch of auxiliary mandrel

When fitting the swing bearing bolt

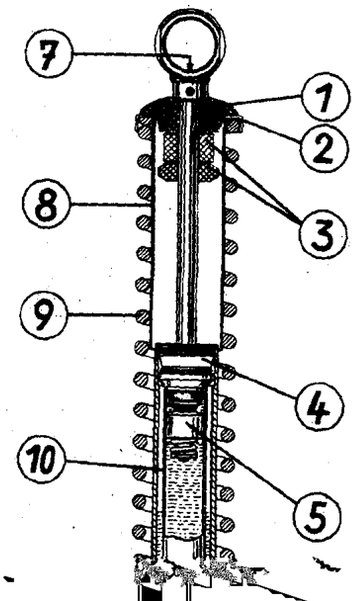
5.1.6. Repair of the Suspension Units

Repairs are limited to the replacement of defective parts of the spring-loaded suspension units and the lubrication of the adjusting sleeves of the rear suspension units.
The shock absorbers must be replaced completely and brought to a shop for regeneration. Self-repair of shock absorbers is not possible. In case of loss of oil, the lacking amount can be replenished (special wrench 05-MW 82-4), in most cases, however, the packing of the piston rod will be defective - the shock-absorber must be regenerated.

Shock-absorber marking

The marking is arranged above the lower fastening eye.

Example: A 22 - 100 - 88/8 M 1.50/1



5.2. Engine Suspension at Cylinder Head

The design of the front elastic engine suspension is shown in Fig. 98. For the repair or the replacement of the front engine suspension, it is practical to demount the carburetter and induction socket and to remove the ignition cable.

The exhaust system can be left on the engine, only the connecting screw between rear exhaust clip and exhaust brace must be loosened.

After unscrewing the two M 8 nuts from the cylinder head, lower the engine to the position shown in Fig. 98. Then loosen the M 10 nut serving for fastening the front suspension to the frame and all individual parts can be removed.

When assembling, see to it that all screwed connections are properly tightened!

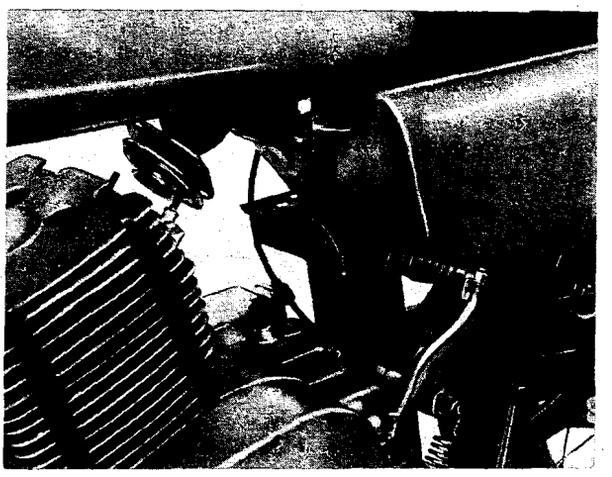


Fig. 98. Replacement of the elastic engine suspension at the cylinder head

5.3. Telescopic Fork

Figs. 99 and 100 show the design and the arrangement of the individual parts of the telescopic fork. The repair of individual sub-assemblies is described in detail below.

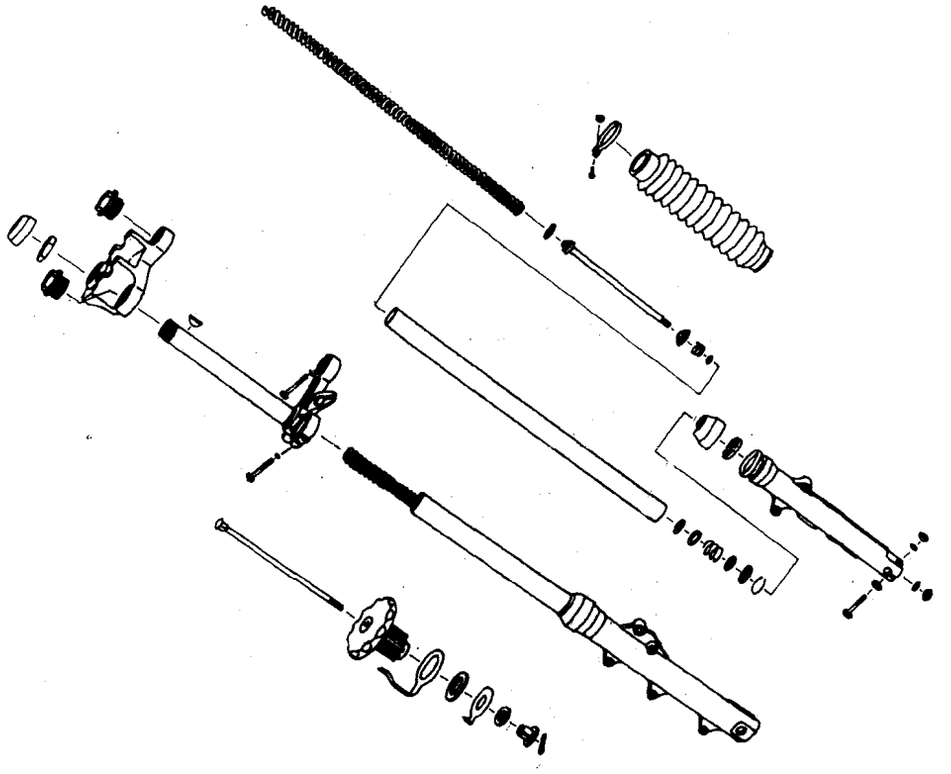
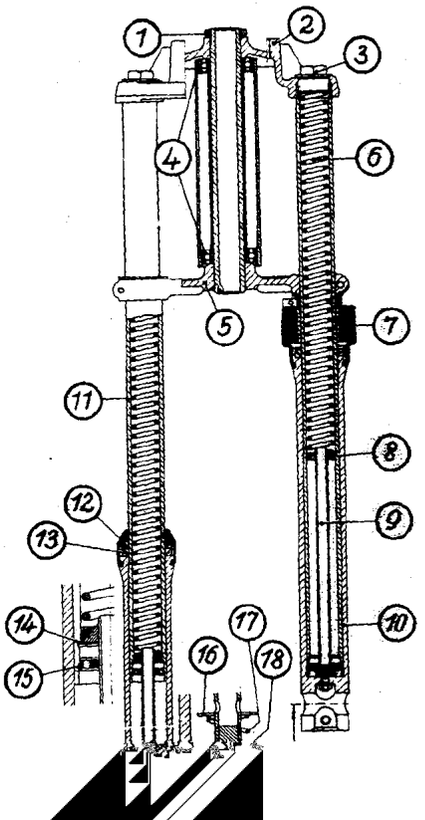


Fig. 99. Exploded view of the telescopic fork



5.3.1. Steering Bearing

Two radial grooved ball bearings 6006 are employed for the steering assembly; a spacer sleeve is inserted between these bearings which are completely free from maintenance.

No adjustments have to be made during assembling and later on.

THE STEERING ASSEMBLY IS MOUNTED IN THE FOLLOWING WAY:

- Fill the 6006 ball bearings with anti-friction bearing grease;
- Press the lower bearing up to the stop on the external ring, use an intermediate ring Ø 54 x 20 for this purpose;
- Insert the spacer sleeve;
- Press the upper bearing on the spacer sleeve until the inner ring contacts the latter.
  Observe the following:
  Place a spacer ring Ø 54 x 40 mm under the lower bearing in order that it will not be pressed out and press the upper bearing over the spacer ring Ø 54 x 20 in place.

  NOTICE: In the later mounting of the upper and lower clamping heads, take care that the nut for the control tube (1), Fig. 100, is tightened with a torque of 150 Nm (15 kpm)!

Then, the steering assembly must be free to be moved easily and it must not jam in any position. If this, however, should be the

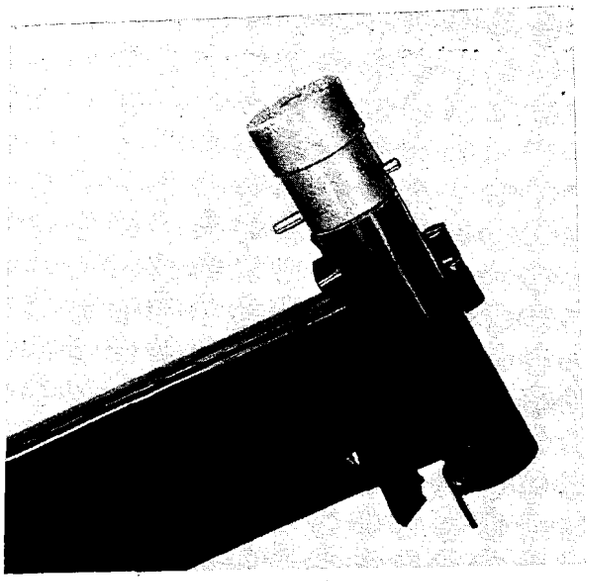


Fig. 102. Fitting the upper part of the extractor

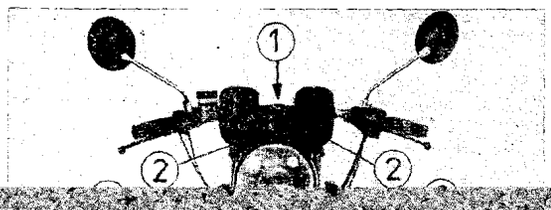
2. When the permissible wear limit between guide tube and sliding tube has been reached.

   TEST METHOD:
   The vehicle is on the prop stand, the telescopic fork is fully extracted. The two sliding tubes are moved to and fro at the axle accomodation. The maximum play must not exceed 2.2 mm (new state 0.8 to 1.2 mm). For this measurement, the two fork members must not be distorted because otherwise the play may be reduced.
   In case of doubt, the complete fork members must be removed, the guide tubes clamped "in soft protective jaws", and the existing play at the axle accomodations measured by means of a dial gauge.

3. When the fork members lose oil (radial seal rings in the sliding tube are leaky). Oil level checking: see Fig. 114.

4. When the hydraulic oil damping is insufficient with the full amount of oil present.

5. When the protective caps or protective bellows must be replaced by new ones.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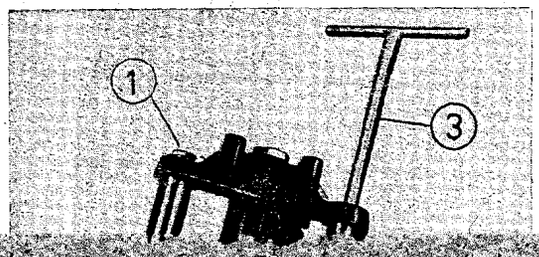
2
2


1
3

NOTE !

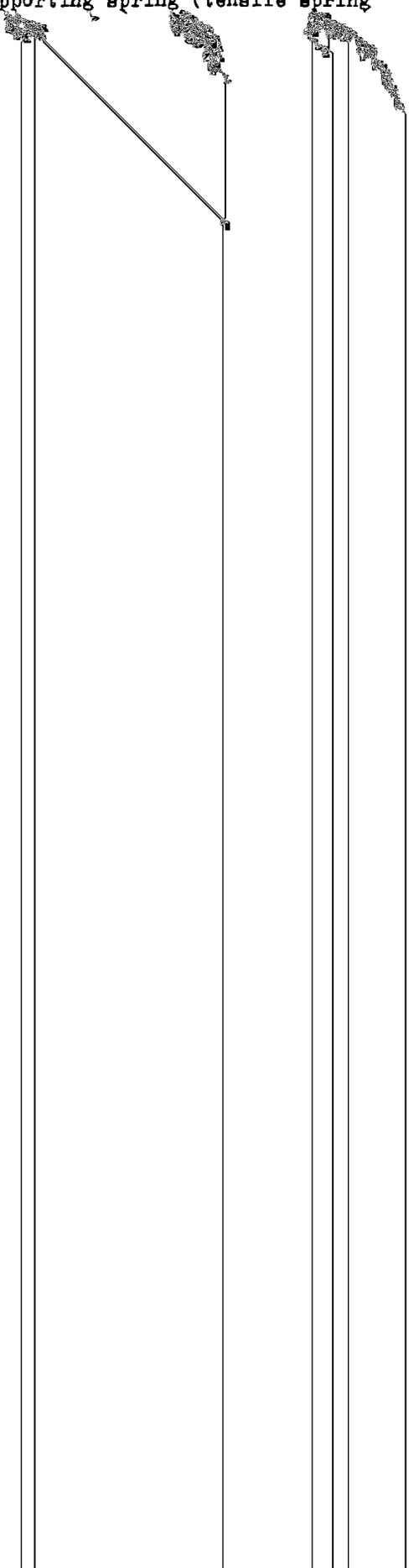
To be observed strictly - when clamping the guide tubes (A) in a vice, use soft protective jaws and clamp in the upper third only.
The sliding tubes have to be clamped at the axle accomodation or the fastening hubs for the mudguard or the brake saddle.

- Remove the sealing washer (3), the compression spring (4) 19 mm in diameter, and the cup for the final stop (5) from

- For the sake of clearness Fig. 109 has been included showing the assembly without the supporting tube pushed in.
- Remove the lock ring (1) seated behind the valve spring and the washer (2) from under the ring (Fig. 110).

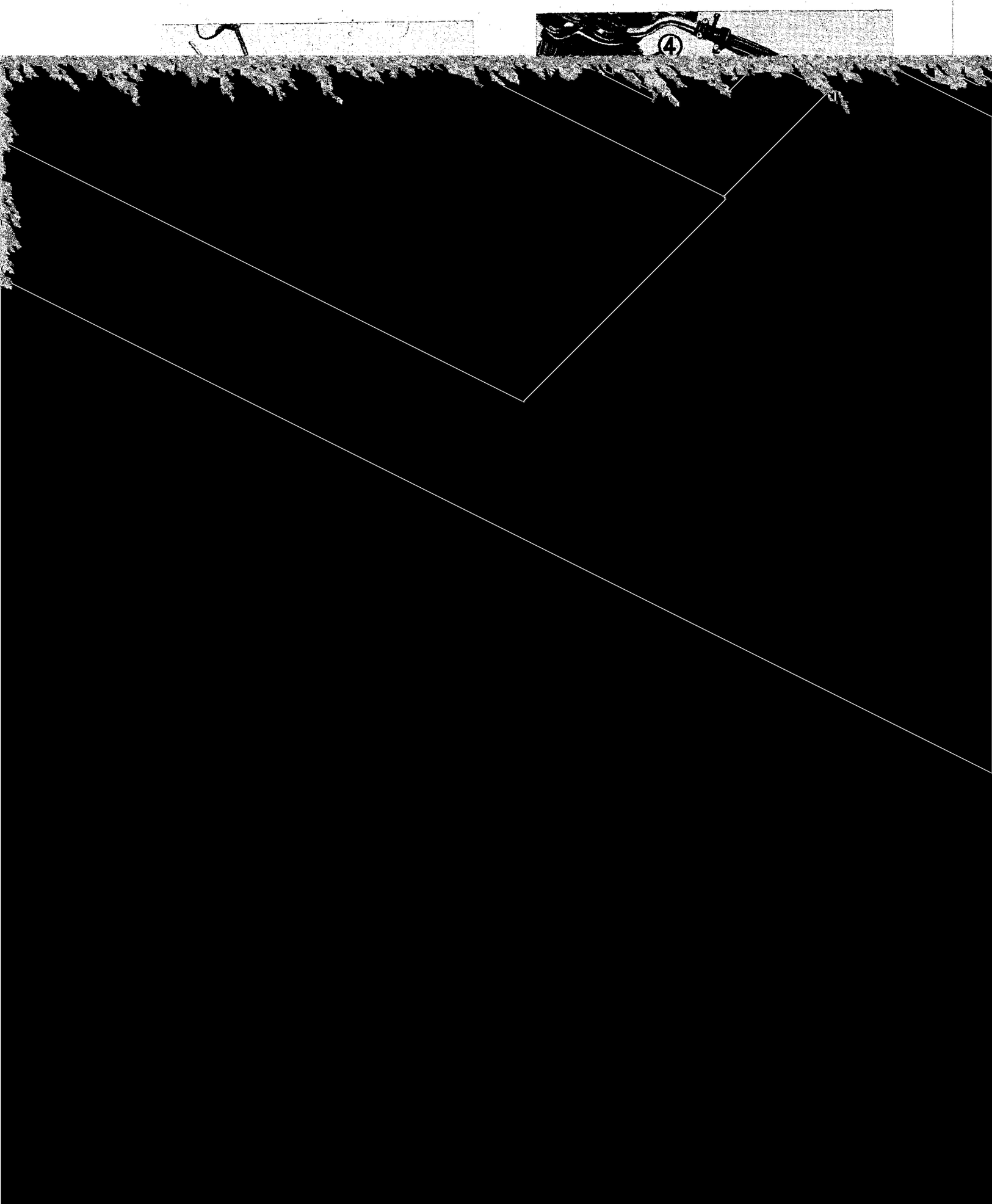
The assembling operations are to be performed in the following order:

In a telescopic fork tight before demounting, the shaft seal ring must be checked for wear on the sealing lip and correct seat of the supporting spring (tensile spring



- Check the guide tube (A), Fig. 109, for chromium defects, scores and distortions In case of doubt, check for true running. Permissible eccentricity 0.05 mm.

- Apply some damping liquid to the guide tube for the shaft seal ring and push the sliding tube from top over the guide tube and fit, at the same time, the thread-


④

In the cock, the fuel flows through two strainers. The first one is accessible (1) after unscrewing the fuel shut-off cock from the fuel tank; the second one after (2) the loosening of the filter bowl (3).

It is advisable to clean the strainers after every 5,000 km of road operation or once a year carefully.

Another cause of troubles in the fuel cock may be the rubber packing (4) under the actuating lever (5) whose drill-holes may be closed or clogged by swelling or by fastening screws (6) which are tightened too much.

Actuating lever and rubber packing can be removed after loosening the two retaining screws arranged on either side of the actuating lever.

On the occasion of repairs in the fuel cock, the fuel hose leading to the carburetter should also be checked.

When this hose has become brittle, leaks may occur in the points of connection. The, the fitting of a new fuel hose having the dimensions 5 x 8.2 mm is required.

NOTICE!

On no account should holding screws (6) be tightened until the spring plate (7) contacts the casing (8). The actuating (5) lever must be easily movable. When the fuel cock should drop, then tighten the holding screws (6) uniformly through maximum one revolution.
The rate of flow must be at least 12 litres per hour.

5.6. Rear-wheel Drive and Rear-wheel Hub

The design of the rear-wheel drive is shown in the Figs. 117 and 118. In contrast to the previous type, two radial grooved ball bearings are incorporated in this type of rear-wheel drive (see Fig. 118).

The chain cover contains a through bush (1) which enables to tighten the nut (2) - see Fig 117 - with the maximum permissible torque without destroying the cover.

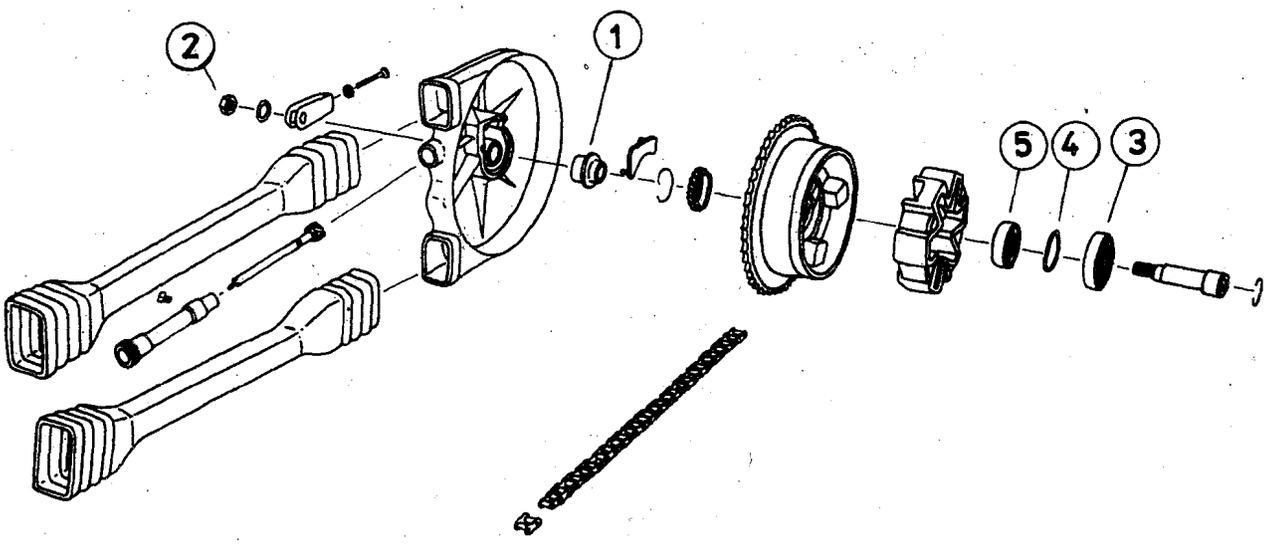
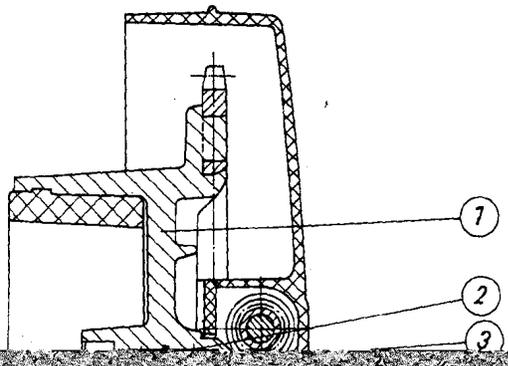
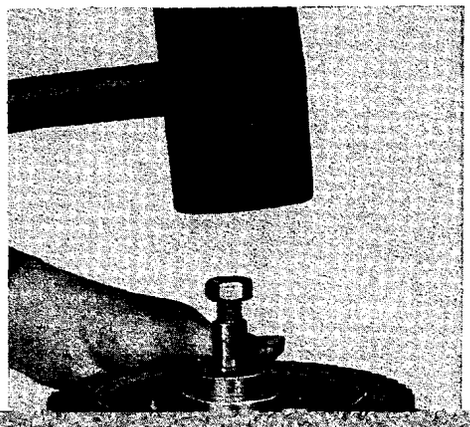


Fig. 117. Exploded view of the rear-wheel drive

Apart from a view corrections of shape, the rear wheel hub is equal to that of the preceding type.





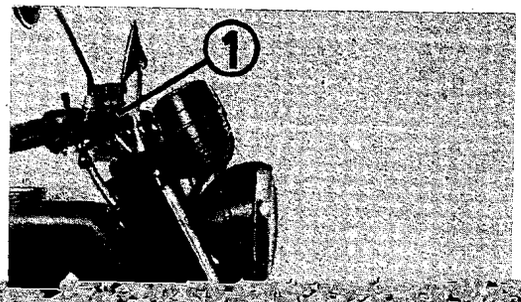
5.7. Changing the Wheel Bearings

With the help of an expanding mandrel (special tool H 8-820-3), demounting the

is centred in the bore and the shoes have to be tooled in a lathe until the difference between the diameter of the brake ring and the diameter of the brake shoes is at least 0.6 mm.

5.8.2. Disk Brake for the Front Wheel

The fixed-saddle brake is hydraulically actuated by means of a lever at the brake master cylinder. The arrangement of the components is shown in Fig. 124.



In an exploded view, the Figs. 125 and 126 show the arrangement of the parts of brake saddle and brake master cylinder.

Demounting and Mounting the Brake Master Cylinder

- Disconnect the cable connections from the stop light switch,
- Loosen the brake hose for about 0.25 revolutions,
- Unscrew the brake master cylinder from the handle-bars,
- Remove the screw cap and the hermetic bellows and decant the brake liquid,

Completely unscrew the brake hose.

For mounting, at first loosen the screwing of the brake hose (union nut) in order that the brake hose is not twisted during screwing in. Tighten all screwed joints, fill in brake fluid and bleed the brake.

Repair of the Brake Master Cylinder

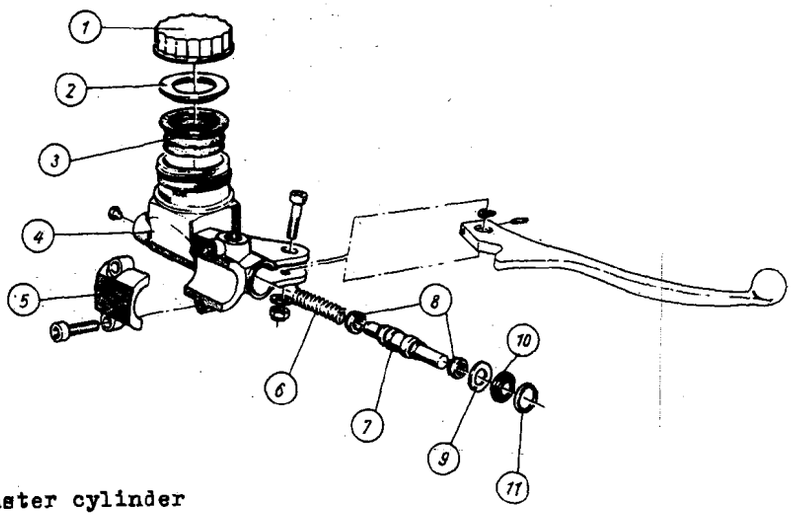


Fig. 125. Brake master cylinder

(1) Cover
(2) Vent ring
(3) Hermetic bellows
(4) Housing
(5) Fastening clip
(6) Spring
(7) Brake piston
(8) Sealing sleeves
(9) Washer
(10) Packing
(11) Circlip

Demounting and Mounting the Brake Saddle

- Remove the brake hose by loosening the union nut. Fasten the hose to the telescopic fork with binding wire.

NOTE: The hose opening must not be deeper than the liquid level in the reservoir of the hand brake cylinder!

- Demount the brake saddle from the sliding tube of the telescopic fork.

Mount the parts in the inverse order. If required, top up with brake fluid, bleed the brake.

Repair of the Brake Saddle

- Remove the cover
- Drive out the two bolts by means of a mandrel from the side of the small bolt diameter
- Remove the brake shoes
- Dismantle the brake saddle
- Press out the brake piston by means of compressed air

As to the discarding of parts, the same criteria apply as for the brake master cylinder.

Mount the absolutely clean parts in the inverse order. Apply brake fluid to the sliding surfaces and internal packing rings before mounting them.

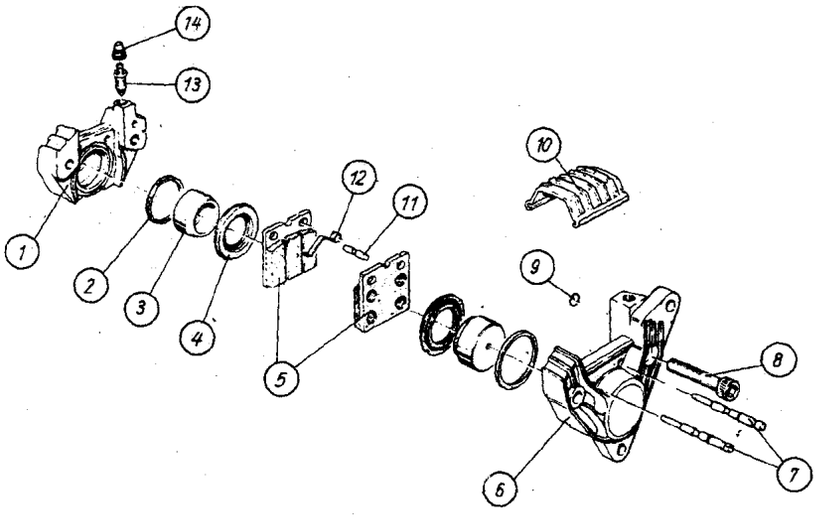


Fig. 126. Brake saddle of the disk brake

(1) Inner brake cylinder
(2) Packing ring
(3) Brake piston
(4) Packing sleeve
(5) Brake shoe
(6) Outer brake cylinder
(7) Guide bolt
(8) Hexagonal socket-head bolt
(9) Packing
(10) Cap
(11) Taper pin
(12) Spring
(13) Vent screw
(14) Protective cap

Replacement of the brake shoes

Replace the brake shoes in the following order of operations, when they are worn down to the wear marking.

- Remove the front wheel
- Remove the brake shoes in the manner described in Section "Repair of the Brake Saddle"
- Externally clean the brake saddle
- Press back the brake piston
- Mount the new brake shoes
- Fit the front wheel

NOTE: Do not actuate the brake when the brake shoes are removed!

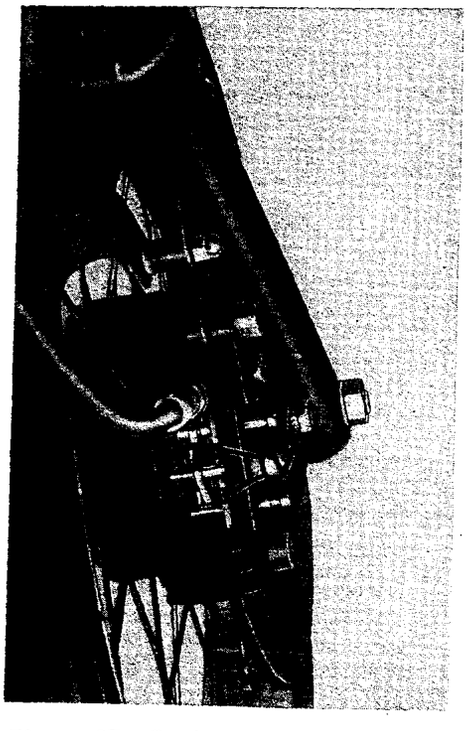


Fig. 127. Brake shoe - wear marking
V = wear groove

Replacing the Brake Disk

The brake disk must be replaced when it is worn down to less than 4.4 mm or when it shows scores whose bottom is such that the actual thickness falls below the above minimum thickness.

NOTE: For reasons of safety, use new self-locking nuts whenever mounting the brake disk!

Before mounting the wheel provided with a new brake disk, press back the brake pistons into the brake saddle.

Replacement of the Brake Fluid

After about two years, the brake fluid must be renewed. This can be done with the help of a filling apparatus or in the following way:

- Put a suitable hose on the bleeder valve of the brake saddle
- Open the bleeder valve. By pumping continuously with the hand brake lever, evacuate the brake system through the hose into a suitable vessel
- Fill in brake fluid
- Bleed the brake system

Filling in Brake Fluid

When a new brake system has been newly installed or repaired or when the brake fluid must be renewed, the filling of new brake

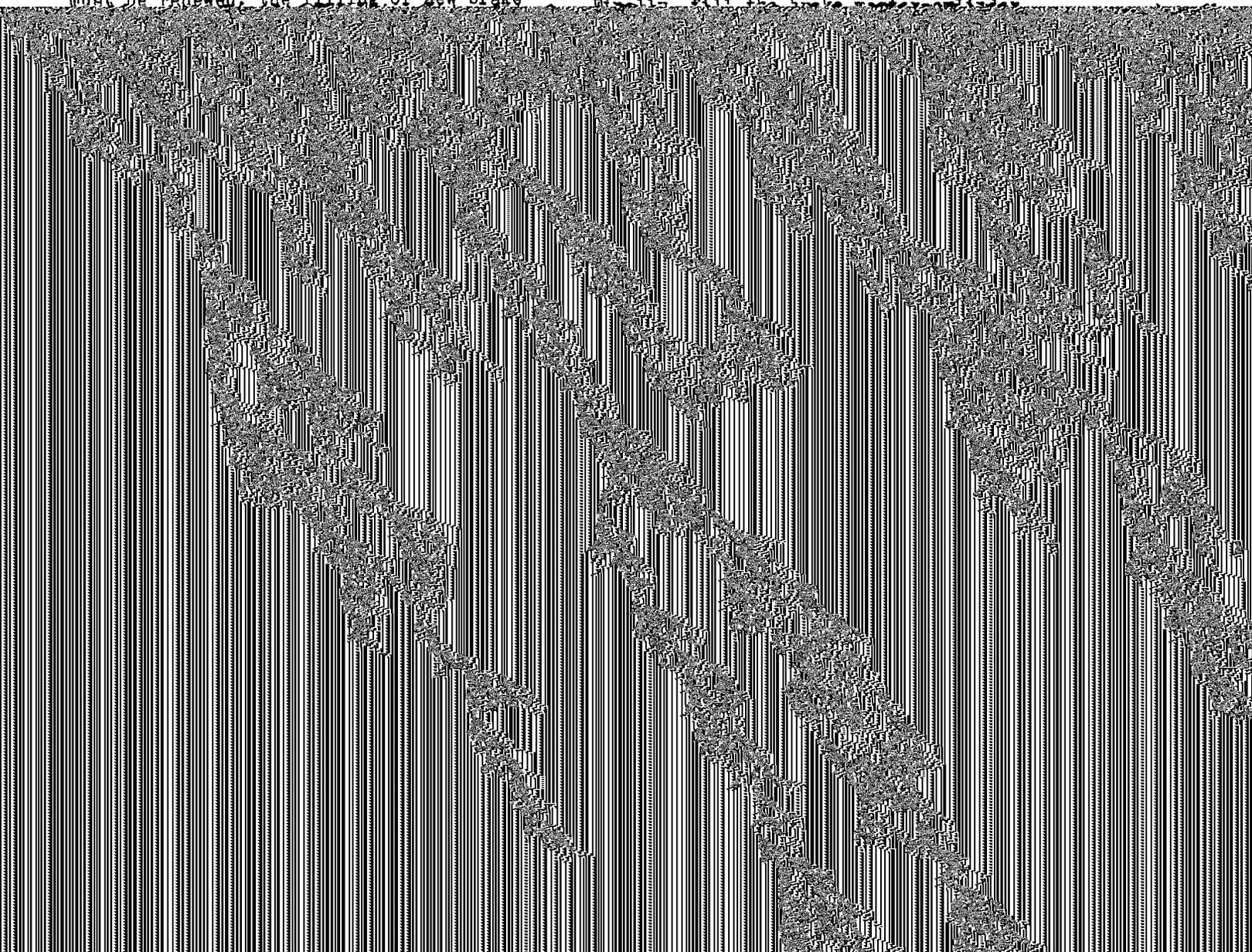
- Open the bleeder valve
- Raise the hose so that the funnel is about 20 cm above the top edge of the reservoir and fill in brake fluid until the maximum level has been reached in the reservoir
- Close the bleeder valve
- Fit the hermetic bellows and screw the cover in place
- Bleed the brake.

Bleeding the Brake

The brake is bled automatically. This process lasts for about an hour with the reservoir opened. The last remains of air escape when slightly tapping brake saddle and brake hose. Then fit the hermetic bellows and screw the cover in place.

More rapid bleeding is effected in the following way:

- Close the reservoir
- Put the filling hose on the bleeder valve and fill it up to the half of the funnel
- Raise the hose (funnel about 20 cm over top level marking of the brake master cylinder)
- Open the bleeder valve through half a revolution and, at the same time, pull the hand brake lever up to the stop. Close the valve with the hand brake lever pulled
- Repeat this process until no air bubbles will emerge. The liquid level must not fall below the lower level marking.



Fault	Possible Cause	Remedy
Brake fluid level drops	brake lines and/or brake cylinder leaky	seal the brake lines, replace the packings in the cylinders or replace brake master cylinder and brake saddle by new ones
	brake shoes worn	replace brake shoes
	brake hose porous or defective	replace brake hose by a new one
Resistance offered by hand lever diminishing when brake temperature is high	brake fluid contains formation of water vapour bubbles	replace the brake fluid by new one
Brake fluid contains water	Interval for change of brake fluid not observed	observe Maintenance Chart
	hermetic bellows not fitted or it is defective	fit the hermetic bellow or replace it; change the brake fluid
Stop light fails when actuating the front wheel brake	cable interrupted, plugged connection oxidised, stop-light switch defective	repair the connections, change the stop-light switch

5.9. Secondary Chain

The placing of a new chain on the vehicle is shown in Figs. 128 to 130.

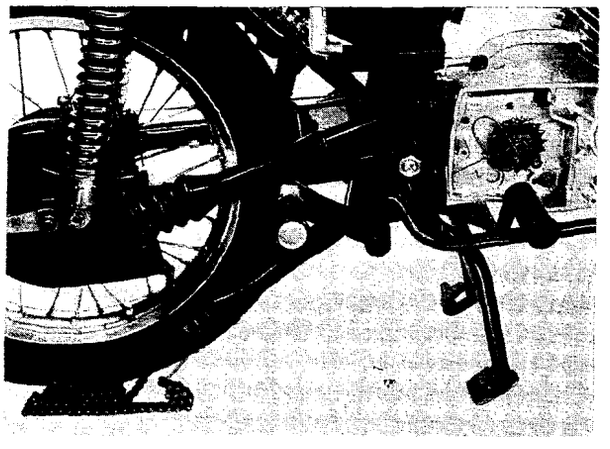


Fig. 128. Fitting a new chain - 1st step

The two chain protection hoses are fist pushed on the engine casing. For placing on the rear sprocket, the chain is pulled through from top to bottom. The upper end is fixed by means of a spoke pushed through the chain. Then use a wire hook to pull the chain from the rearto the front (through the lower chain protection hose) and place i round the front sprocket wheel.
Finally, the chain is pulled by means of a wire hook from the front to the rear through the upper chain protection hose and then connected together by means of the chain connector.

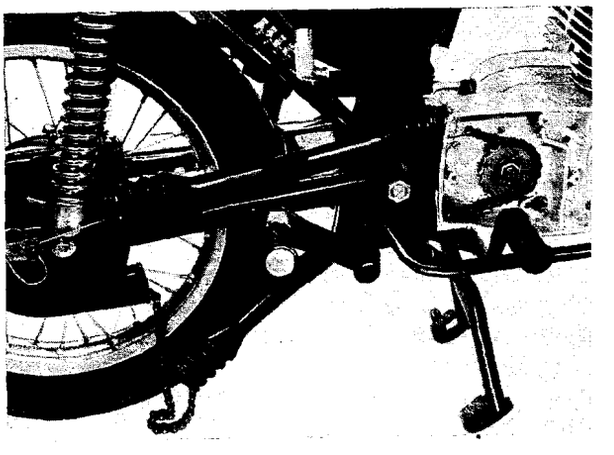


Fig. 129. Fitting a chain - 2nd step

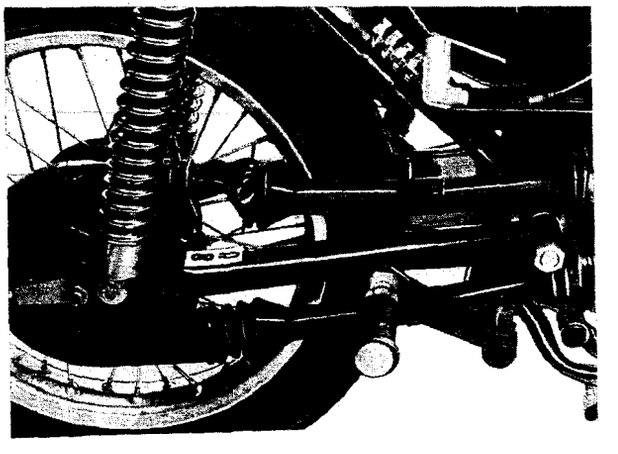


Fig. 130. Fitting a chain - 3rd step

In this connection, the upper chain protection hose must be pushed slightly ahead and retained by means of a spoke (Fig. 130). Pay particular attention to the position of the chain connector:

OPENING TO THE REAR!

When replacing a chain, the new chain must be tied to the old one and then pulled through by the latter one. A replacement of the chain is required when more than 5 rollers are broken or more than 2 rollers side by side are broken or when the chain bolts in the chain links are worn.
When a chain of a different make is used, the chain connectors of this make must be used because the bolt diameters may differ.

When replacing a chain, the sprocket wheels must also be checked.
When they are worn, they must be replaced, too.
Correct chain tension and chain lubrication exert a great influence on the service life of the chain.
A correct chain tension is ensured when the upper chain protection hose with the cahin inside can be pressed with two fingers, without undue force, on to the cross tube of the rear-wheel swing-fork. Check for one full revolution of the chain!
The rear wheel suspension units must be fully extracted (the motor-cycle is standing on the prop stand). When the chain seems to be too slack, it should be taken into consideration that the chain becomes more taut when the springs of the rear wheel are compressed.

Lubrication of the chain is necessary every 2,500 km.

With the dynamo cover removed, antifriction bearing grease Ceritol + k2 or k3 is applied to the lower part of the chain by means of a screwdriver while the rear wheel is turned slowly in travel direction through one full revolution of the chain; then apply the same amount of grease to the upper part of the chain and turn the rear wheel opposite to the normal sense of rotation.

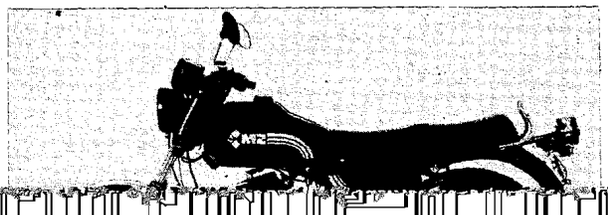
5.10. Exhaust System

(without packing). In new condition, the union nut is tightened with a torque of 150^{+30} Nm (15^{+3} kpm).

After having covered 500 km, the nut must be re-tightened in any case with the same torque because, during this distance, the taper of the exhaust pipe will attain proper contact with the supporting surface of the cylinder and the thrust area of the union nut.
Re-tightening is effected by means of a hook spanner, B 39-442, and an extension pipe put on.
A proper exhaust pipe fastening largely depends on the tightly fitting of all three suspension points (cylinder, lower connection, rear brace). When one of these points is defective, the stress on the other two will increase and they will work loose.
The rubber bearings of the brace must not be replaced by a rigid connection because of the elastic engine suspension.

5.11. Aligning the Wheels, Balancing the Front Wheel

Correctly aligned wheels are indispensable for good roadholding.
Since the front tyre is not so wide as the rear tyre, the front wheel must be set parallel to the measuring lath.



5.12. Cable Controls

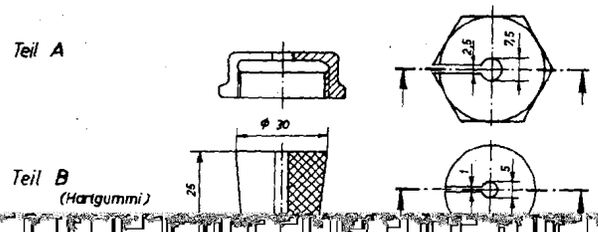
The cable controls are exposed to external influences such as rain, dirt and lye in a high degree on the motor-cycle. In motor-cycles which are operated daily and frequently parked in the open, high friction occurs in the cable controls so that the actuating levers can hardly be pulled.

Ease of motion is improved and the service life extended when the cable controls are sealed at the actuating levers and thoroughly lubricated to prevent the ingress of water and dirt.

The simplest way of sealing is the application of water-repellent grease, e.g. Ceritol, to the projecting wire end and to the slot in the adjusting screw of the actuating lever.

An additional possibility of extending the service life of the cable controls is given by attaching a rubber protective bellow, part No. 05.44.050; the interior of the bellows is filled with a water-repellent grease.

The cable controls are lubricated by means of the device shown in Fig. 134.



As lubricant, either a mixture of gear oil and gear grease in the mixing ratio of 1 : 3 or a mixture of antifriction bearing grease Ceritol + k3 and fuel in the mixing ratio of 1 : 1 is used.

One end of the sheath of the cable controls is clamped in the taper rubber cap and, together with the rubber cap, screwed on the device with the help of a union nut.

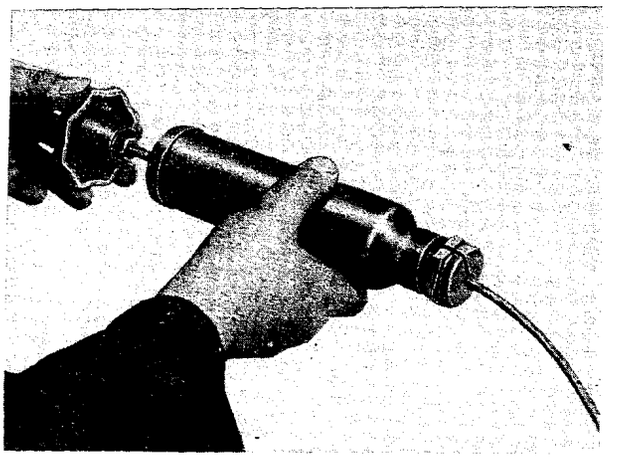


Fig. 134a. Cable control clamped in a lubricating device

6. Electrical Equipment

6.1. Three-phase Dynamo

6.1.1. Mode of Operation

The traffic growing denser and denser and the trend toward increasing the safety on the road by the use of halogen light, additional fog lamps and rear fog lights also on motor-cycles lead to an increase of the demand for electrical energy.

This increased demand cannot be met by the d.c. dynamo with reasonable costs and due to increased engine speeds.

Compared with this, the three-phase current dynamo of the same weight is in a position to produce a considerably higher power.

Three-phase dynamos have no commutator, the output current is drawn from the stator winding without contact. Only a small exciter current, branched off via 3 exciter diodes, is transmitted to the rotor via 2 carbon brushes and slip rings so that operation at high rotational speeds is possible.

The alternating current drawn from the stator is converted into direct current by an efficient three-phase bridge rectifier.

Due to the use of modern silicon semi-conductors, it ensures maintenance-less operation and a long service life.

The bridge rectifier is a separate component on which the exciter diode trio is also mounted.

The supplied voltage is kept at the desired level by means of an electromechanical one-element regulator. At the same time, the maximum current is limited by the regulator.

When observing the regulator voltage and the mounting conditions required in the technical documents, protection of the three-phase dynamo from destruction and a long service life of the electrical equipment are ensured.

6.1.2. Technical Data

Identification No.	8046.2
Dynamo voltage	14 V
Idling speed	$\geq$ 1,300 rpm
Speed at 2/3 of the maximum current	$\geq$ 2,200 rpm
Maximum speed	10,000 rpm
2/3 of the maximum current	10 A
Maximum current	15 A
Resistance of the rotor winding	4.2 $\pm$ 0.3 ohm
Length of carbon brush	16 mm
Length of carbon brush (minimum)	9 mm
Carbon-brush spring force	1.4 to 3.2 N (0.14 to 0.32 kp)
Slip rings (minimum diameter)	31 mm
Eccentricity	0.05 mm
Tightening torque for rotor fastening screw	20 $\pm$ 2 Nm (2 $\pm$ 0.2 kpm)
Sense of rotation (viewing the slip ring body)	clockwise
Polarity	mass negative

6.1.3. Technical Characteristic

The three-phase dynamo is a three-phase 8-pole synchronous generator in star connection.

The rotor carrying the exciter winding and the slip rings is fastened to the taper end of the crankshaft of the driving engine. The stator accomodating the polyphase winding is centred in the engine casing and, together with an aluminium die-casting cap carrying the ignition device and the carbon-brush holder, fastened by 3 screws passed via the external diameter of the stator.

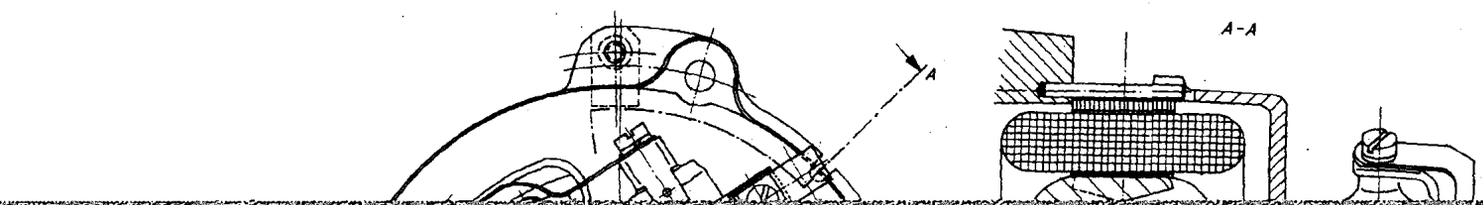
The three-phase current is rectified in a rectifier in three-phase bridge connection.

The exciter current for the production of the magnetic field is branched off from the stator winding and rectified by 3 additional exciter diodes and 3 negative power diodes.

The excitation current is fed to the excitation winding from terminal 61 via the regulator, the carbon brushes and the slip rings. The regulator keeps the dynamo voltage constant and limits the maximum current.

The three-phase dynamo exhibits good self-excitation properties. Operation without battery is possible.

Ignition device: Contact breaker with ignition capacitor. With pertinent cam, one ignition pulse per camshaft revolution.



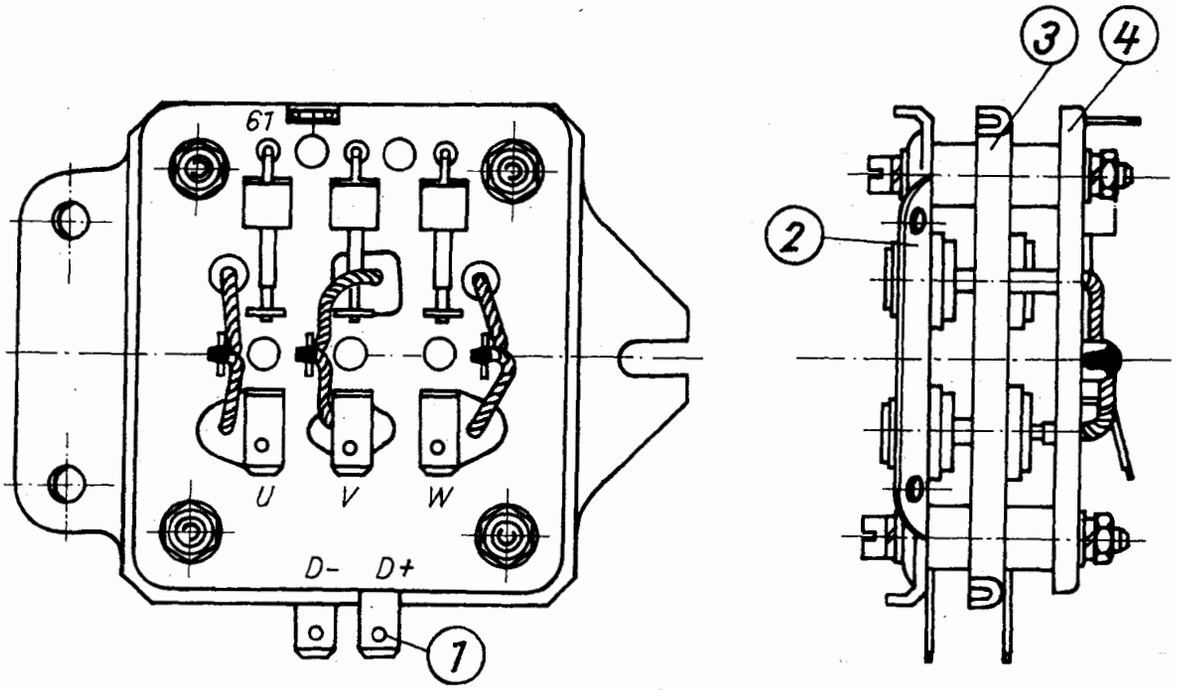


Fig. 136. Rectifier for three-phase dynamo 12 V, 15 A
(1) 6 x flat plug connection 6,3 TGL 22 425
(2) diode plate (negative)
(3) diode plate (positive)
(4) insulating plate with excitation diodes

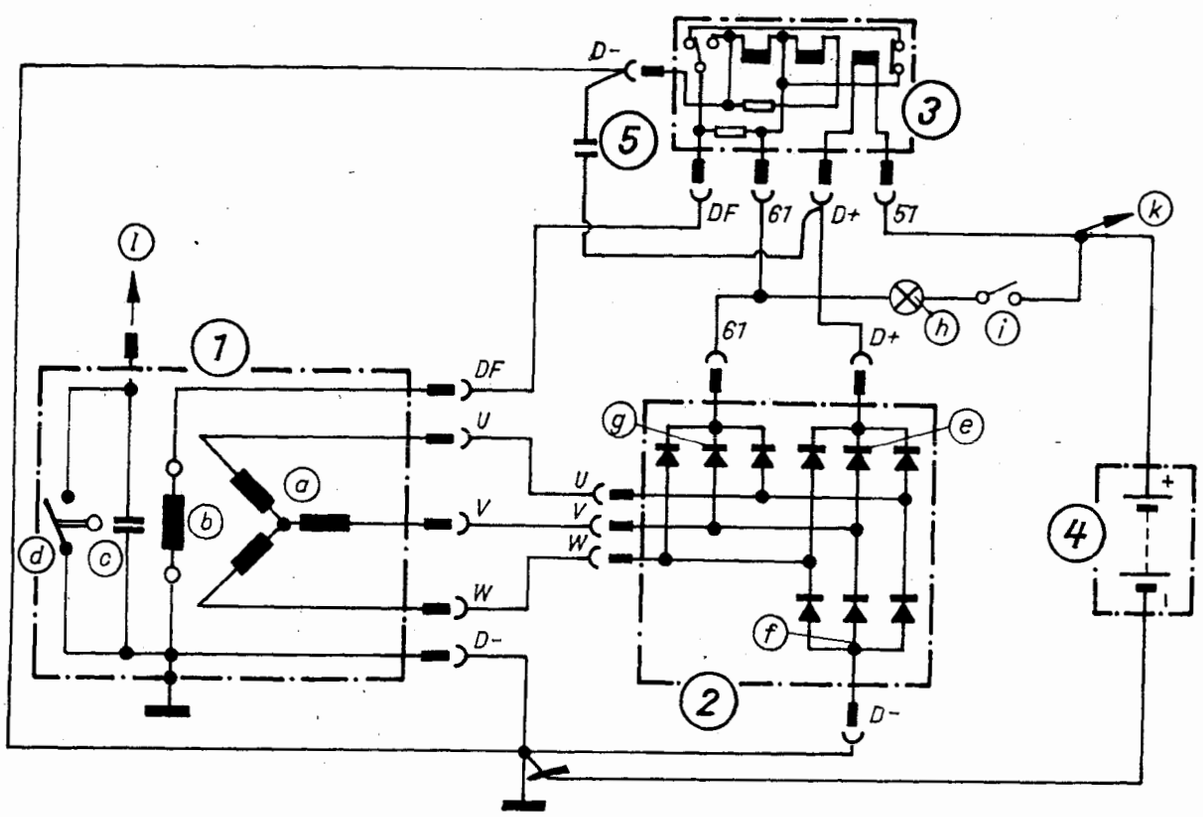


Fig. 137. Circuit of dynamo, rectifier and regulator

(for legend see page 68)

Legend for Fig. 137

(1) Three-phase dynamo

a) Stator
b) Rotor
c) Ignition capacitor
d) Contact breaker

(2) Rectifier

e) Positive diodes
f) Negative diodes
g) Excitation diodes
h) Control light
i) Ignition switch
k) to the loads
l) to the ignition coil

(3) Regulator

(4) Battery

(5) Capacitor 2.5 µF, 50 V

6.1.4. Fault Diagnoses

Below sequences of operations are described which serve for locating defects in the current supply system within a short time.
The method is to be selected according to the case in question.
Faults in the current supply system are in general indicated by the occurrence of one of the following deviations:

a) Abnormal behaviour of the charging control light;

b) Insufficiently charged battery. Indicated by the failure to start of the serviceable engine and by the low density of the battery acid;

c) Excessively charged battery; indicated by a high water consumption and boiling battery acid;

d) Emission of noise due to mechanical wear of the carbon brushes and slip rings or rubbing of the rotor at the stator parcel.

6.1.5. Behaviour of the Charging Control Light

Ignition switch	Charging control light	Engine	See Section 6.1.7.2.
According to specifications			
Off	Off	stopped	
On	On	stopped	
On	Off	running	
Erroneous			
Off	On	stopped	Part I
On	Off	stopped	Part II
On	reduced brightness	stopped	Part III
On	On	running	Part IV

6.1.6. Measuring Instruments

Instrument	Application
Autolicht-Prüf-Fix 12 V (test lamp with voltage source)	line testing, diode testing
Multimeter	voltage measurement, diode testing
Resistance measuring bridge after Thomson	resistance measuring at stator
Resistance measuring bridge according to Wheatstone	resistance measurement at rotor
Oscillograph	judgement of curve shape of voltage of three-phase dynamo according to Section 6.1.7.1.

6.1.7. Measurements at the Vehicle

Most of the faults can be identified even with the electrical devices installed.
The most rapid and exact indication can be obtained by means of an oscillograph. Practically all faults occurring in the three-phase dynamo and in the rectifier can be derived from the displayed curve shape.

During measurement, the engine must be operated with at least 3,000 rpm.
If an oscillograph is not available, a multimeter (e.g. UNI 7) should be used according to Section 6.1.7.2.

6.1.7.1. Use of an Oscillograph

The oscillograph must be connected to terminal D+ and ground. All load with the exception of the ignition system must be switched off. The battery remains connected.

NOTICE: When employing an oscillograph without d.c. voltage amplifier, the curves will appear on the Zero line of the oscillograph (see Fig. 138)!

All curve shapes deviating from the Figs. 138 and 139 are indicative of errors.

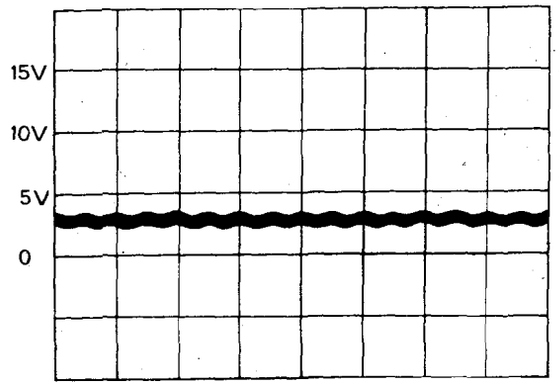


Fig. 138. Normal operation of the three-phase dynamo - oscillograph without d.c.voltage amplifier

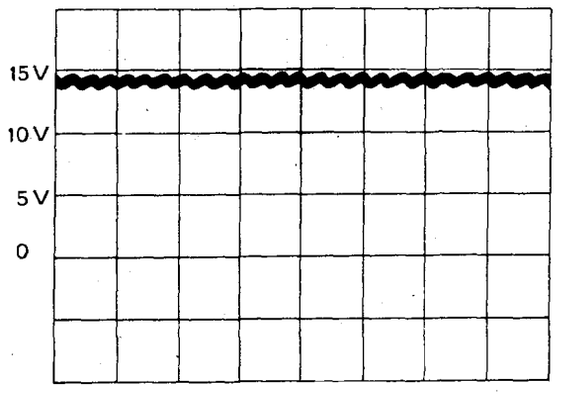


Fig. 139. Normal operation of the three-phase dynamo

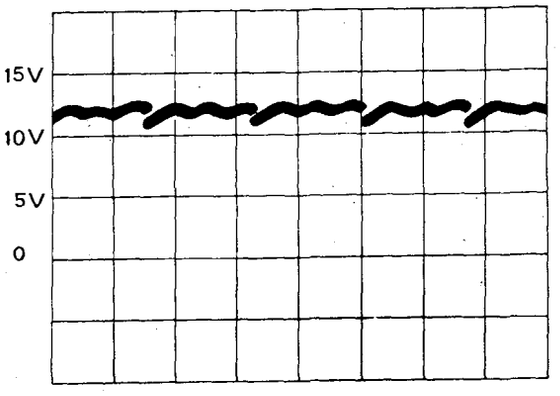


Fig. 140. Short-circuit of positive diode

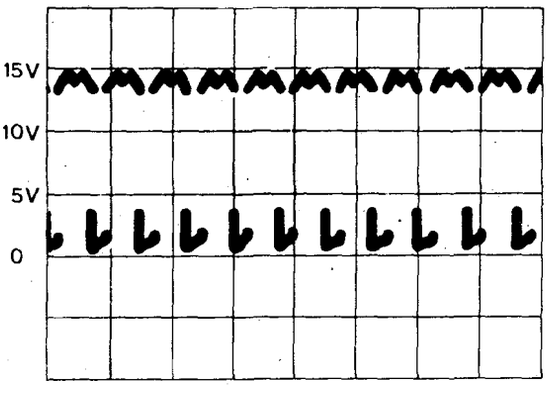
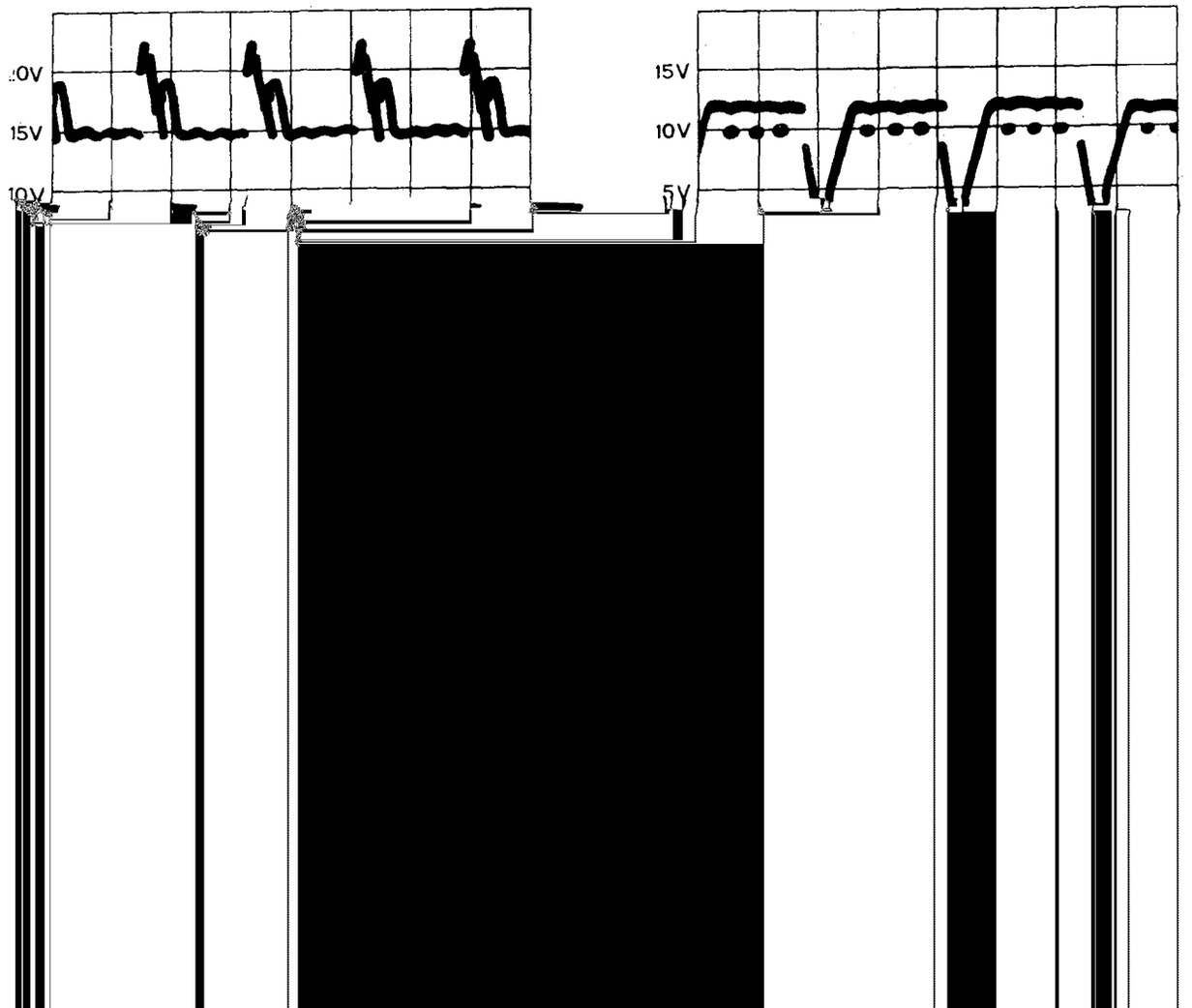


Fig. 141. Short-circuit of negative diode



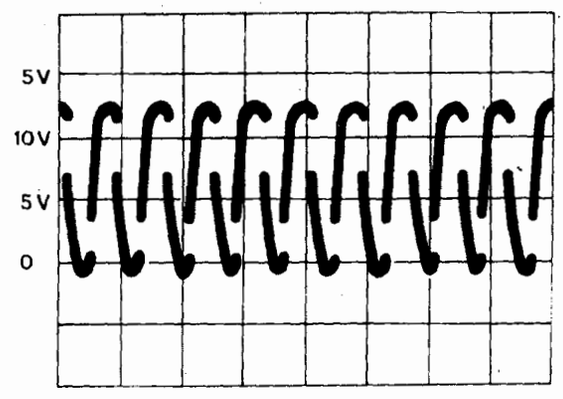


Fig. 146. Short-circuit of stator winding

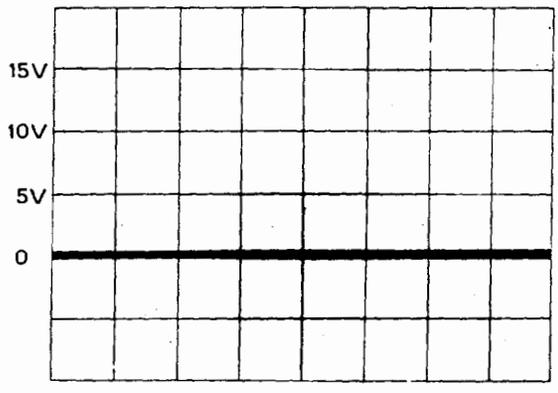


Fig. 147. Short-circuit of rotor winding

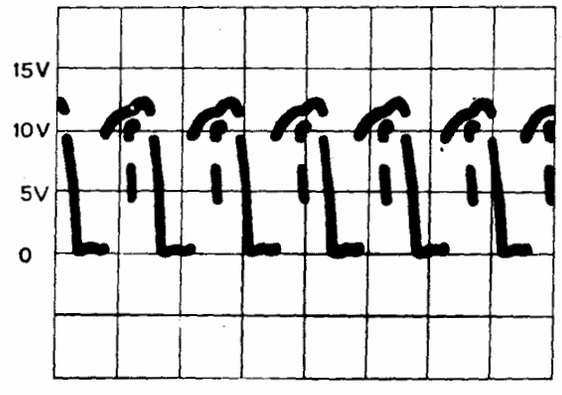


Fig. 148. Ground contact of stator winding

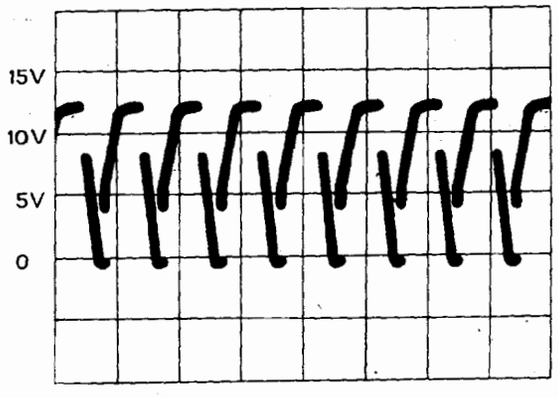


Fig. 149. Interruption of stator winding

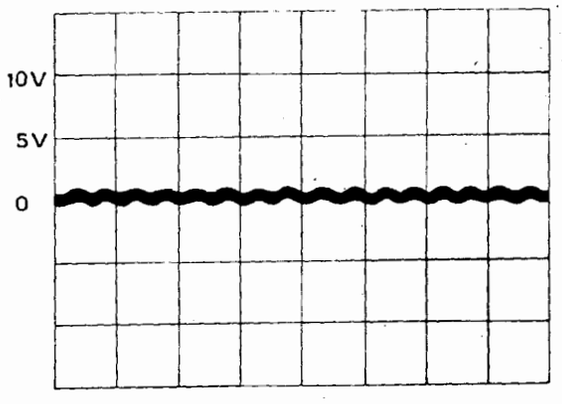


Fig. 150. Interruption of rotor winding

6.1.7.2. Fault Localisation

Part I

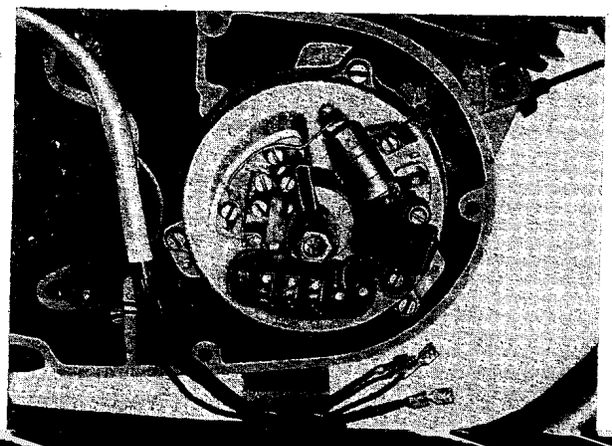
Fault	Possible Cause	Remedy
Charging control light lights - ignition switch switched off - engine stopped	ignition switch defective	replace ignition switch
	cable to control light is short-circuited with positive potential	remove the short circuit
Part II		
Charging control light fails to light - ignition switch switched on - engine stopped	charging control light defective	replace electric bulb or lighting fitting
	cable 61 to regulator interrupted	replace cable by a new one
	ground of regulator and cable DF interrupted	replace cable by a new one
	rectifier defective (checking acc. to Section 6.1.10.1.)	replace rectifier
Part III		
Charging control light emits dimmed light - ignition switch switched on - engine stopped	corrosion in holder of charging control lighting fitting	clean or replace the holder
	cable DF from regulator to three-phase dynamo interrupted	replace cable by a new one
	rotor defective (checking acc. to Section 6.1.10.3.)	replace rotor
Part IV (loads switched off)		
Charging control light lights - ignition switch switched on - engine runs	damaged cables and connections between 61 regul. and 61 rectifier, D+ regulator and D+ rectifier, 51 regulator and battery	repair or replace the damaged parts
	The voltage measured between D+ regulator and ground is greater than that between 51 regulator and ground ($\Delta U > 0.2$ V)	replace the regulator
	regulator contacts between DF and 61 of the regulator insulated from each other	replace the regulator
	with the battery disconnected and the plugged connections withdrawn, perform a test between DF and 61 at the regulator by means of a resistance measuring bridge ($R > 0.5$ ohm)	
	rectifier defective (check according to Section 6.1.10.1.)	replace the rectifier
	cable DF between regulator and three-phase dynamo interrupted	renew the cable or the connections involved
	damaged carbon brushes or carbon brush connections	replace the damaged parts by new ones
	rotor defective (check according to Section 6.1.10.3.)	replace the rotor
	Cables U/V/W between stator and rectifier and/or ground connection damaged	replace the damaged parts by new ones
	magnetic shunt of stator (check according to Section 6.1.10.2.)	replace the stator
	shorted turns of stator (check according to Section 6.1.10.2.)	replace the stator

6.1.8. Demounting from the Vehicle

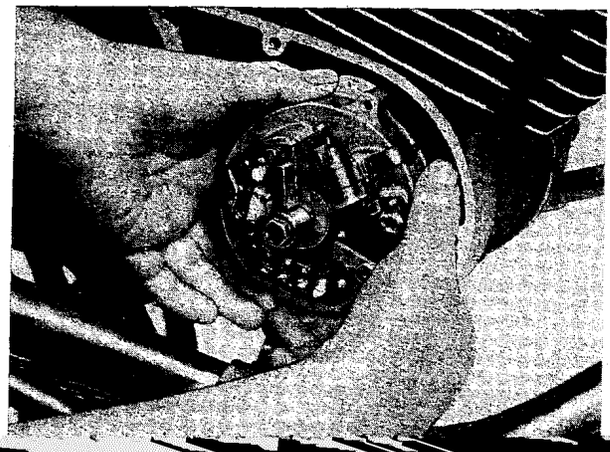
6.1.8.1. Demounting the Three-phase Dynamo

NOTICE:
Before demounting, disconnect the battery from the electrical system!

All plugged connections (U, V, W, DF, 61, D-) must be removed from the three-phase dynamo.



After loosening the three fastening screws, remove the stator with retaining cap.



6.1.8.2. Demounting the Rectifier

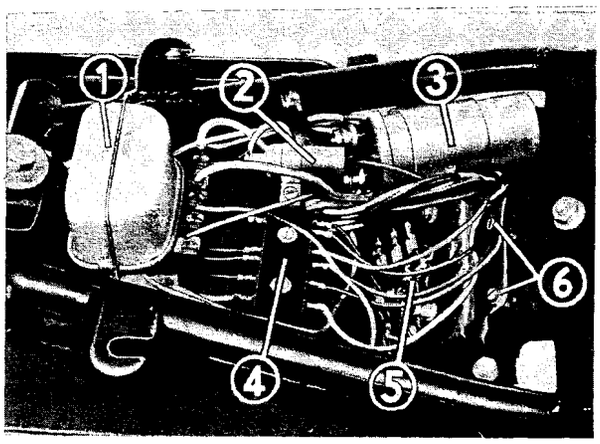


Fig. 155. Internal electrical equipment
(1) Regulator
(2) Capacitor 2.5 µF , 50 V
(3) Ignition coil
(4) Line connectors
(5) Rectifier
(6) Fastening screws

NOTICE:

Before demounting, disconnect the battery from the electrical system!

Remove the plugged connections U/V/W, 61, D+ and D- . For the later assembling operations, it is advisable to mark the cables D+ and D- and 61 for identification because exchanging by mistake of these connections will lead to the destruction of the diodes of the rectifier.

The connections U/V/M between three-phase dynamo and rectifier may be exchanged, damage will not be caused.

After loosening the fastening screws (6), the rectifier can be removed.

6.1.9. Demounting the Three-phase Dynamo

6.1.9.1. Stator with Retaining Cap

Carbon-brush holder (9, Fig. 156)

Loosen the plugged connections of the carbon brush. Remove the fastening screws. Pull off the holding clamp (10, Fig. 156). Hold the carbon brushes (8, Fig. 156) during this operation to prevent them from jumping out. Check carbon brushes and compression springs for wear.

Stator (6, Fig. 156)
Remove the soldered joint of the stator winding U/V/W.
Loosen the holding angle (5, Fig. 156). With this, the stator as complete component can be removed from the retaining cap (7, Fig. 156).

Rotor (4, Fig. 156)

The rotor is not intended for repairs. Replacement of the slip ring body must take place in special regenerating workshops.

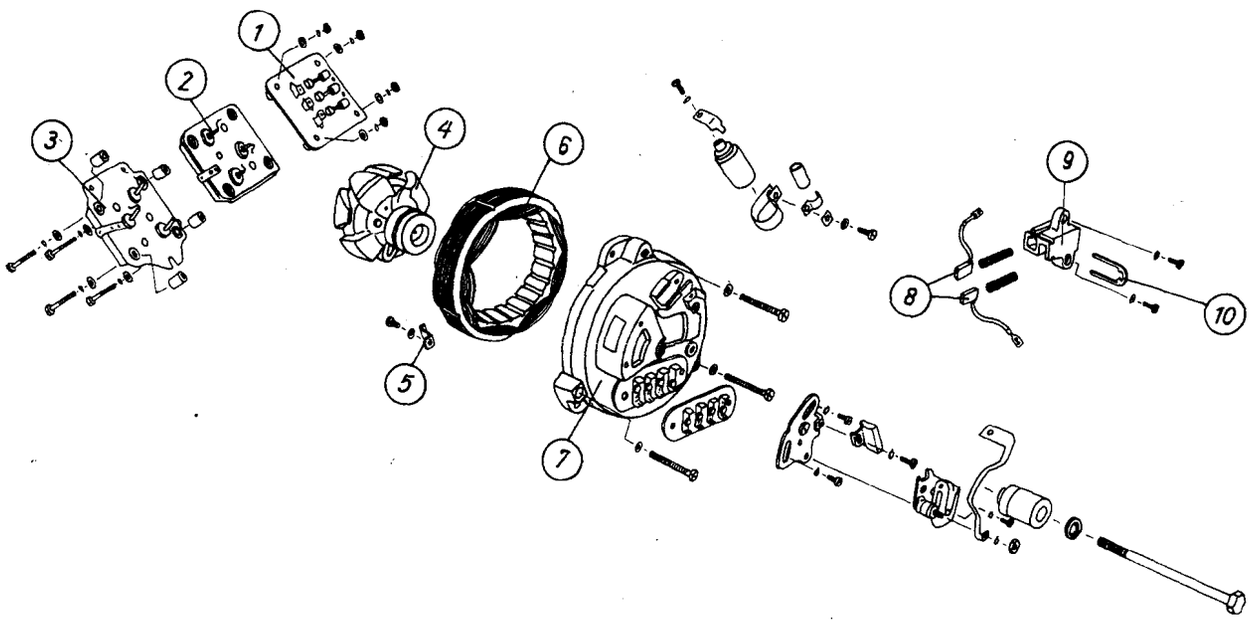


Fig. 156. Exploded view of the three-phase dynamo
(1) Insulating plate with excitation diodes
(2) Diode plate - positive
(3) Diode plate - negative
(4) Rotor
(5) Holding angle
(6) Stator
(7) Retaining cap
(8) Carbon brushes
(9) Carbon-brush holder
(10) Holding clamp

6.1.9.2. Rectifier

Loosen the four M4 fastening screws and unsolder the rectifier flexible wires from the plugged lugs U/V/W.

The three components can be tested separately (see Section 6.1.10.1.).

For pressing out defective positive or negative diodes, use a suitable mandrel (Fig. 157).

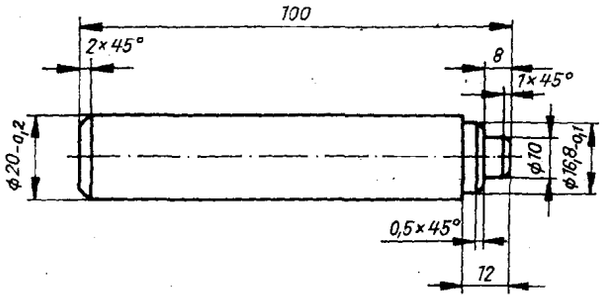


Fig. 157. Pressing-out mandrel
Round steel 22 TGL 11 163
St 50 K TGL 0-1652

For pressing new rectifiers in place, a pressing-in punch must be used (Fig. 158).

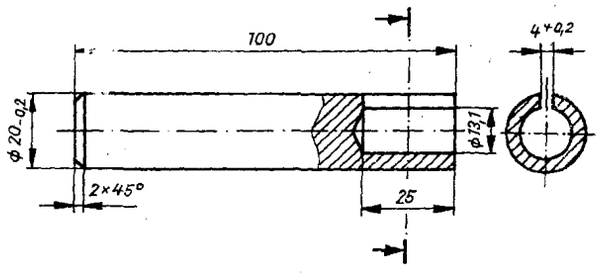


Fig. 158. Pressing-in mandrel
Round steel 22 TGL 11 163
St 50 K TGL 0-1652

A maximum pressing force of 4,000 N (400 kp) is permissible for pressing in. Care must be taken that the punch exactly contacts the diode edge.

For the use of semiconductor diodes, the instructions of the manufacturer must be observed.

6.1.10. Checking the Components

6.1.10.1. Checking the Rectifier

The rectifier diodes are tested by means of a continuity tester.

Fig. 159. Principle of diode testing

The measuring tips are applied to the anode and cathode connections of the diodes. When the positive measuring tip is applied to the anode and the test lamp lights, then the diode is serviceable.

When the lamp fails to light or when the test lamp lights while the positive pole is applied to the cathode, the diode is faulty and it must be replaced.

In the positive diode plate (D+), the cathodes are at the cooling plate and in the negative diode plate (D-) the anodes.

The excitation diodes are with their cathode applied to connection 61.

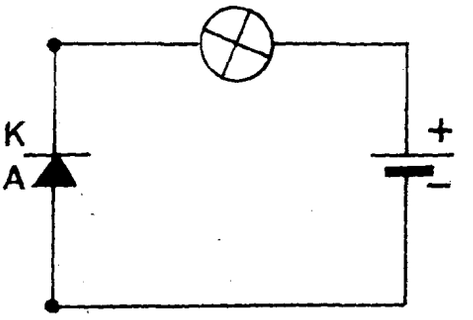


Fig. 160. Diode is in order

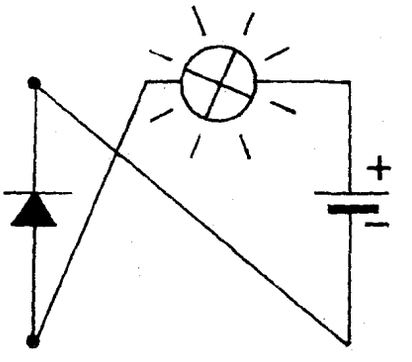


Fig. 161. Check-test - diode is in order

6.1.10.2. Testing the Stator

Testing the stator winding for shorted turns:

A resistance of about 0.32 ohm should be measured between the phases (U/V/W, V/W).

Testing the stator for magnetic shunt:

Between the stator sheet pack and the winding ends of the stator, the latter is tested for magnetic shunt by connecting a test lamp and applying a test voltage of 24 V a.c. All cables U/V/W must be disconnected from the stator. When the lamp lights up, the stator is defective and must be replaced by a new one.

Stator

When mounting the stator in the retaining cap take care that the groove in the stator coincides with the groove in the retaining cap.

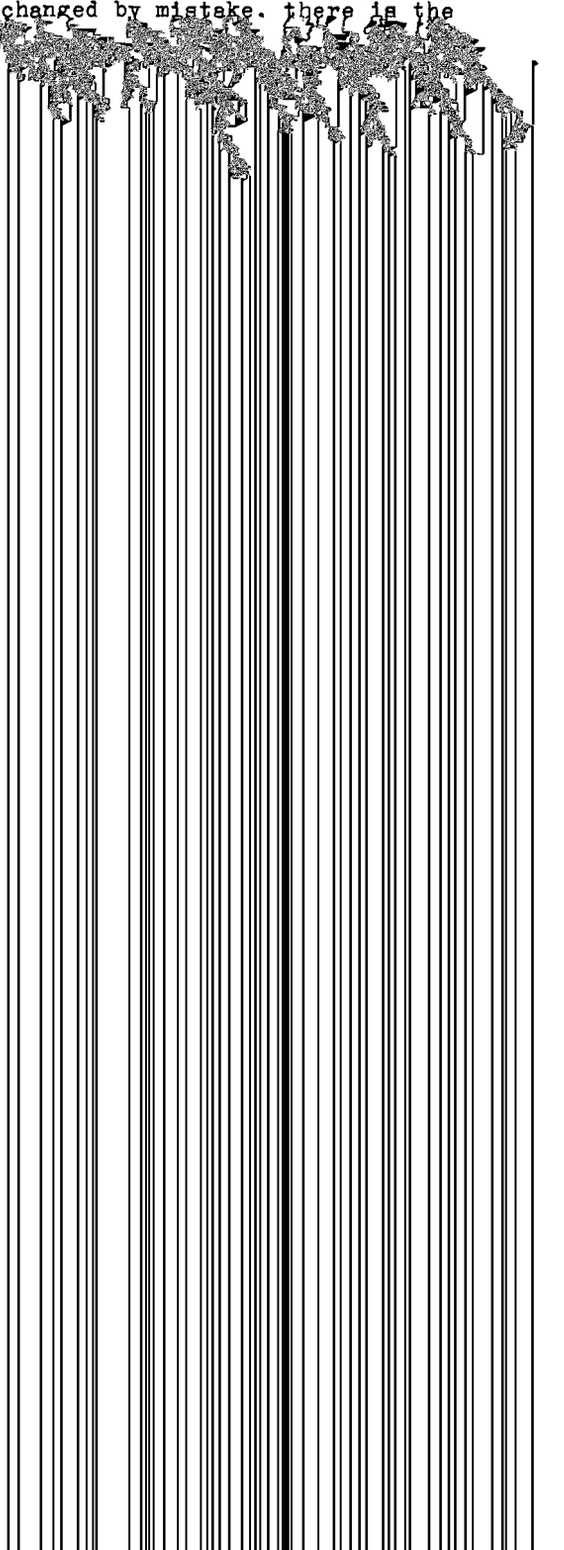
Permissible torque for tightening the rotor fastening screw M 7/5.8 = 20 ± 2 Nm (2 ± 0.2 kpm)

Permissible torque for tightening the stator fastening screw 5/5.8 = 4 ± 0.5 Nm (0.4 ± 0.05 kpm).

It is advisable to mount the carbon-brush holder after mounting the retaining cap.

NOTICE:

Before connecting the battery, check the lines. When the connections D+, D-, 61, DF are exchanged by mistake, there is the



6.2. Regulator

The three-phase dynamo is a temperature-compensated, positive-regulating regulator with break characteristic. This single-system regulator, 14 V, 15 A, operates with voltage regulation and current regulation.The current regulation is rated for a maximum current of 15 A. The regulating (series) resistor (connection side) and a balancing resistance are incorporated in the regulator.

6.2.1. Mounting

In order to ensure proper operation of the regulator it must be mounted so that it is not exposed to vibrations.
This has been realised in the ETZ 250 fully because the regulator cut-out is supended by means of a foamed-plastic pocket and a rubber stopper elastically.

When mounting, take care to see to it that the regulator cut-out is properly inserted in the holder provided for this purpose.

6.2.2. Maintenance

Maintenance of the regulator is generally restricted to keeping the connections clean. When the headlamp light is too dim, when there are starting difficulties and the like, do not always blame the regulator for the fault and on no account make any unauthorised interventions but first check the lines and their connectors for proper fit and corrosion.
See to it that the regulator is not touched by parts such as a spare inner tube and the like placed under the dual seat.

6.2.3. Adjustment

Before the electrical adjustment, a mechanical pre-setting or a correction of the mechanical setting must be effected in any case. This facilitates the electrical adjustment and ensures the observance of the required voltage/current characteristic.

An electrical adjustment of the regulator IN THE VEHICLE is a makeshift and should be avoided in the interest of an optimum performance of the function of the current supply system.

For adjusting the regulator cutout, it is mounted on a test stand controllable within a speed range from 0 to 7,000 rpm together with a dynamo of the required type.

In order to avoid errors in the adjustment, the voltage must always be started from the speed "zero" of the dynamo. The voltage is measured between the terminals D+ and D- of the regulator. The measuring instrument to be used should be of quality 1.5.

To be set:

- regulated voltage U_{3A}

Voltage which will be regulated over the entire speed range when the dynamo is loaded with 3 A. The voltage must be within the specified tolerance range. Short voltage peaks beyond the tolerance range at the beginning of the lower-position and upper-position regulation should not be confused with wrong adjustment.

The regulated voltage may differ for about + 0.2 to - 0.1 V (voltage jump) between the end of the lower-position regulation and the beginning of the upper-position regulation.

The voltage jump should not be adjusted too negative otherwise the regulator armature will chatter, i.e. continuously move between upper and lower position.

- maximum load voltage U_{HL}

Voltage which is regulated at a speed of more than 3,800 rpm when the dynamo is loaded with 15 A.

- release current I_{AS}

At this current, the current regulation starts operating.

Electrical setting values

The following values apply to a regulator temperature of 20 °C ± 5 °C.

regulated voltage:	13.8 V to 14.6 V
maximum load voltage:	13.0 V to 13.5 V
release current:	11.5 A to 14.0 A

NOTICE:

To change the regulated voltage and the release current, only carefully bend the spring holder. Do not bend the contact tongue!

6.2.4. Damages and their Causes

The most essential things have already been said in Section 6.1.

In addition, the following must be observed:

The improper fitting of the protective cap of the regulator cutout leads to accidental ground when the cap gets into contact with the core or with the contact angle of the regulator cutout. Before opening the regulater, remove the fuses. The lugs at the side of the cap must be correctly inserted into the recess provided for this purpose in the regulator base. The wire bow must tightly fit on the cap.

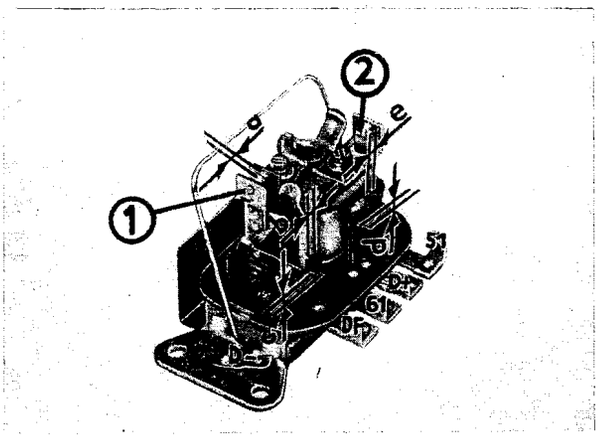


Fig. 162. Mechanical regulator adjustment

a at least 0.3 mm
b 0.8 to 1.1 mm
c 0.5 ± 0.1 mm
d 0.5 ± 0.1 mm
e 1.4 to 1.5 mm
(1) contacts of the voltage regulator
(2) contacts of the current regulator (current limiting switch)

6.3. Battery

A 6-volt lead battery with a rated voltage

After about 2 to 3 hours, the plates and separators have soaked and the electrolyte level is dropped.
Once more, electrolyte of the same density and temperature must be topped up to the upper edge of the separator. Subsequently, the battery is charged with direct current of 0.5 A.
During the charging, the holes of the battery must be open.
Charging must be continued until all cells vividly and uniformly evolve gas and the voltage reaches 2.5 to 2.7 V per cell.

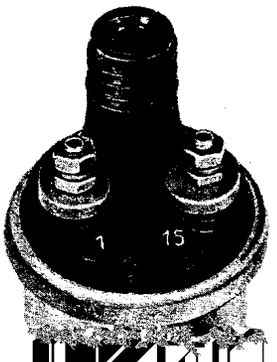
For 2 to 3 measurements at intervals of one hour, the density of the electrolyte (1.28 ± 0.01 g/cm^3) and the cell voltage must remain constant. During charging, the temperature of the electrolyte must not exceed 50 °C. At the end of the charging process, the level of the electrolyte must again be measured.

Mounting the battery

Before mounting the battery in the vehicle, the two battery cables must be connected to the battery (red cable to the positive pole - brown cable to the negative pole) and preserved with grease for battery terminals or acid-free vaseline. After fitting the protective cap, the battery can be mounted and the two battery cables can be connected to the fuse box.

HERE, AGAIN OBSERVE: connect

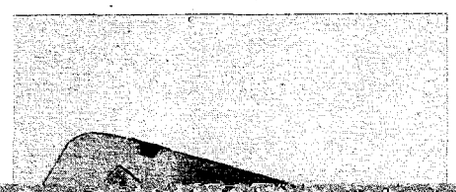
red cable to red cable,



The design of the contact breaker is shown in Fig. 165.
The adjusting plate (4) serves as carrier of plate (3) and the felt pad (11) and also for adjusting the firing point.
To the plate (3) with the fixed contact (2 b), the bearing bolt (5) is fastened on which the lever (1) is pivoted.

The contact (2 a) riveted to the right end of the lever (1) is pressed on the fixed contact (2 b) by the return spring (6) which also serves as current conductor and is supported at one spring end by the connecting screw (7). The contact breaker points gap can be adjusted precisely by

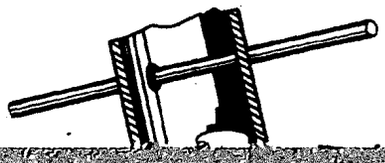
- ADJUSTING THE FIRING POINT



The pointer of the timing gauge is at "O" of the scale when the piston is in T.D.C. The test lamp with an electric bulb (G) of 12 V and max. 2 watt is with its positive side (1) clamped to the current bar (from contact breaker to capacitor) and with its negative side (M) to the engine casing or the cylinder.
When continuing to turn the crankshaft through about 340 degrees in clockwise di-

6.4.4. Sparking-plug

In essence, the sparking-plug consists of three parts. These are the insulating body, the central electrode and the steel casing with ground electrode. The spark appears between central electrode and ground electrode and ignites the fuel-air mixture.



to draw conclusions about the mode of operation of the engine, the formation of the petroil-air mixture, the fuel used and the suitability of the plug for the engine after a prolonged period of use of the plug.

The correct SPARKING-PLUG APPEARANCE:

Face of the sparking-plug thread black and the tip of the insulating body with ground electrode grey-yellow to fawn.

6.4.5. Ignition Line Connector (Sparking-plug Connector)

The ignition line connector establishes the connection between the sparking-plug and the ignition cable and to screen the elec-

Ignition line connector:

1. Dust and water is between insulating body of the sparking-plug and the compression moulding of the connector =

   starting difficulties,
   erratic ignition

2. Due to improper handling, the insulating body is cracked (hair cracks)

   tracking to ground =

   starting difficulties,
   weak spark,
   decrease in power

Lines:

1. Defective insulation of the high-voltage line (ignition cable) sparkover to ground (cylinder head) =

   starting difficulties especially in wet weather,
   erratic ignition at high rotational speeds

2. Broken lines, short-circuit =

   blown fuse

3. Flat plugged connections heavily corroded, very high contact resistance =

   the voltage applied to the devices is too low.

6.5. Lighting and Signalling System

6.5.1. Headlamp

The headlamp is opened by loosening the fillister-head screw and removing the front part of the headlamp housing. The front part consists of the chromium-plated front ring, the reflector with diffusing screen, the tiwn-filament bulb and the parking lamp and their holders.

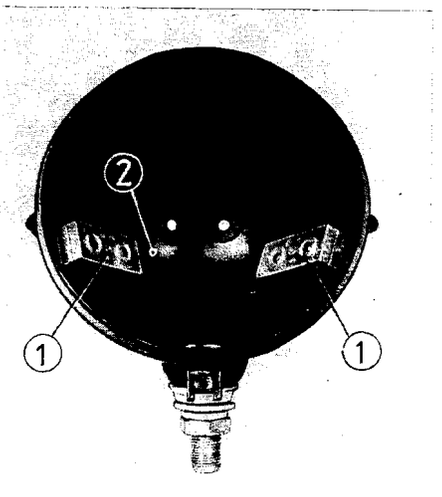


Fig. 170. Headlamp housing

In the headlamp housing, there are two line connectors (1) and one ground connection screw (2) which is used for all ground cables passed through the headlamp.

NOTICE:

As line connector only that one may be used which is shown in Fig. 171 in open position!

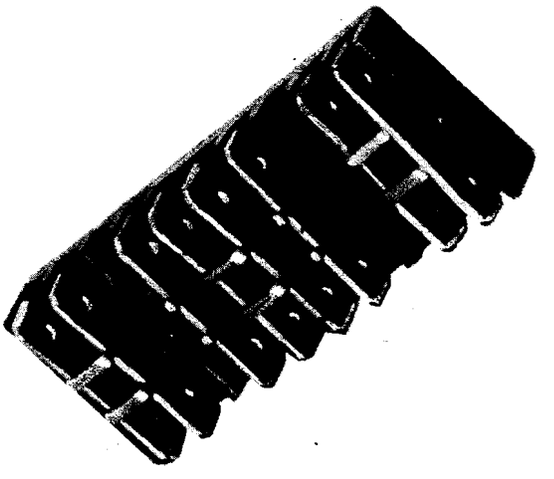


Fig. 171. Line connector for headlamp and for the internal electrical equipment

When replacing a twin-filament bulb, observe the following:

The clamping member (thermosetting plastic part), which establishes the electrical connection with the lamp, must be withdrawn in straight direction - it must not be tilted - otherwise the contact lugs will be distorted. As a consequence, the current flow may be interrupted.

The cables which lead to the terminals 31, 56a, 56b, need not be disconnected. It is advisable, however, to check them that they fit tightly. Only the cable 58 (parking light) must be loosened.

The holder (1) for the twin-filament bulb and the parking lamp is loosened from the upper sheet-metal nose of the reflector by lifting the retaining spring (H). Then the twin-filament bulb can be taken from the reflector. The glass bulb of the lamp should not be gripped by the bare hand. Even clean fingers leave traces of grease!

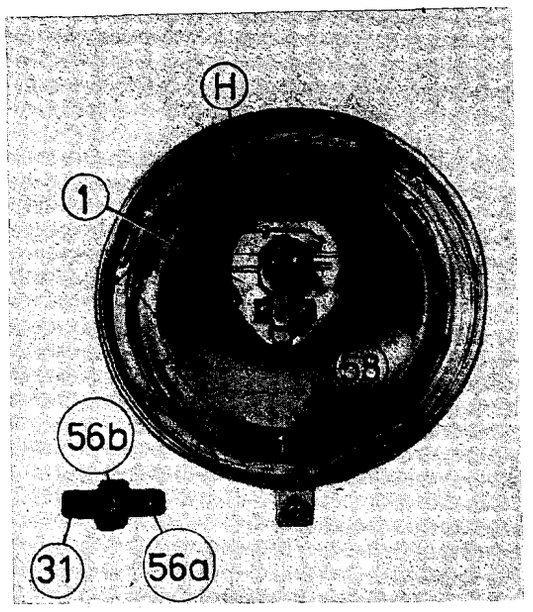


Fig. 172. Front part of the headlamp with lamp holder

When fitting take care that the nose at the lamp cap engages with the recess in the reflector.

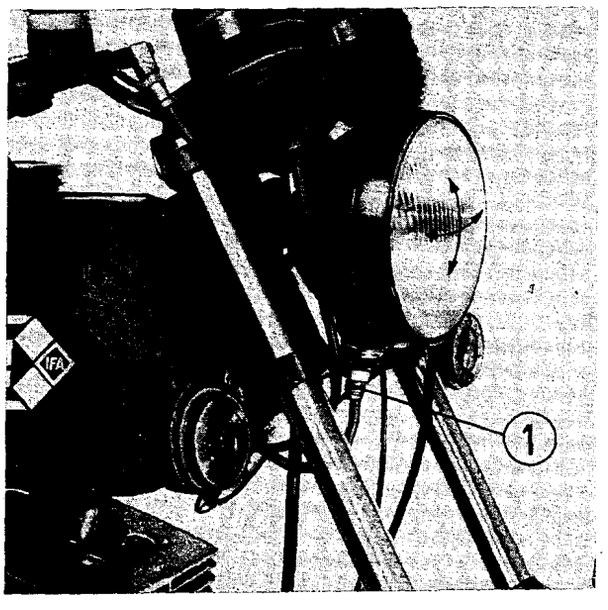


Fig. 173. Adjustment of the headlamp

When the carriageway illumination is insufficient, the points of contact in the leads to the twin-filament bulb must be checked and carefully cleaned, if required.

DIRTY CONTACTS CAUSE A CONSIDERABLE VOLTAGE DROP!

In older vehicles, the reflector may have become dull. In the interest of your safety it is necessary to replace it by a new one. The diffusing screen and the reflector are glued together, they cannot be replaced separately.

An important task is the adjustment of the headlamp. It is necessary for your own safety and for the safety of other road users.

The headlamp can be adjusted after loosening the fastening nut (1).

The passing beam of the headlamp is adjusted according to the scheme given in Fig. 174.

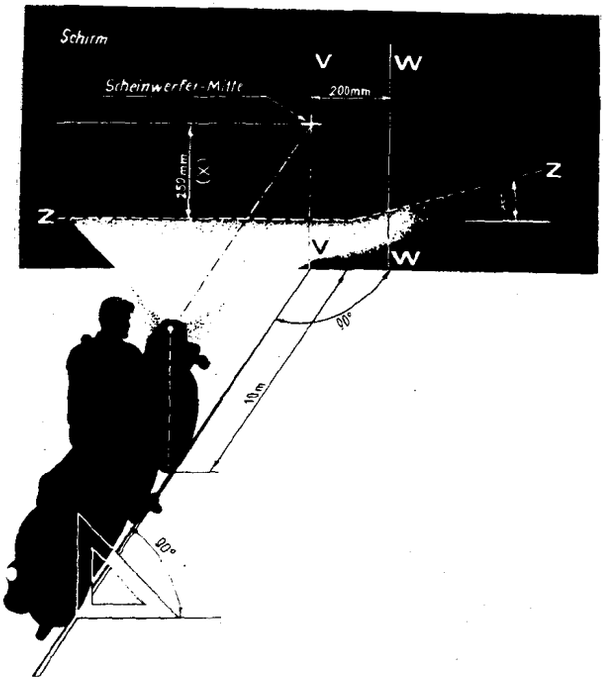


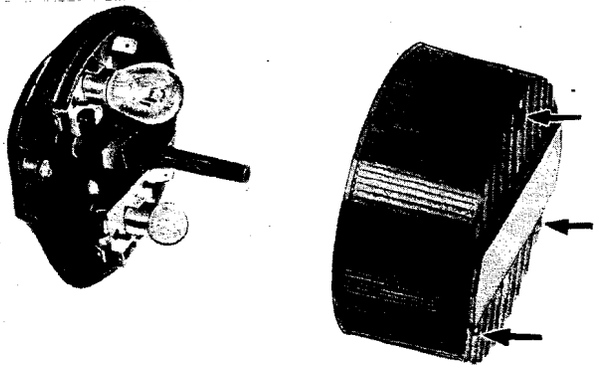
Fig. 174. Headlamp adjusting scheme

The vehicle is placed according to the illustration and loaded according to the primary operating conditions. The suspension units are consequently set to "hard" or "soft".

The light/dark boundary must concide exactly with the Z-line, and the break must lie between the lines V-V and W-W. When the headlamp has been adjusted according to these instructions, the light-dark boundary will be at the correct level under all operating and load conditions.

6.5.2. Combined Stop-Tail-Number-plate Lighting Fitting

The combined stop-tail-number-plate lighting fitting is proved with ball lamps which are held in holders with bayonet catch as usual.



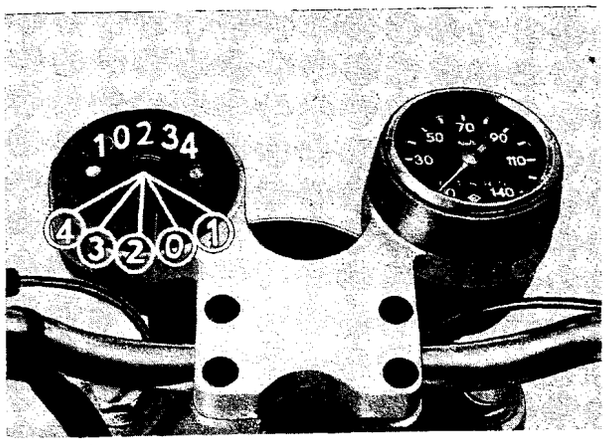


Fig. 176. Switch positions of the ignition-light switch

Demounting and mounting the ignition-light

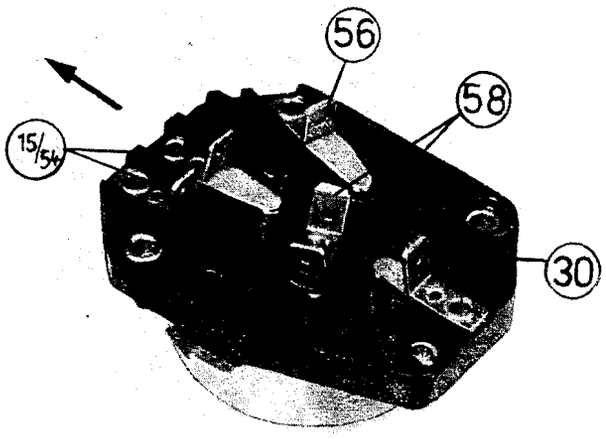


Fig. 178. Connections of the ignition-light switch

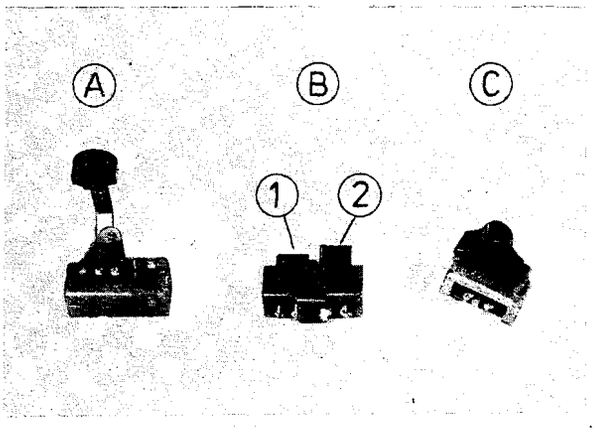


Fig. 180. Individual switches of the switch combination at the handle-bars

The ignition-light switch shown in Fig. 178 cannot be used for the older MZ-types because the former switch position (5)

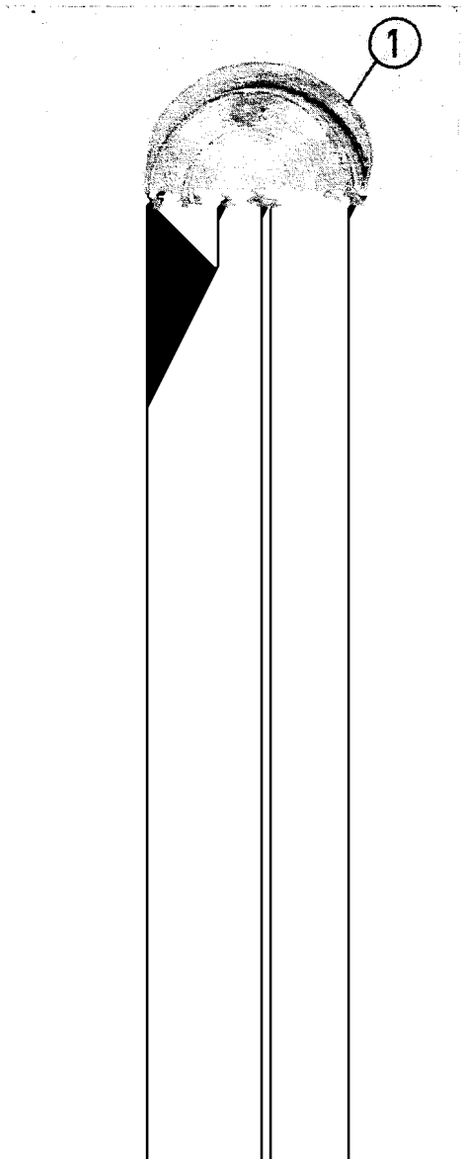
NOTICE.

Now, an assistant presses the brake pedal down until the brake shoes begin to rub on the brake drum while the rear wheel is turned. Retain the brake pedal in this position and turn the adjusting screw until the stop light flashes up.
For this work, the ignition must be switched on and the cable connected. Then tighten the two nuts. The rear nut must be tightened with every care because the insulating bush is made of plastic. At the same time retain the adjusting screw (3) by means of a screwdriver.
When the adjusting range is insufficient, the back rest must be demounted and the contact spring at the cam spindle must be realigned.

6.5.6. Flashing-light Direction Indicator System

The ETZ 250 is provided with a four-indicator flashing-light system equipped with 21-W ball lamps. When replacing the flashing lamps, only 21-watt lamps mustbe installed. Other lamps, e.g. such of 15 watt, change the specified flashing frequency of 90 ± 30 cycles/minute.

A tell-tale lamp (No. 4 in Fig. 185) is used for checking the direction indicating system. The two front flashing-light diffusing screens are provided with a larger rim (1) than the two rear ones. This rim is intended for checking the flashing-light system by the driver.



The flasher unit is elastically suspended at the battery holding cover with the connections pointing downwards.

NOTICE:

The line from the ignition lock with positive potential is to be connected to terminal 49 and the line from the flasher switch with negative potential to the terminal 49a of the flasher unit.

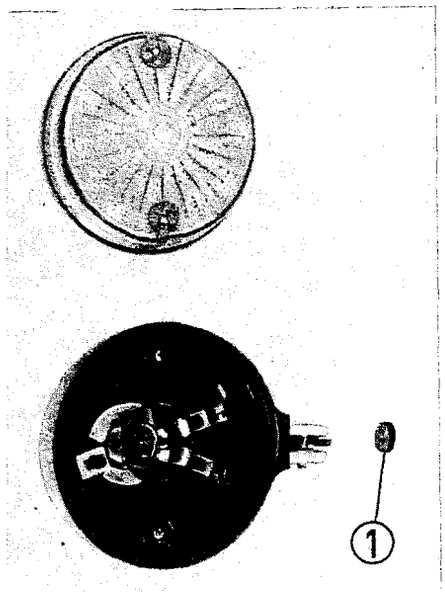


Fig. 183. Rear flashing-light direction indicator

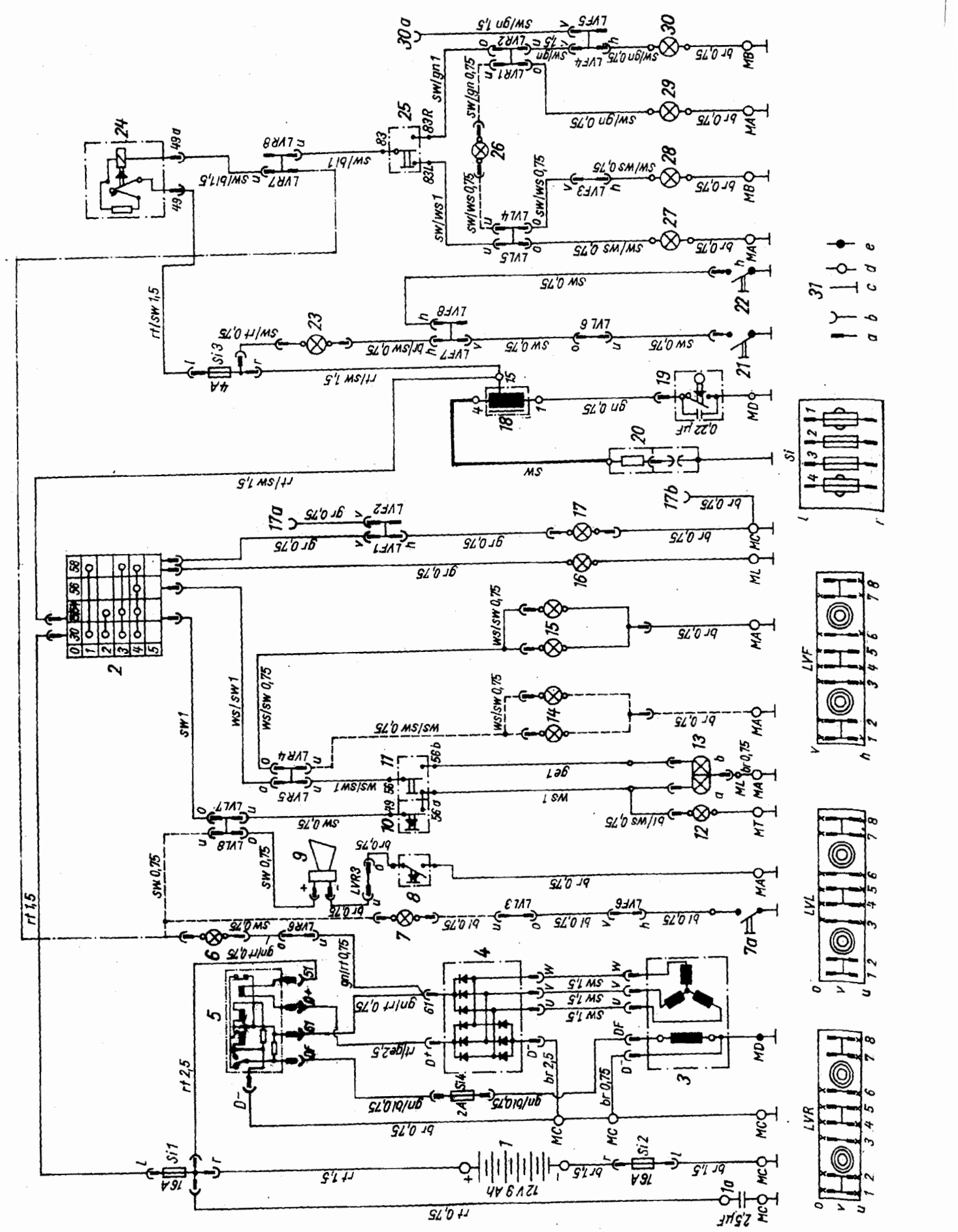


Fig. 184. Circuit diagram

Legend for Fig. 184, Circuit diagram

(1) Battery
(1a) Capacitor
(2) Ignition-light switch
(3) Dynamo
(4) Rectifier
(5) Regulator
(6) Charging control lamp (in standard design also for checking the direction indicators)
(7) Idling control light (only deluxe model)
(7a) Switch for idling control light
(8) Switch for horn (switch combination at handle-bars
(9) Horn
(10) Switch for by-pass light signal (switch combination at handle-bars)
(11) Dimmer switch (switch combination at handle-bars)
(12) Tell-tale light for high headlight beam
(13) Lamp for headlamp
a) high beam
b) passing beam
(14) Illumination for speedometer scale (only deluxe model)
(15) Illumination for tachometer scale
(16) Parking light (in headlamp)
(17) Tail light and number-plate illumination (in tail-stop and number-plate lighting fitting, bottom)
(17a) Socket outlet for side lamps (only for side-car operation)
(17b) Socket outlet for ground (only for side-car operation)
(18) Ignition coil
(19) Contact breaker of the ignition
(20) Sparking-plug with screened connector
(21) Stop light switch - front wheel brake
(22) Stop light switch - rear wheel brake
(23) Stop light (in tail lighting fitting top)
(24) Flasher unit
(25) Switch for direction indicators (switch combination at handle-bars)
(26) Tell-tale light for direction indicators (only deluxe model)
(27) Flashing-light direction indicator, front, left-hand side
(28) Flashing-light direction indicator, rear, left-hand side
(29) Flashing-light direction indicator, front, right-hand side
(30) Flashing-light direction indicator, rear, right-hand side
(30a) Socket outlet for flashing-lights (only for side-car operation)
(31) Graphical symbols for:
a Flat plug
b Receptacle for flat plug or socket outlet

LVR Cable connector in headlamp, right-hand side
o top
u bottom
v front
x occupied connection

LVL Cable connector in headlamp, left-hand side
o top
u bottom
v front
x occupied connection

LVF Cable connector at chassis, at filter bowl top
v front
h rear
x occupied connection

Si fuse box
l left
r right

MA ground point headlamp

MB ground point combined stop-tail-number-plate lighting fitting

ML ground lamp for headlamp

MC ground point of vehicle (at cable connector at chassis)

MD ground point of dynamo

MT ground point of tachometer

Cable colours:

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

1) dash-dotted line represents conductors which are only present in the standard design

2) dashed line represents conductors which are only present in the deluxe model

6.6. Instruments and Tell-tale Lights

The arrangement of instruments is shown in Fig. 177. The standard design of the ETZ 250 is only provided with one tachometer (at the right of the instrument pod).

In addition to the tachometer, also arranged at the right, the deluxe model is provided at the left with a speedometer (revolution counter) mechanically driven by the crankshaft (see also Fig. 88).

Arrangement and meaning of the tell-tale lights are indicated in Fig. 185. As to the wiring and interconnection with other electrical devices, the necessary information is given in the Circuit Diagram, Fig. 184.

Tachometer and revolution counter are illuminated in night operation. For this purpose, the lamps marked by (3) in Fig. 186 are used which get ground via the flat plug connection (4). The function of the lamps indicated by (1) is illustrated in Fig. 185.

The electrical potential for the control lamps (1)is fed via the flat plug connections (2).

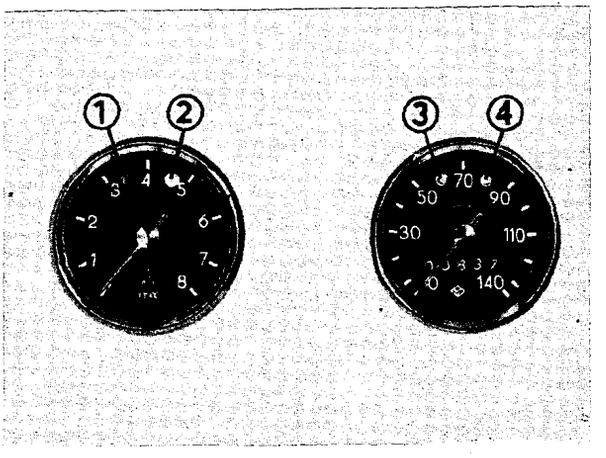


Fig. 185. Arrangement of the tell-tale lights

(1) Idling indication, yellow (only deluxe model)

(2) Control light for dynamo, red (only deluxe model)

(3) High headlight beam control, blue

(4) Control of direction indicators, green (in the standard design of the motor-cycle, this is also the control light for the dynamo)

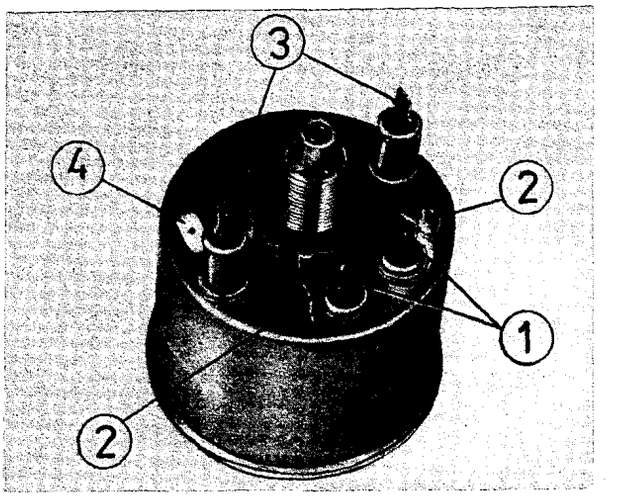


Fig. 186. Arrangement of the lamps in the instruments

Removal of the lamps from the instruments becomes possible after withdrawing the flat plugs from the vertical connections of the lamps. Then the lamps can easily be drawn from the instrument casing.

7. Induction System

7.1. Description and Function of the System

The entire induction system is an integrated system which is optimally adapted to the engine. Any change in this system will have a detrimental effect on the power, the consumption, the wear, etc.

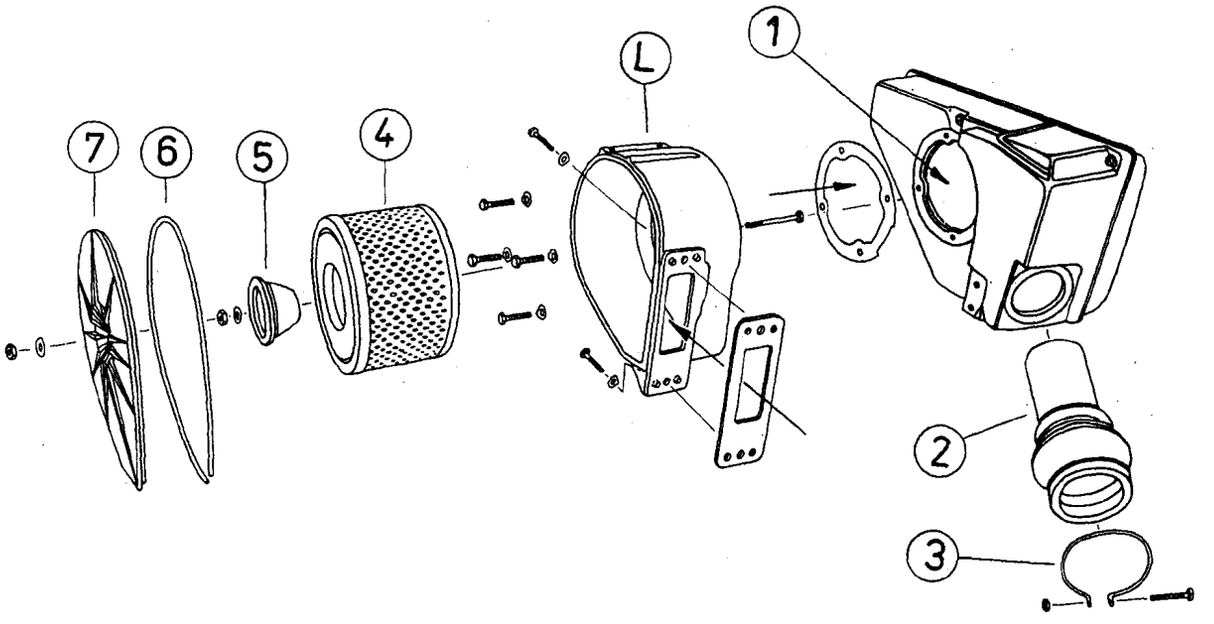


Fig. 187. Intake silencer and air filter

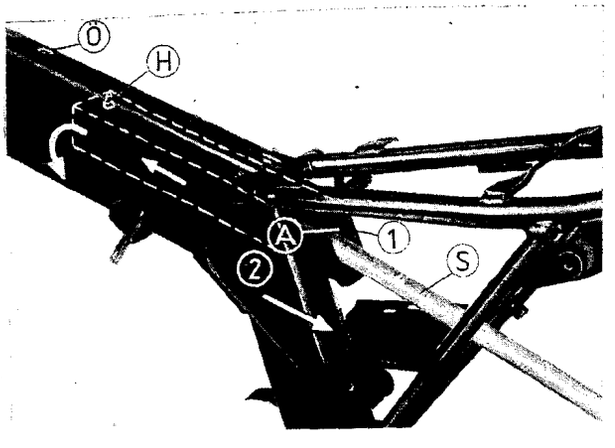


Fig. 188. Induction pipe mounting

The induction system begins at the opening arranged under the regulator and ends at the intake port of the cylinder. In the entire system no point must allow the admission of additional air apart from the holes provided for this purpose.

The air, and from the carburetter the fuel-air mixture must take the following course in order to get into the crankcase:

The air is drawn in through the opening (A) of the induction pipe (1), see Fig. 188. The induction pipe serves for silencing and stilling of the air.

After leaving the induction pipe, the air flows back into the frame member and enters the air filter casing (L) tightly screwed to the frame tube, see Fig. 187.

When passing through the air filter, the air is purified. The dust particles in the air are retained by the filter. Subsequently, the pressure differences induced by the induction vibrations are equalised to a great extent in the intake silencer compartment (1).
Then the air is drawn in the connecting

The connecting piece must be checked for porous spots, especially within the range of folds, from time to time.

7.1.4. Carburetter

In the ETZ, a BVF-carburetter of type 30 N 2-5 is employed. This is a carburetter with a cold-starting device.

1. COLD STARTING DEVICE

As the name indicates, this is a device for facilitating the starting of the engine in a cold state.

The cold starting device is shown in Fig. 189 (driving position, lever for starting carburetter at the handle-bars contacts the front stop) and in Fig. 191 (cold starting, lever for starting carburetter at the handle-bars is drawn towards the driver).

In the driving position of the lever for the starting carburetter at the handle-bars, the packing (2) at the starting piston (1) must completely seal the starting mixing tube (3).

The cable control adjusting screw (4) must, therefore, always be set in such a manner that a play of about 1 mm is present between cable control sheath and adjusting screw.

When the lever for the starting carburetter at the handle-bars is set to cold starting position (the lever is drawn towards the driver), then the starting piston with packing is lifted and, thus, the upper opening of the starting mixing tube (A), Fig. 191, is released.

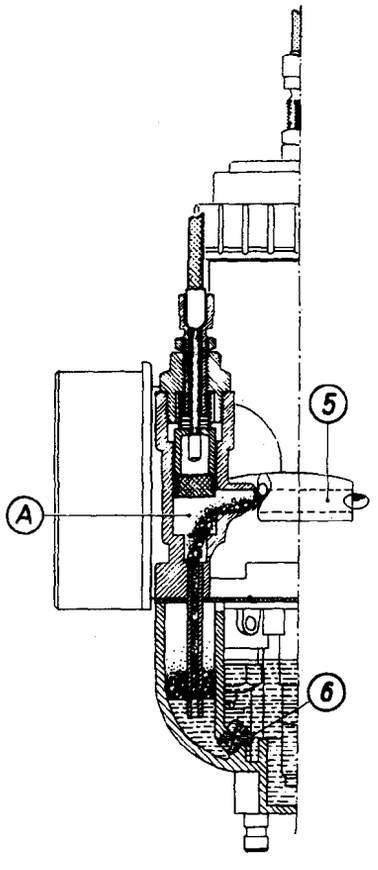


Fig. 191. Starting piston lifted (cold starting)

The fuel in the starting mixing tube is sucked up when the engine is started and then passes through the starting duct (5), Fig. 191, which ends in the suction port after the throttle valve.

In order to ensure the required underpressure for cold starting in the starting system, the throttle valve must be in the idling position.

<u>The starting device is ineffective when, in starting the engine, the throttle valve is lifted beyond the idling system!</u>

The lower opening of the starting mixing tube ends in a separate space, the starting compartment, which is connected with the compartment for the central float through the starting jet (6), Fig. 191.

The drill-hole of the starting jet is arranged in such a way that, after the sucking off of the amount of fuel standing in the starting mixing tube, only such an amount of fuel is allowed to follow that the engine, with the starting lever drawn for a long time, can just process the too rich mixture.
The fuel required for starting is premixed in the starting compartment.
The air required for this purpose is sucked up from the compartment for the central float through a recess in the upper edge of the partition wall. The central float is aerated through an overflow tube (15), Fig. 196, which is arranged in the centre of the float chamber.

2. CARBURETTER

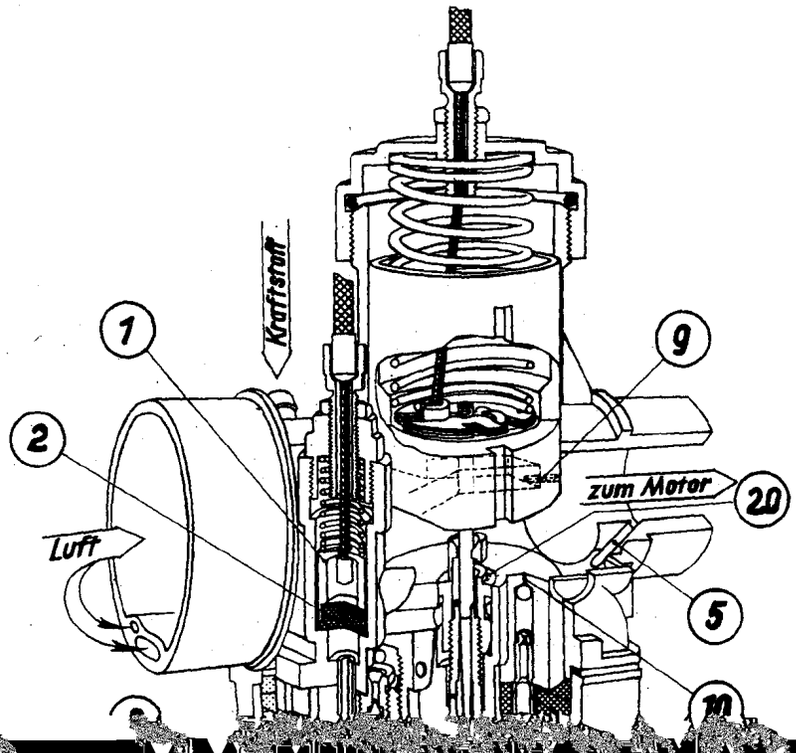
The fuel flows through the float valve (16 in Fig. 192) into the float chamber. When the fuel level has reached a certain height (Fuel level), the float needle valve is closed by a sheet-metal nose (17), Fig. 196, which is arranged at the holder of the float.

With the engine running, due to accelerating, the partial load needle is lifted more or less from the needle valve (18) and, consequently, the throttle valve raised for the same amount.
The air sucked up by the engine flows through suction port of the carburetter and, hence, past the atomiser insert. As a consequence, the fuel is sucked up through the main jet (19) and needle jet to the suction port.

By the atomiser insert (18 in Fig. 196), the fuel is atomised and mixed with the air flowing through. This ignitable fuel-air mixture is then conducted to the engine.

The formation of an ignitable mixture in idling is due to the idling jet and the specified setting of the slow-running air screw (see Fig. 192, Nos. 8 and 11).

The correct mixing ratio between fuel and air in the partial-load range is brought about by the needle position, that is to say, the notch in the needle holder into which the partial-load needle is suspended.


Kraftstoff
1
2
9
zum Motor
20
Luft
5
11

The fuel level to be kept constant in the float chamber is regulated by the float needle valve and the float.

The adjustment of the fuel level substantially contributed towards the formation of this fuel-air ratio.

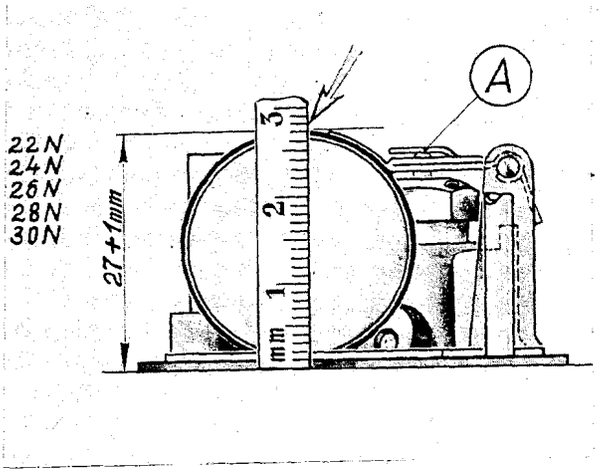


Fig. 194. Float valve closed, measured without packing

(A) Closing plate

A fuel level set too high means - too rich a mixture; a fuel level set too low means - too lean a mixture. Therefore, the basic adjustment of the fuel level is of particular importance.

Please, take the illustrations Fig. 194 and 195 into cinsideration!

For the basic adjustment of the fuel level always start from the fact that the tongue (A) in Fig. 194 must be parallel to the holder of the float. An extremely bent tongue (A) means that the holder of the float is distorted at the lower soldering joint (kink angle). In this case, the floats must be reset to the basic dimension 30.0 mm (with the float valve closed and the damping of the float needle not depressed) uniformly(in the kink angle, lower soldering joint).

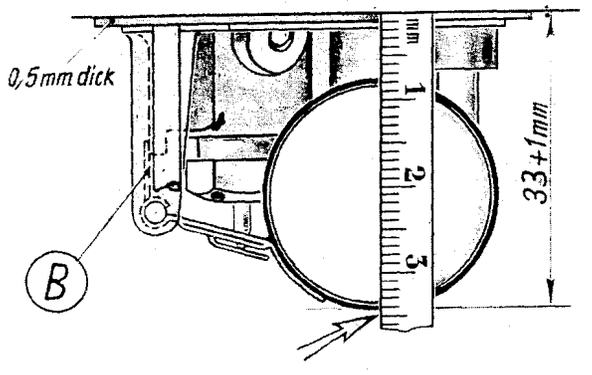


Fig. 195. Float valve fully open, measured without packing

(B) Stop tongue

The dimension (27 mm) given in Fig. 194 means fully spring-loaded damping of the float needle - a slight correction is effected at the tongue (A).

NOTICE:

On no account should the tongue (A) be bent downward towards the holder of the floats because in this event the float needle valve will not be opened sufficiently so that fuel is admitted at a slow rate, a fact, which leads to too lean a mixture with increasing rotational speeds of the engine!

The dimension (33 mm) given in Fig. 195 limits the float travel downwards and can be readjusted at the stop tongue (B).

NOTICE:

The float travel must not be smaller than 6 mm (the difference between 33 and 27 mm)!

7.1.4.3. Fuel Level - Fine Adjustment

If a level testing equipment is not available, the fuel level can be measured directly at the carburetter in the vehicle. For this purpose, an old float chamber is required which is provided with a cut, 20 mm wide and 25 mm long, in the narrow end so that the float needle valve becomes visible and which is closed with a piacryl plate glued in place. A separate application adhesive should be used.

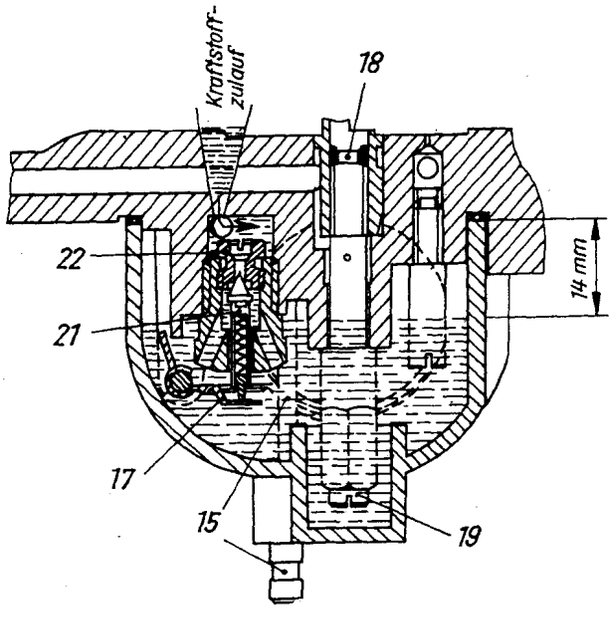


Fig. 196. Carburetter lower part (sectional view) fuel level

(15) Vent tube for the float chamber
(17) Closing plate of the float valve
(18) Needle jet with jet carrier
(19) Main jet
(21) Spring-loaded float needle
(22) Float valve, complete

On the piacryl plate glued in place, the dimension of 14 mm, starting from the sealing surface, is projected.

The float chamber prepared in this way is attached with PACKING to the carburetter to be measured. An accurate measurement depends on the fact that the flow rate of the fuel is 12 l per hour. The fuel tank must be at least half full in order that the specified pressure on the float needle valve is given.

Plug the carburetter, which is cleaned and checked for proper basic adjustment, into the fuel hose and open the fuel cock. Fuel will be admitted into the float chamber until the float lifted by the raising fuel level closes the float needle valve, thus, interrupting the fuel feed. The level now actually present in the float chamber is compared with the marking at the inspection glass and, if required, corrected by readjusting the tongue (A), Fig. 194.

When the float needle valve is leaky, this is indicated by the dripping vent (15), Fig. 196. In this case, demount the valve and once more carefully clean it. If it then is still leaky, it must be replaced by a new one.

The fuel level is 14 ± 1 mm measured from the top edge of the float chamber.

7.1.4.4. Idling Adjustment

NOTE:

1. The carburetter should be adjustend when the engine still has operating temperature. The vehicle must stand on plane ground.
2. The idling position of the throttle valve should not be set by means of the adjusting screw for the throttle cable control but by the stop screw for the throttle valve.

The stop screw (14) for the throttle valve is adjusted in such a way that the engine runs perfectly smooth. Then the slow running air screw (11) is fully turned down and slackened back through one revolution. Subsequently, the slow running air screw is screwed down and back for trial to find the maximum rotational speed of the engine. When it has been found, the stop screw for the throttle valve must be set in such a way that the engine again reaches the idling speed (see Fig. 192).

This process must be repeated until the engine speed will no longer change when

7.2. Fault Localisation

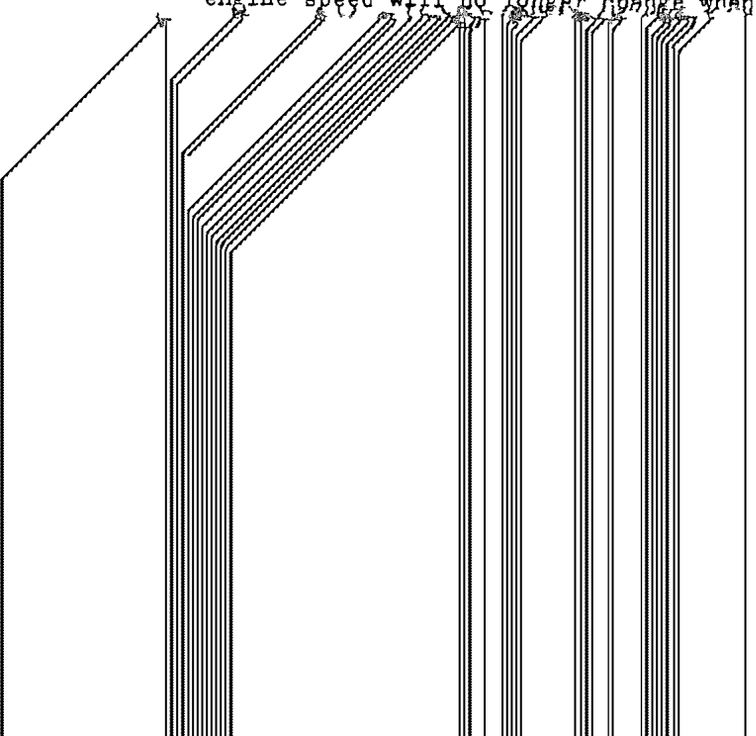
7.2.1. Too Lean a Mixture

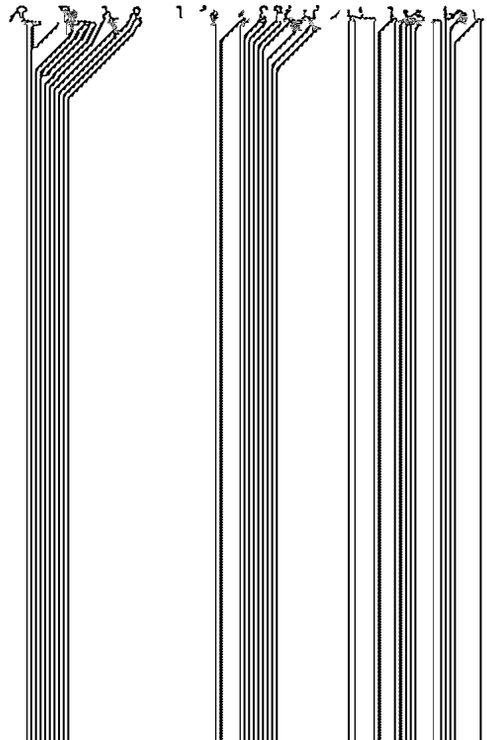
The fact that the fuel-air mixture becomes too lean is identified by the following features:

1. Severe burning of the electrodes of the sparking-plug;
2. Beads appear at the sparking-plug;
3. Within the range from half to full throttle, the power delivered by the engine is too low;
4. The engine tends to become stuck!

Faults and defects which cause the mixture to become too lean and their remedies:

1. Air filter fails to fit properly in the centring collar of the intake silencer casing
   - Remove the air filter and fit it correctly in the centring collar.
2. After improper handling, the air filter has been damaged.
   - Replace the air filter by a new one.
3. Packings between air filter casing and intake silencer or between air filter casing and frame defective.
   - Replace the packings or re-tighten the screwed connections.
4. Packing between air filter casing and cover missing or defective.
   - Fit a new packing or replace the old one by a new one
5. Connection to carburetter is defective or porous or it fails to fit properly in in drill-hole of the intake silencer casing.
   - Replace the connecting piece by a new one or align it.
6. Intake socket porous.
   - Replace the intake socket by a new one or - if still possible - seal it by means of artificial resin.
7. Insulating flange broken or porous; packings defective.
   - Replace the parts in question by new ones.





10. Central float is distorted - float valve is insufficiently opened
    - Adjust the central float.
11. Float needle jams
    - Polish the float needle and through bores in the valve body,
    - Check the velve for foreign particles,
    - Replace the float needle and the valve seat for new parts.

7.2.2. Too Rich a Mixture

The fact that the fuel-air mixture becomes too rich is identified by the following features:

1. Starting the engine is difficult;
2. Engine power output drops with increasing temperature of the engine;
3. High fuel consumption;
4. Inclination to simulate a "four-stroke engine";
5. Sparking-plug with the specified calorific value is oiled up;
6. Formation of smoke intense and visible in the state when the engine has operating temperature.

Faults and defects which cause the mixture to become too rich and their remedies:

1. Dry air filter is too old (more than 10,000 km of road operation)
   - Replace the air filter by a new one.
2. Dry air filter has become wet
   Cause: Air filter casing not tight - water has entered
   - Dry the air filter, replace it, if required.
3. Partial-load needle is suspended at a notch which is at too high a level
   - Suspend the partial-load needle lower for one or more notches until a normal ratio of mixing has been reached.
4. Needle jet and partial-load needle worn (more than 20,000 km of road operation)
   - Replace the two parts by new ones.
5. Float valve leaky
   Cause: 1) valve dirty,
   2) float needle worn
   - Clean the float valve,
   - Fit a new float needle.
6. Central float distorted - float valve remains open too wide
   - Adjust the central float.
7. Main jet too large
   - Use another main jet with the same dimension printed on it (jets with the same nominal dimension differ by their tolerances),
   - If this fails to be a remedy, use the next smaller jet.
8. Packing in starting piston damaged
   - Replace the packing by a new one.
9. Spring for starting piston has an insufficient pre-tension
   - Replace the spring by a new one.
10. Sheath of the cable control for the starting device has no clearance; consequently, the starting piston cannot seal properly the starting mixing tube
    - Adjust the cable control sheath so that a clearance of 1 mm is given.

8. Special Tools

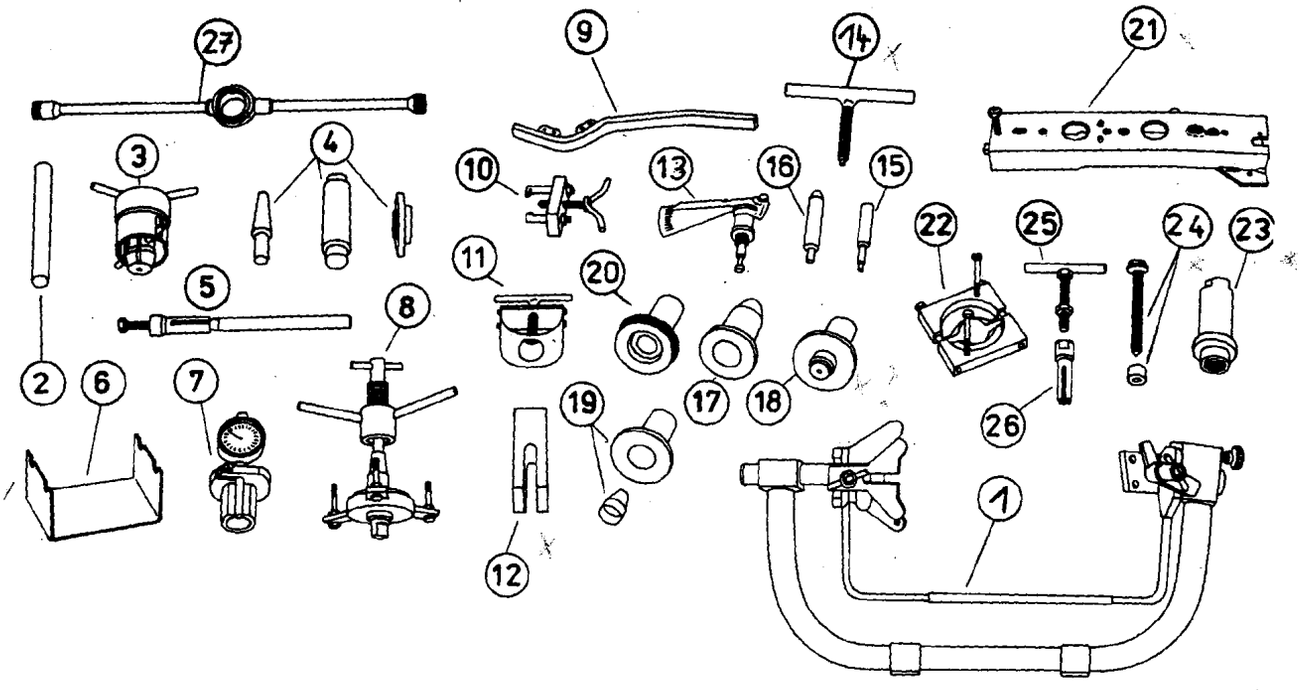


Fig. 197. Range of Special Tools for the ETZ 250

8.1. List of Special Tools

		Spare Reference No.	Drawing No.
1	Engine assembling device	22-50.014	1a
	Clamping piece rear 1)	89-99.321	1b
	Clamping piece, front complete 1)	89-99.322	1c
2	Centring bolt for swing-fork (05-MW 26-4)	89-99.055	2
3	Extractor for bearing in control head	22-51.006	3
4	Fitting device for rubber bearing in swing-fork	22-51.445	4
5	Expanding mandrel for wheel bearing (H 8-820-3)	89.99.090	5
6	Assembly device for gearbox	29-50.011	6
7	Measuring instrument for end play of clutch driver (05-ML 13-4)	89-99.117	7
8	Clutch clamping device (05-MV 150-2)	89-99.071	8
9	Holding-up device for gearbox sprocket wheel (05-MW 45-3)	89-99.057	9
10	Extractor for driving gear (05-MV 45-3)	89-99.064	10

1) For the completion of engine assembling devices purchased up to 1980 for the ETZ 250 engine

		Spare Reference No.	Drawing No.
11	Pressing-out device for gudgeon pin	22-50.010	11
12	Piston support	22-50.412	12
13	Ignition timing gauge	29-50.801	without
14	Anchor pulling screw (02-MW 39-4)	89-99.026	13
15	Drift for locating sleeves (11-MW 3-4)	89-99.072	14
16	Guide mandrel for gudgeon pin (05-MW 19-4)	89-99.051	15
17	Drift for bearings 6203 and 6204 (11-MW 7-4)	89-99.073	16
18	Drift for bearing 6306	29-50.405	17
19	Fitting tool for packing ring 30 x 72 x 7, dynamo side	29-50.406	18
20	Fitting tool for packing ring 30 x 72 x 7, clutch side	29-50.409	19
21	Assembling bridge	22-50.430	20
22	Ball bearing extractor (bearing 6306)	22-50.431	21
23	Pulling sleeve (clutch - thread M 24 x 1.5)	22-50.435	22
24	Pressing spindle for pressing piece	22-50.437	23
25	Extracting screw for bearing 6203	22-50.438	24
26	Clamping cartridge	22-50.439	25
27	Fitting wrench for telescopic fork (19-MW 22-1)	89-99.136	without
	Spacer ring	not included in this range	26
	Piston ring pliers (05-MW 141-4)	89-99.124	27
	Clamping ring (05-MW 147-4)	89-99.128	28
	Special spanner for shock absorber (05-MW 82-4)	89-99.059	29

8.2. Drawings of Special Tools

1. Engine Assembling Device
   22-50.014

All assembling devices sold by MZ until 1980 cannot be used for holding the engine of type EM 250.

The MZ Spare Sale Department offers for modifying these older devices modification sets consisting of

clamping piece 89-99.321, rear and

clamping piece, front complete, 89-99.322

to customers entitled to purchase special tools.

In addition, the front clamping point at the 22-50.014 device must be modified according to drawing 1a; this is possible by means of the usual workshop tools.

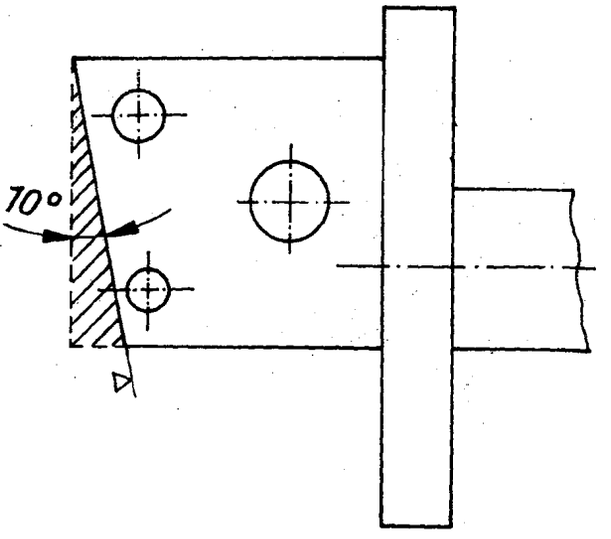


Fig. 1a. Modification of the clamping point of the assembling device 22-50.014

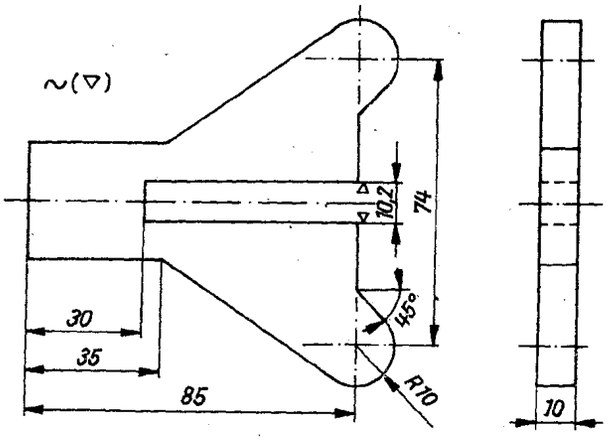


Fig. 1b. Clamping piece, rear, 89-99.321

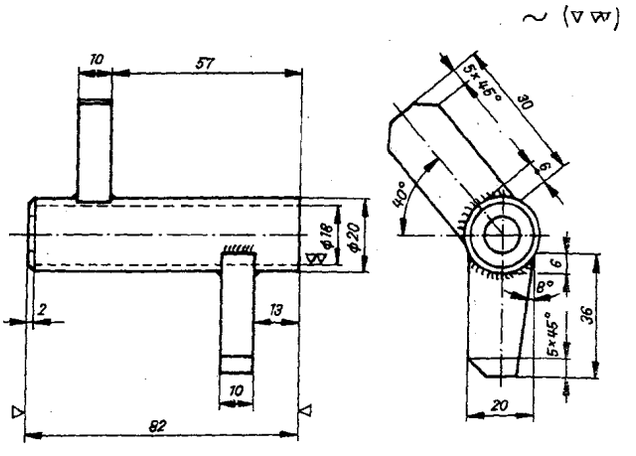
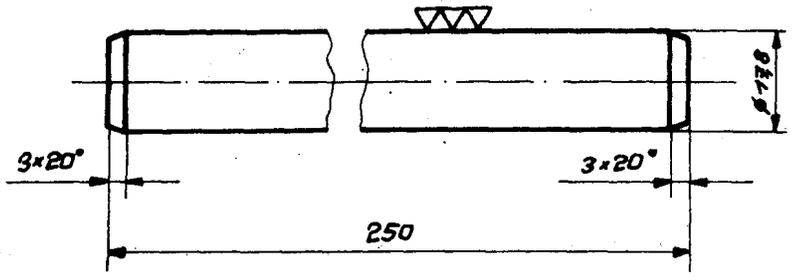


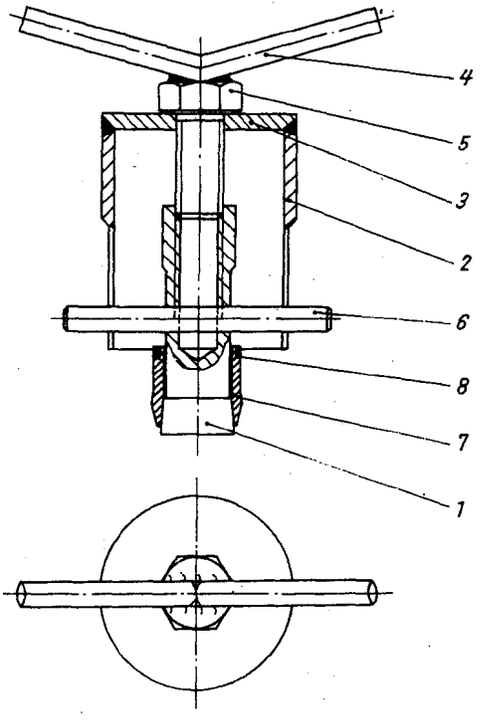
Fig. 1c. Clamping piece, front, complete, 89-99.322

2. Centring bolt for swing-fork (05-MW 26-4) 89-99.055



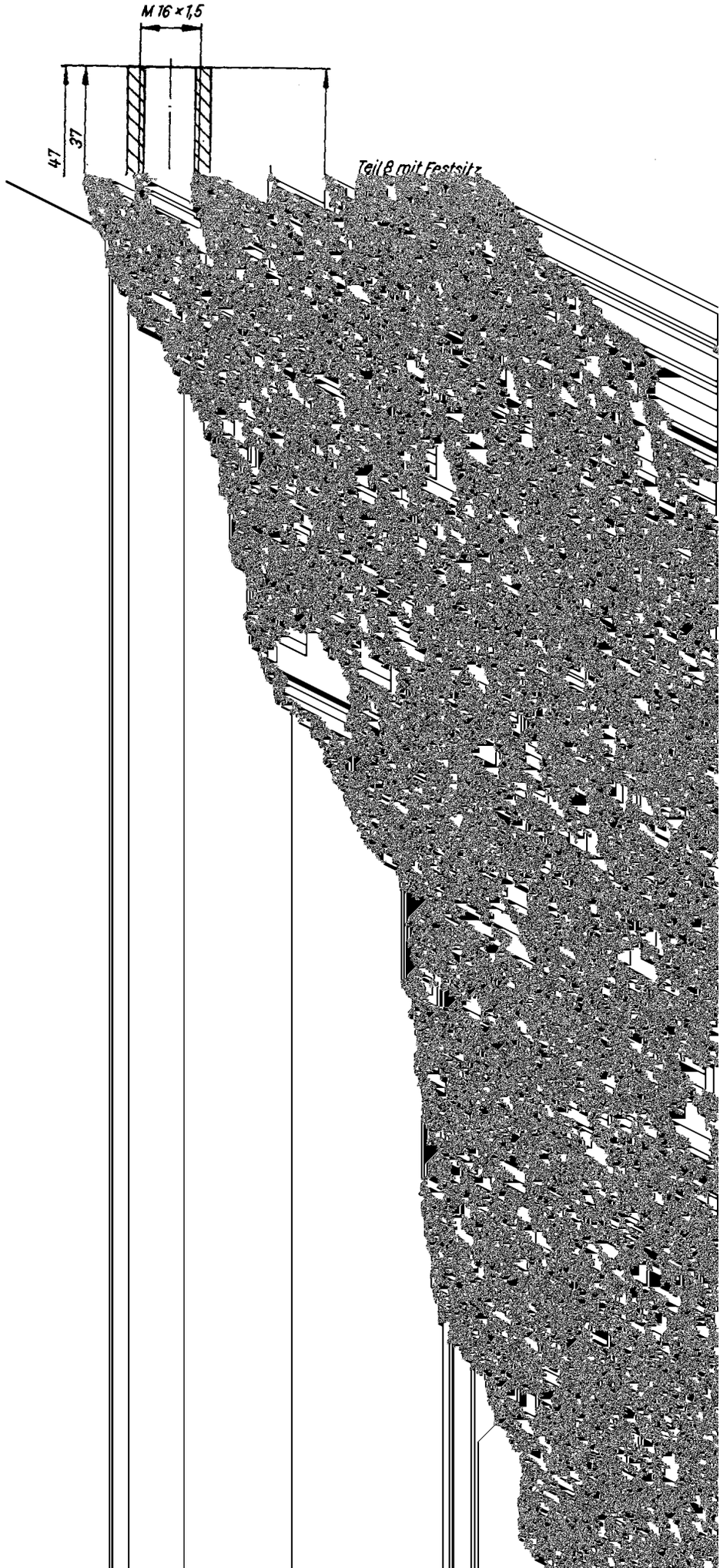
Part	Quantity	Description	Material	Rough Size	Remarks
	1	centring bolt	C 15 K	Ø 18 x 255	case hardened

3. Extractor for bearing in control head 22-51.006

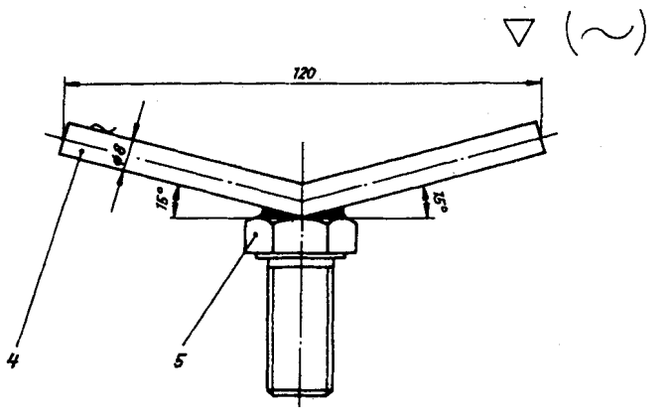


Part	Quantity	Description	Material	Rough Size	Remarks
1	1		C 45	Ø 30 x 80	hardened and tempered
2	1	pipe 76 x 10	St 35 hb	75 long)	welded part
3	1		St 38 b-2	Ø 65 x 10)	
4	1		St 38 b-2 K	Ø 8 x 130)	welded part
5	1	hexagon head screw M 16x 1.5 x 35		)	TGL 0-961
6	1		St 38 b-2 K	Ø 8 x 92	
7	1		16 Mn Cr 5	Ø 36 x 30	case hardened
8	1	circlip 28 x 1.6			TGL 0-9045

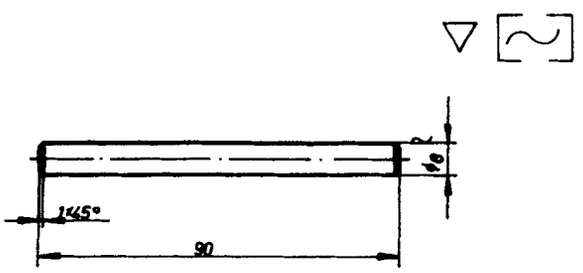
Part 1



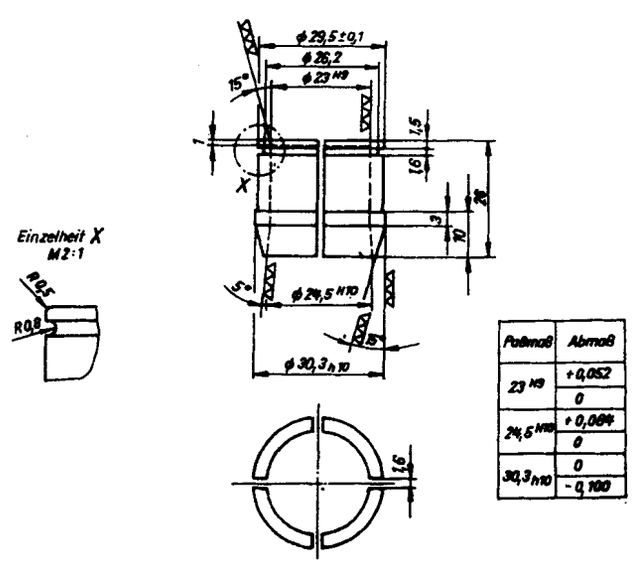
Parts 4/5



Part 6



Part 7



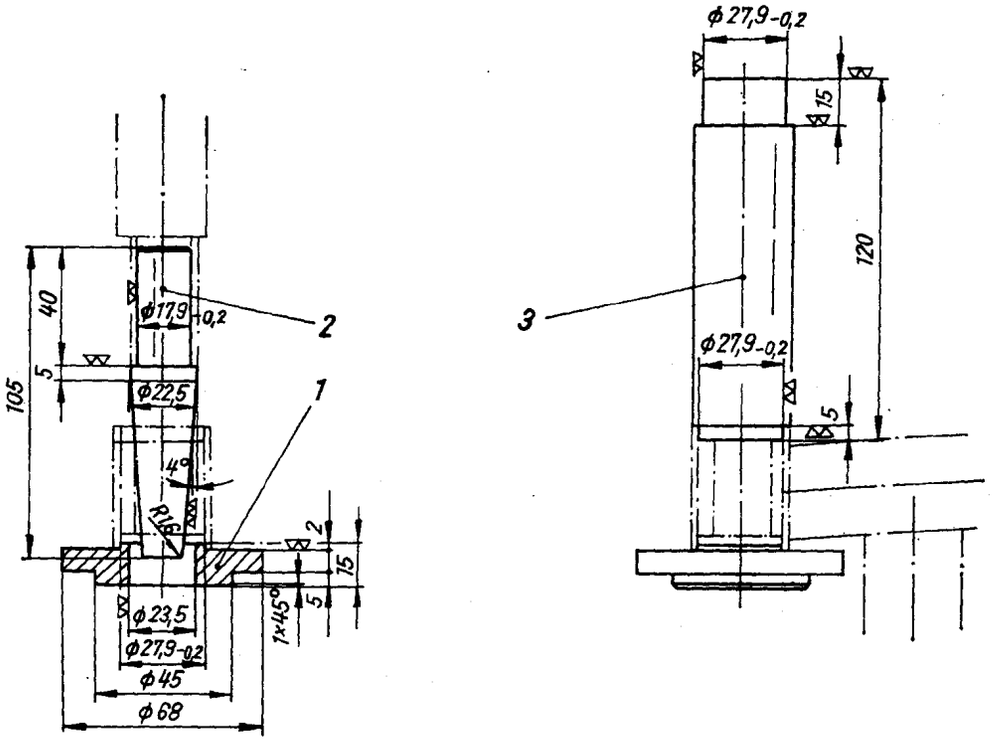
Paßmaß	Abmaß
23 H9	+ 0,052
	0
24,5 H10	+ 0,084
	0
30,3 h10	0
	- 0,100

Einzelheit X
M 2 : 1 =
Detail X, scale 2 : 1

Paßmaß =
Nominal dimension

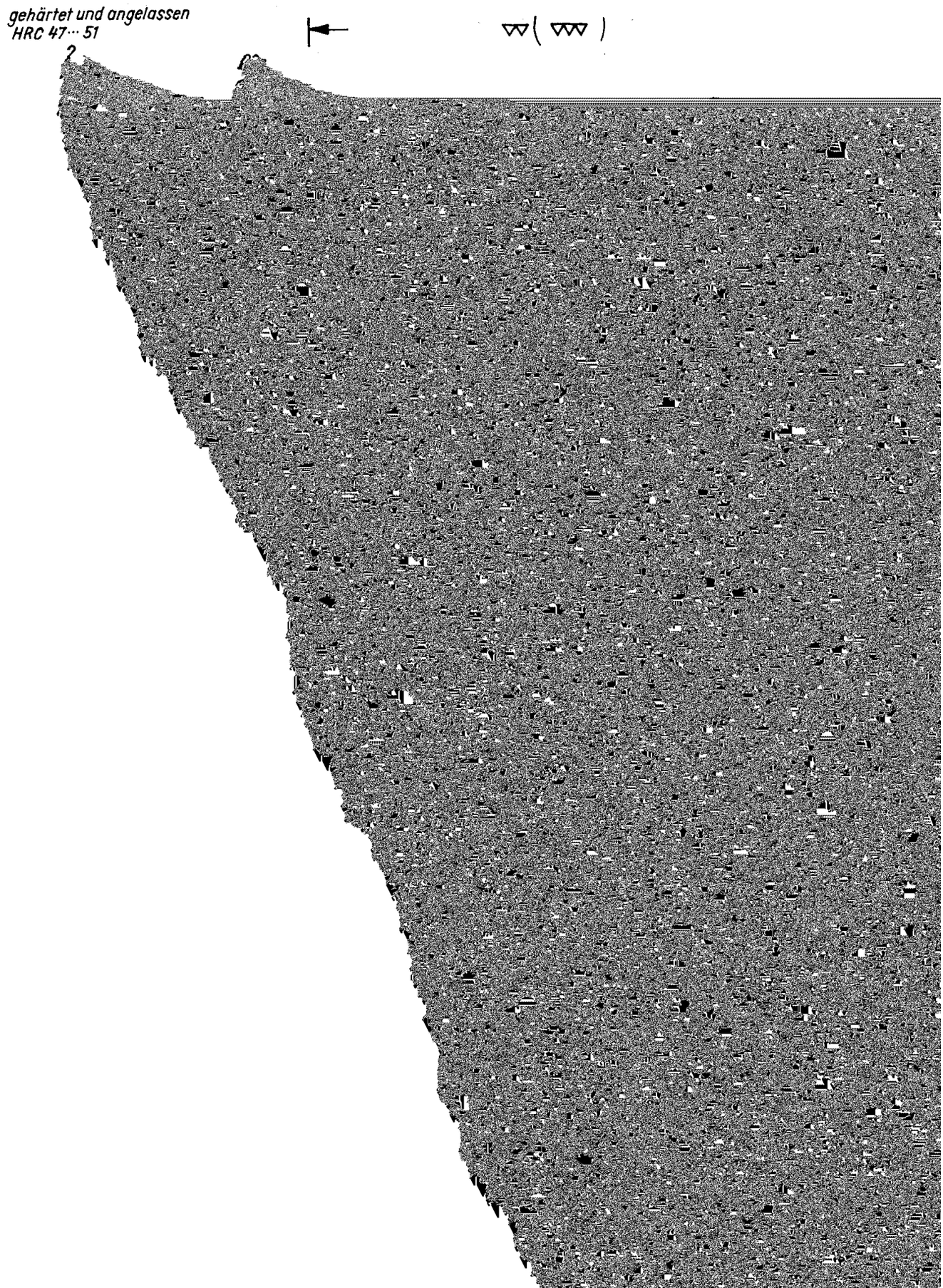
Abmaß =
Allowance

4. Fitting device for rubber bearing in swing-fork 22-51.445

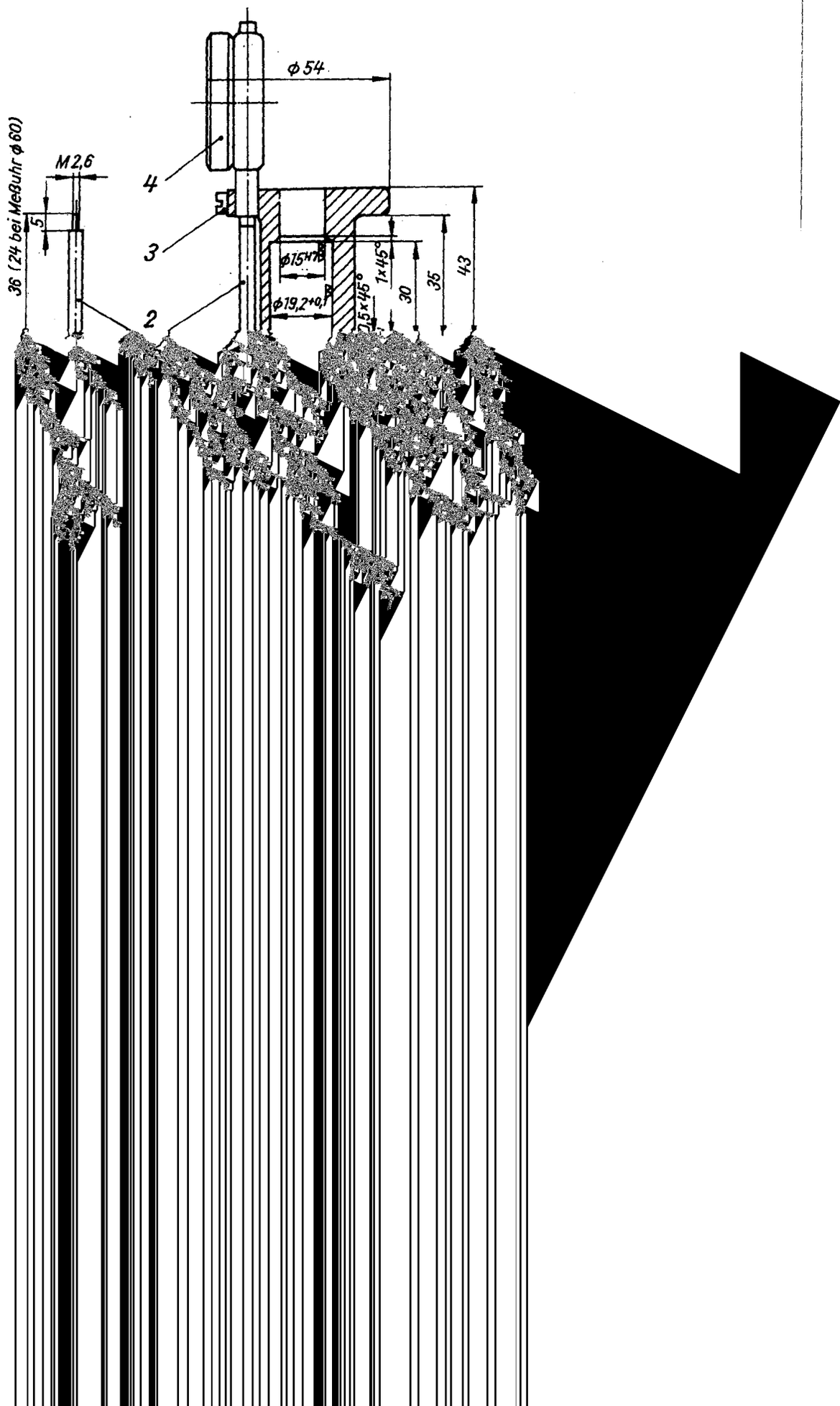


Part	Quantity	Description	Material	Rough Size	Remarks
1	1		St 38 b-2	Ø 70 x 20	
2	1		C 45	Ø 23 x 110	nickel-plated
3	1		St 38 b-2 K	Ø 32 x 125	nickel-plated

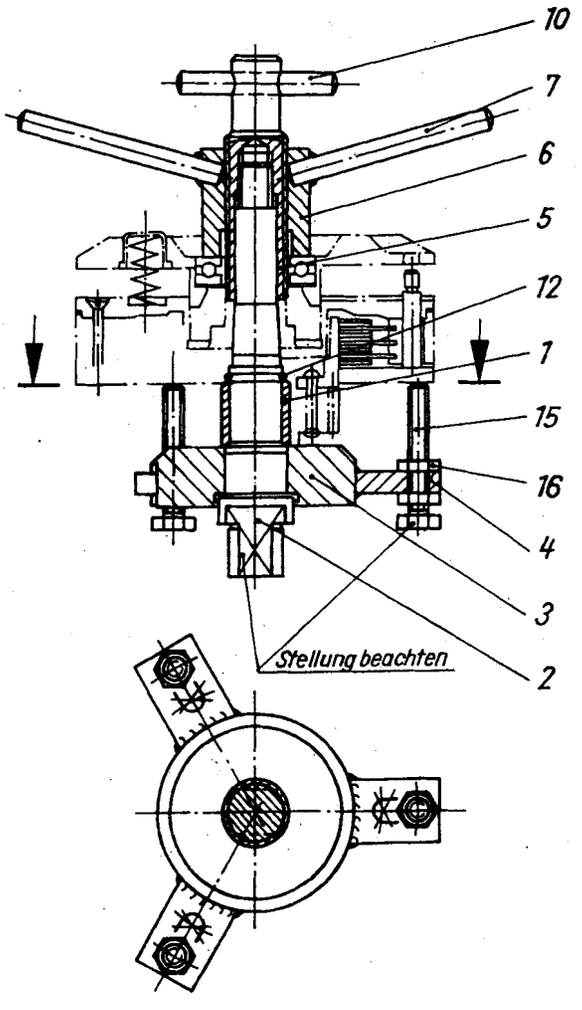
5. Expanding mandrel for wheel bearing (H 8-820-3) 89-99.090



7. Measuring instrument for end play of clutch driver (05-ML 13-4) 89-99.117

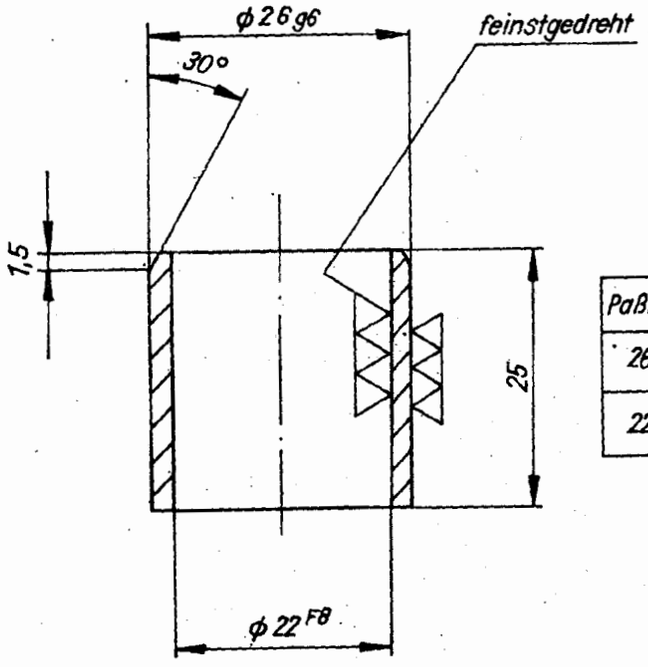


8. Clutch clamping device (05-MV 150-2) 89-99.071



Part	Quantity	Description	Material	Rough Size	Remarks
1	1	pipe 28 x 4	St 35 hb	30 long	
2	1	crankshaft end	05-43.058		to be employed
3	1		St 38 b-2	Ø 80 x 26	welded part
4	3		St 38 b-2	10 x 30 x40	welded part
5	1		C 45	Ø 30 x 96	
6	1		St 38 b-2	Ø 45 x 45	
7	2	cylindrical pin 10 m 6 x 80	welded part		TGL 0-7
10	1	cylindrical pin 8 m 6 x 60			TGL 0-7
12	1	circlip 22 x 2			TGL 0-9045
15	3	hexagon-head screw M 8 x 50			TGL 0-933
16	6	hexagon nut M 8			TGL 0-439

Part 1



Paßmaß	Abmaß
26 g6	-0,007 -0,020
22 F8	+0,053 +0,020

feinstgedreht = precision turned in a lathe

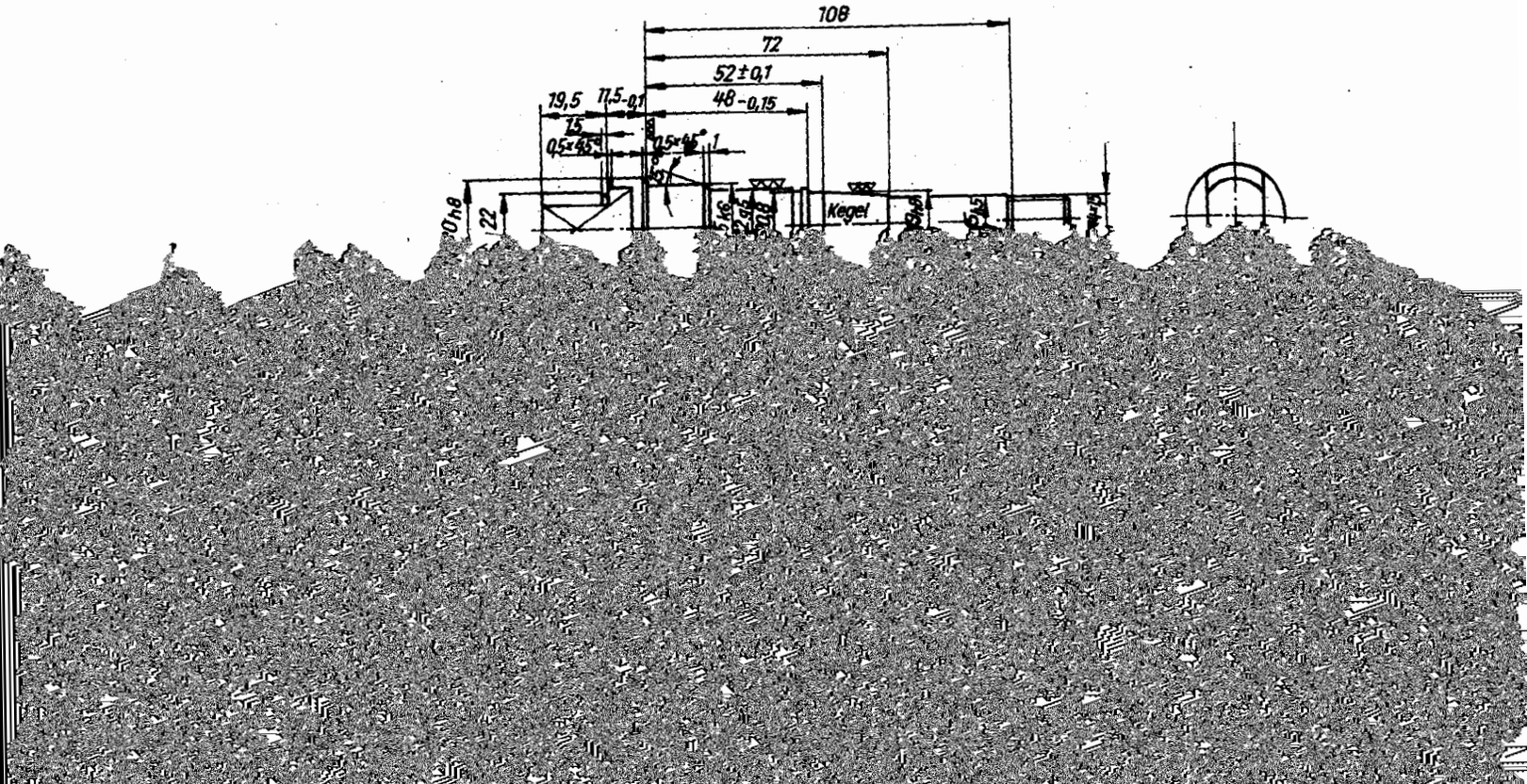
Kegel = cone

Paßmaß = nominal dimension Abmaß = allowance

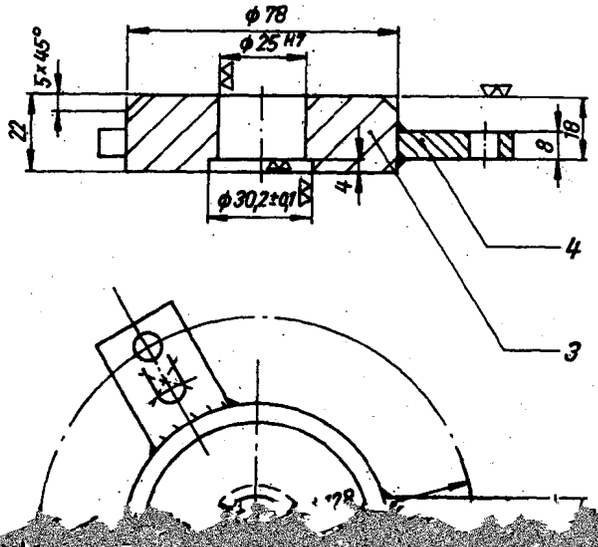
gehärtet und geschliffen = hardened and ground

(a) Gewinde weich = (a) thread soft

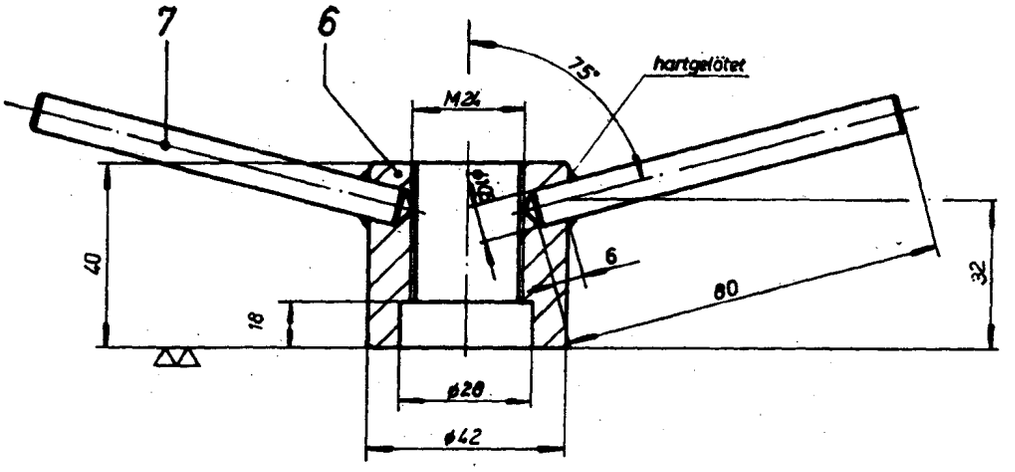
Part 2



Parts 3/4

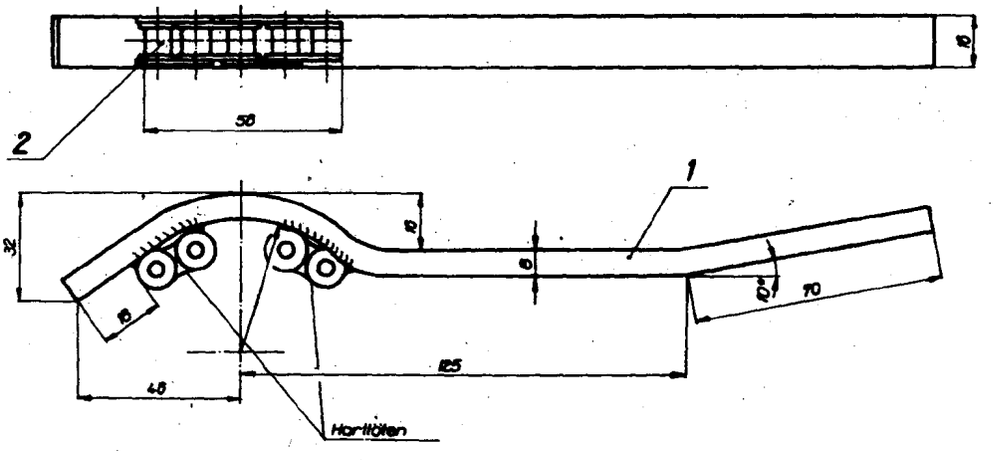


Parts 6/7



hartgelötet = brazed

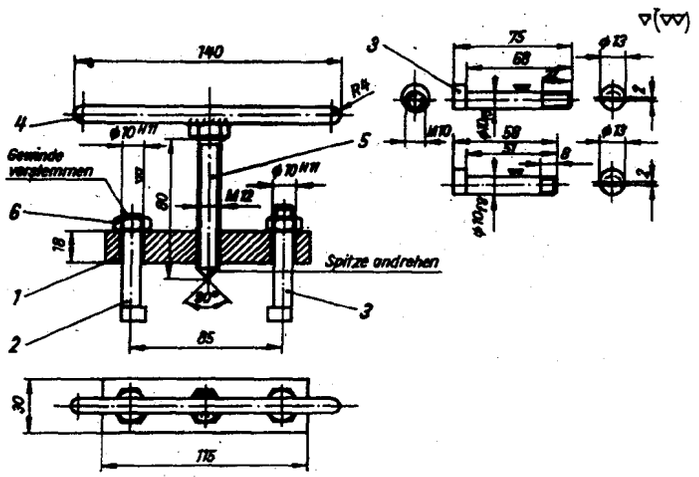
9. Holding-up device for gearbox sprocket wheel (05-MW 45-3) 89-99.057



Hartlöten = brazing

Part	Quantity	Description		Material	Rough Size	Remarks
1	1	wrench	welded part	St 34 K	16 x 8 x 270	TGL 0-1652
2	1	roller chain			12.7 x 8.51	DIN 8180

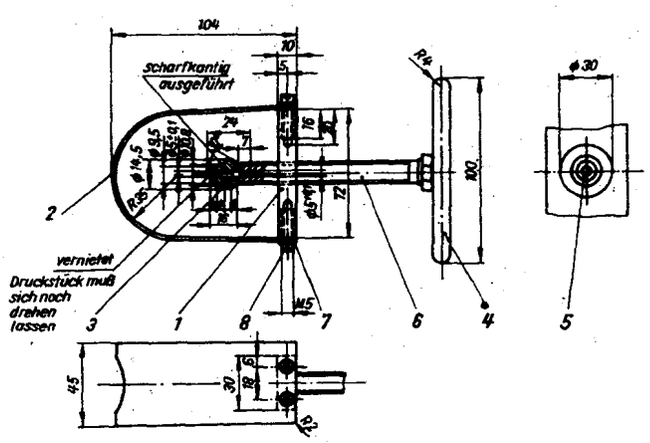
10. Extractor for driving gear (05- MV 45-3) 89.99.064



Gewinde verstemmen = thread to be caulked Spitze andrehen = tip to be turned in lathe

Part	Quantity	Description	Material	Rough Size	Remarks
1	1		St 38 u-2	30x20x120	TGL 7973
2	1		C 45	Ø 18 x 62	TGL 7970
3	1		C 45	Ø 18 x 70	TGL 7970
4	1) welded		St 38 K	Ø 8x145	TGL 7970
5	1) part	hexagon-head screw M 12 x 80			tip turned
6	2	hexagon nut M 10			TGL 0-934

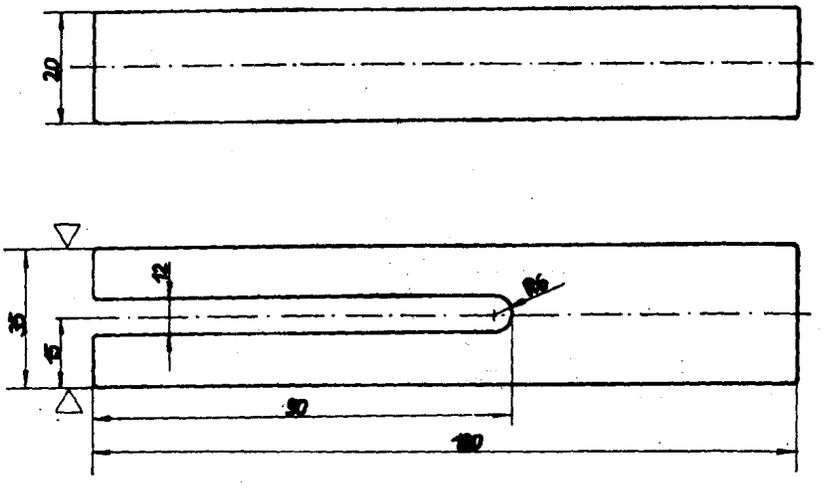
11. Pressing-out device for gudgeon pin 22-50.010



scharfkantig ausgeführt = provided with sharp edge vernietet = riveted Druckstück muß sich noch drehen lassen = thrust member must be capable of being turned

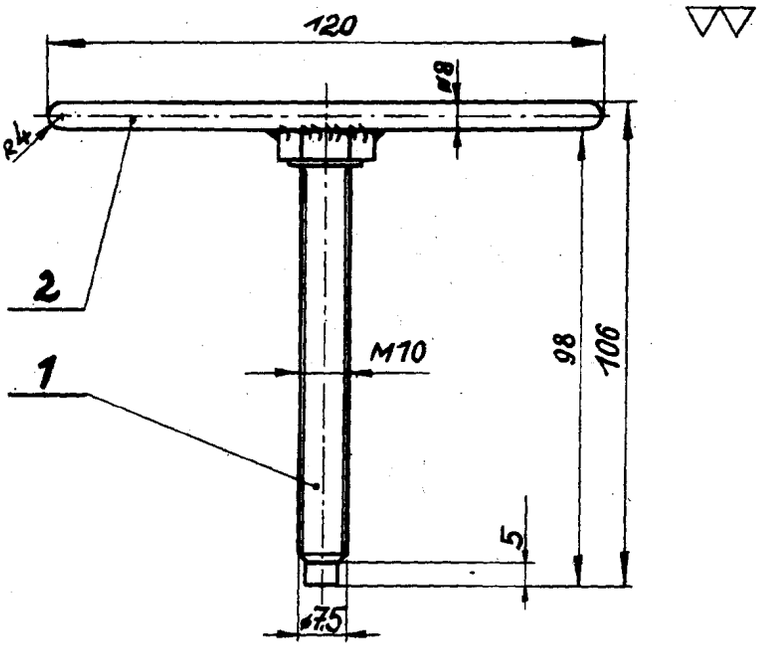
Part	Quantity	Description	Material	Rough Size	Remarks
1	1		St 38 b-2	30x10x72	TGL 7973
2	1	spring steel band 0.6 mm thick	C K 67	245 x 45	TGL 7975
3	1		C K 45	Ø 20x20	TGL 7970
4	1) welded		St 38 K	Ø 8x100	TGL 7970
5	1) part		St 38 K	Ø 5x30	TGL 7970
6		hexagon-head screw M 12 x 100			TGL 0-933
7	4	washer Ø 5.3			TGL 0-125
8	4	fillister-head screw M 5 x 12			TGL 0-84-5 S

12. Piston support 22-50.412



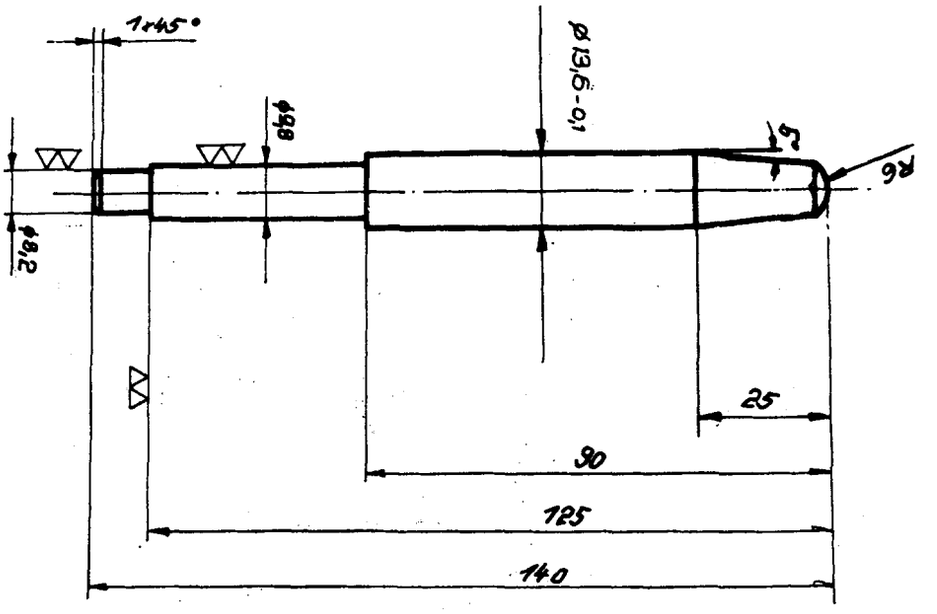
Part	Quantity	Description	Material	Rough Size	Remarks
	1	fork	HGW 2088	180x35x20	TGL 12 246

13. Anchor pulling screw (02-MW 39-4) 89-99.026



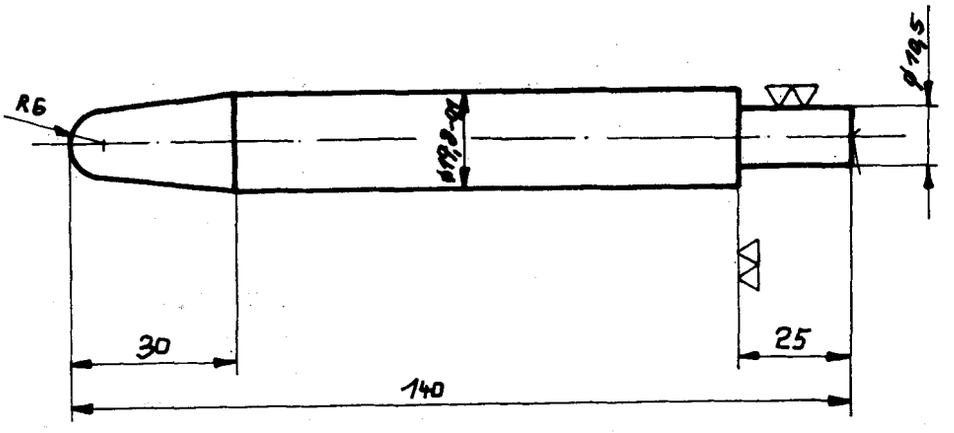
Part	Quantity	Description	Material	Rough Size	Remarks
1	1	hexagon-head screw M 10 x 90			lug turned in lathe
2	1	handle	St 38 K	ø 8 x 125	

14. Drift for locating sleeves (11-MW 3-4) 89-99.072



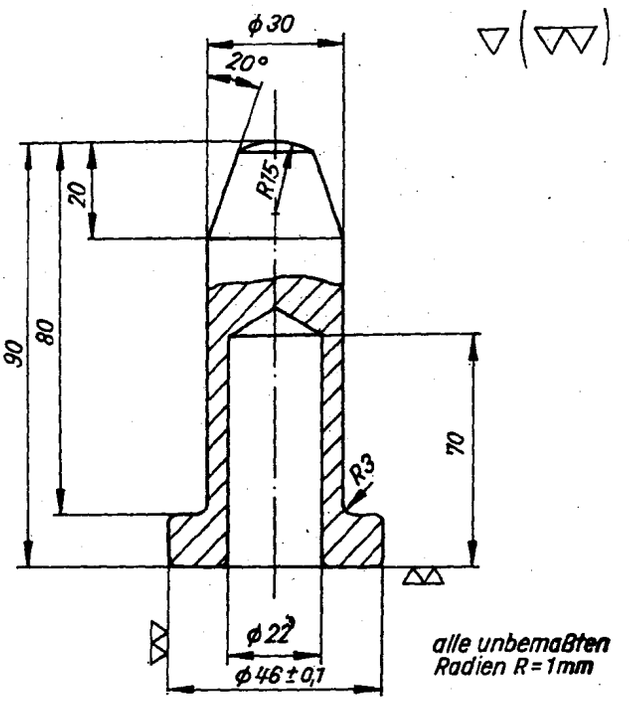
Part	Quantity	Description	Material	Rough Size	Remarks
	1	drift	C 15	Ø 15 x 145	case hardened

15. Guide mandrel for gudgeon pin (05 MW 19-4) 89-99.051



Part	Quantity	Description	Material	Rough Size	Remarks
	1	guide mandrel	St 38 b-2	Ø 20 x 145	

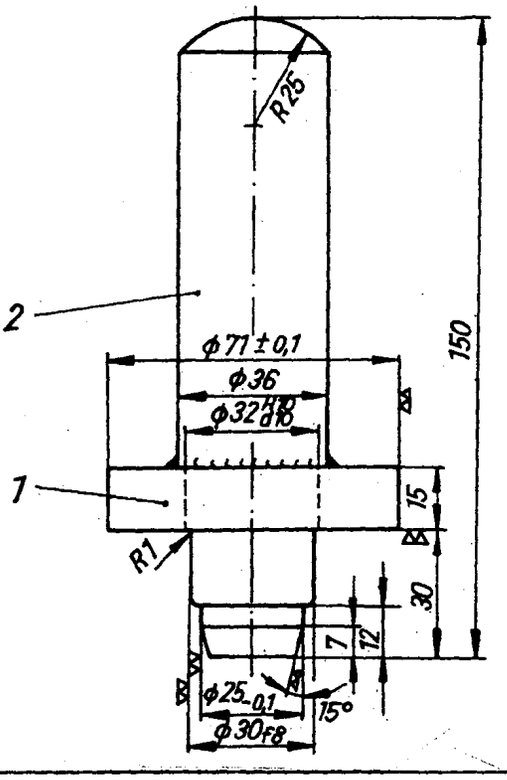
16. Drift for bearings 6203 and 6204 (11 MW 7-4) 89-99.073



alle unbemaßten Radien R = 1 mm = for all radii without dimension R = 1 mm

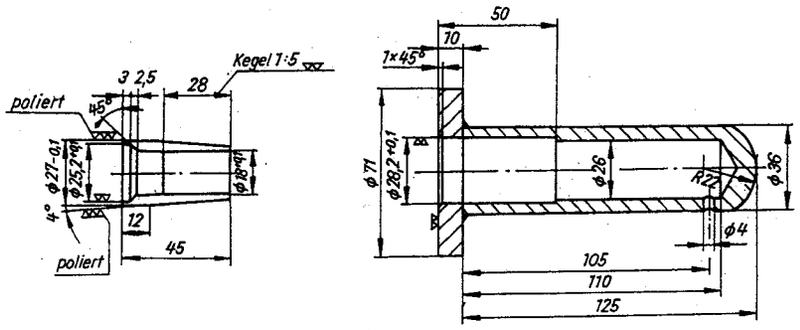
Part	Quantity	Description	Material	Rough Size	Remarks
	1	drift	C 15	ϕ 50 x 100	case hardened

17. Drift for bearing 6306 29-50.405



Part	Quantity	Description	Material	Rough Size	Remarks
1	1		C 15	ϕ 75 x 20	
2	1		C 15 K	ϕ 36 x 155	

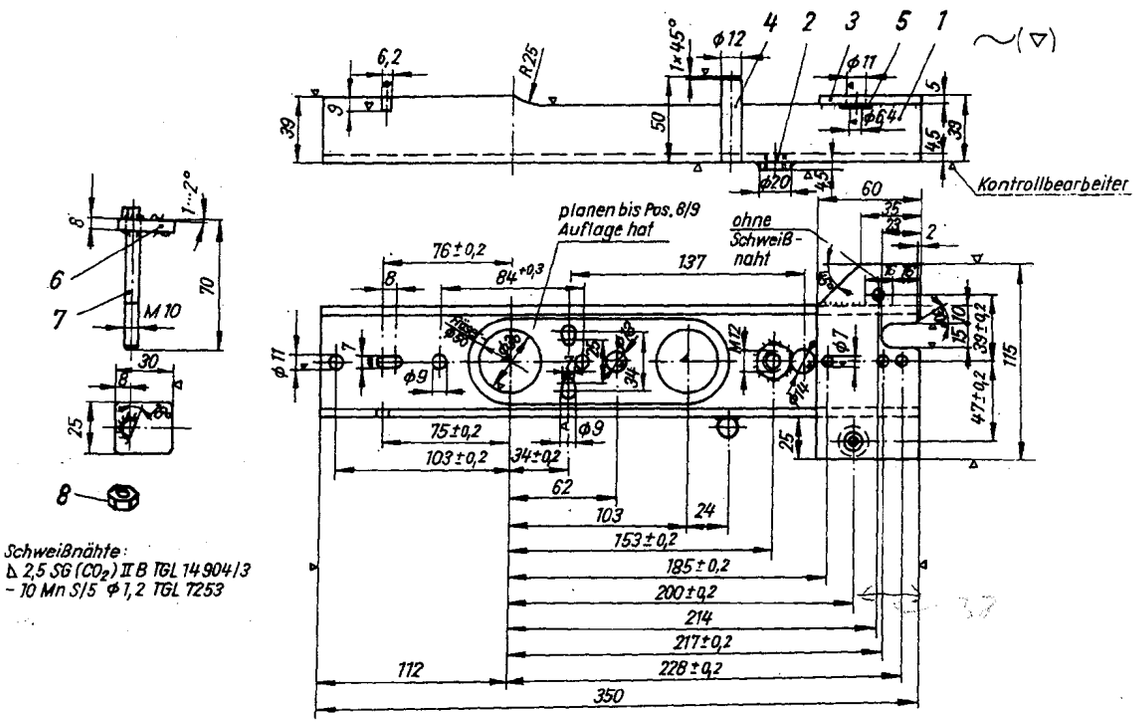
18. Fitting tool for packing ring (30x72x7) 29-50.406 (dynamo side)



poliert = polished Kegel 1 : 5 = cone 1 : 5

Part	Quantity	Description	Material	Rough Size	Remarks
1	1	welded part	C 15	Ø 75 x 15	

20. Assembling bridge 22-50.430



Schweißnähte: welding seams Fräser Ø 50 = milling cutter 50 in diameter

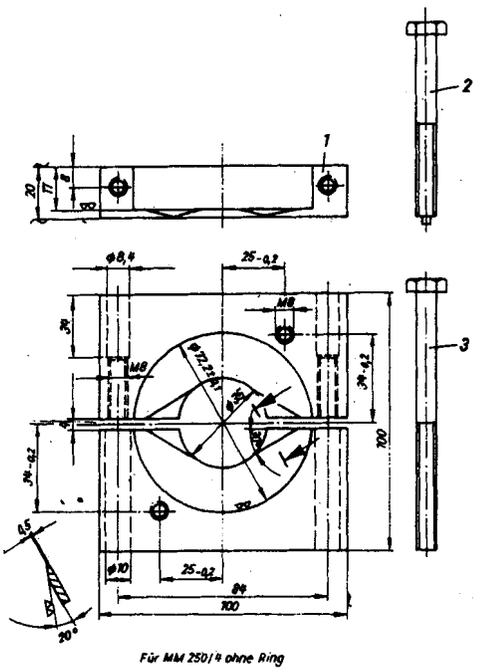
planen bis Pos. 8/9 Auflage hat = to be faced until items 8/9 make contact

ohne schweißnaht = without welding seam

kontrollbearbeitet = control finished

Part	Quantity	Description	Material	Rough Size	Remarks
1	1	U-steel 6 1/2	St 38 b-2	350 long	TGL 0-1026
2	1		St 38 b-2k	Ø 20 x8	
3	1		St 38 b-2	5x60x115	welded part
4	1		St 38 b-2	Ø 12x55	
5	1	washer R 8.5			TGL 0-440
6	1		St 38 b-2	6x25x30	welded part
7	1	hexagon-head screw	M 10 x 70		TGL 0-931
8	1	hexagon nut	M 10		TGL 0-934

21. Ball bearing extractor bearing 6306 (22-50.431)

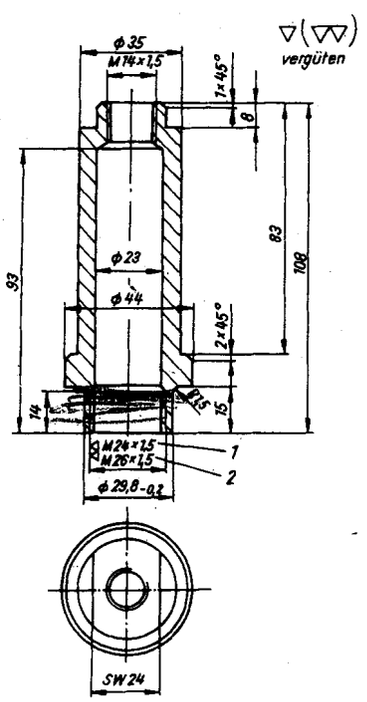


Zapfen gehärtet = pin hardened

Part	Quantity	Description	Material	Rough Size	Remarks
1	1		C 15	20x100x105	carbonitrided
2	2	hexagon-head screw	M 8 x 70		TGL 0-931
3	2	hexagon-head screw	M 8 x 100		TGL 0-933

22. Pulling sleeve clutch - thread M 24 x 1.5 (22-50.435)

PARTS 16, 19

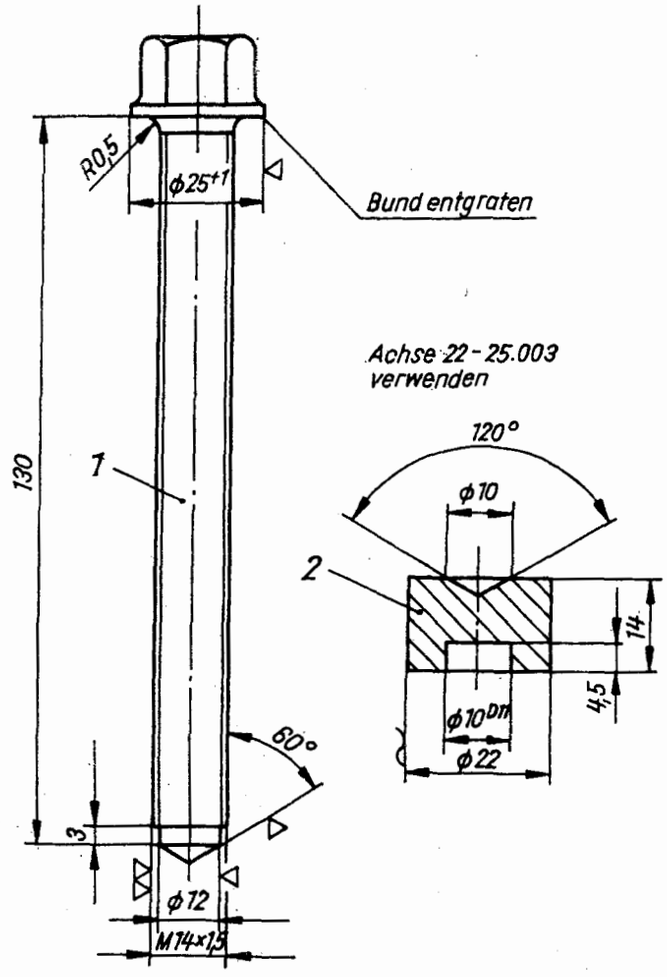


vergüten = to be hardened and tempered

(1) for MM 250/4
(2) for MM 175/2, 250/2, 250/3

Part	Quantity	Description	Material	Rough Size	Remarks
	1		C 45	Ø 45 x 112	hardened and temp.

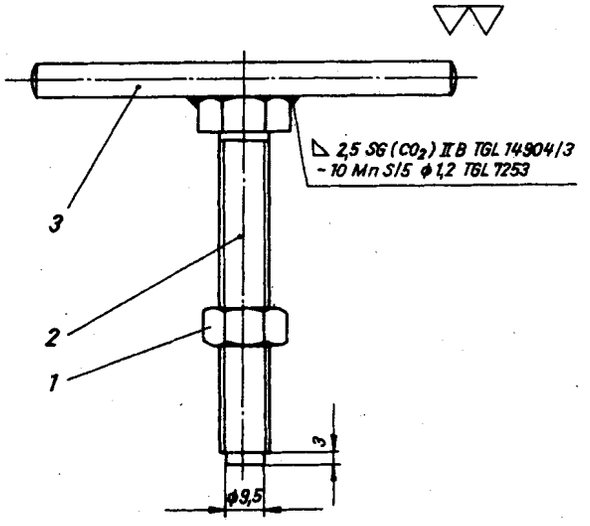
23. Pressing spindle with pressing piece 22-50.437



Bund entgraten = collar to be burred
Achse 22-25.003 verwenden = Use axle 22-25.003

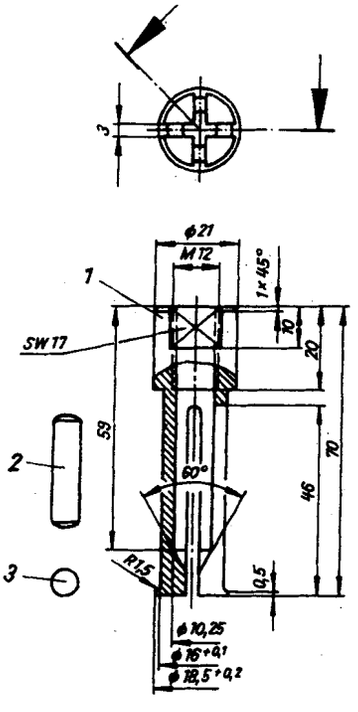
Part	Quantity	Description	Material	Rough Size	Remarks
1	1	pressing spindle	C 60 K	Ø 15.4 x 169.5	
2	1	pressing piece	C 45 K	Ø 22 x 18	

24. Extracting screw for bearing 6203 (22-50.438)



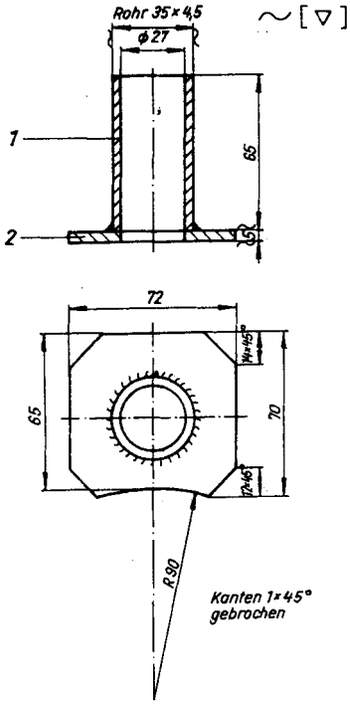
Part	Quantity	Description	Material	Rough Size	Remarks
1	1	hexagon nut M 12			TGL 0-934
2	1	hexagon-head bolt M 12 x 80)	welded		TGL 0-933
3	1	cylindrical pin 8 x 6 x 100)	part		TGL 0-7

25. Clamping cartridge 22-50.439



Part	Quantity	Description	Material	Rough Size	Remarks
1	1	clamping cartridge	C 60	ϕ 25 x 75	
2	1	bolt 10 x 40			TGL 0-1433
3	1	ball 9			TGL 15 515

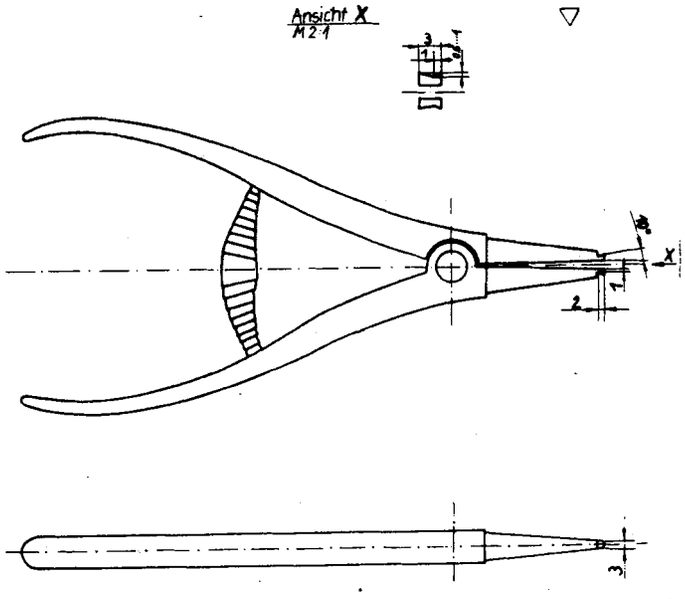
26. Spacer (not on sale by MZ)



Rohr 35 x 4,5 = pipe 35 x 4.5 Kanten 1 x 45° gebrochen = edges chamfered 1 x 4

Part	Quantity	Description	Material	Rough Size	Remarks
1	1	pipe) welded part		C 15 K	Ø 35 x 70
2	1	)		C 15	75 x 75

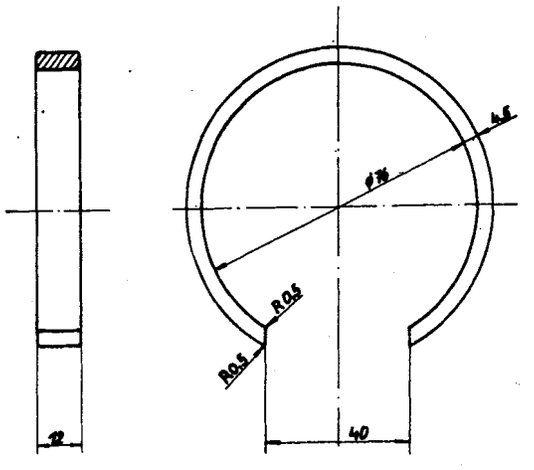
27. Piston ring pliers (05-MW 141-4) 89-99.124



Ansicht X M 2 : 1 = View X scale 2 : 1

Part	Quantity	Description	Material	Rough Size	Remarks
	1	lock-ring pliers A 1 60			TGL L 8-72 5

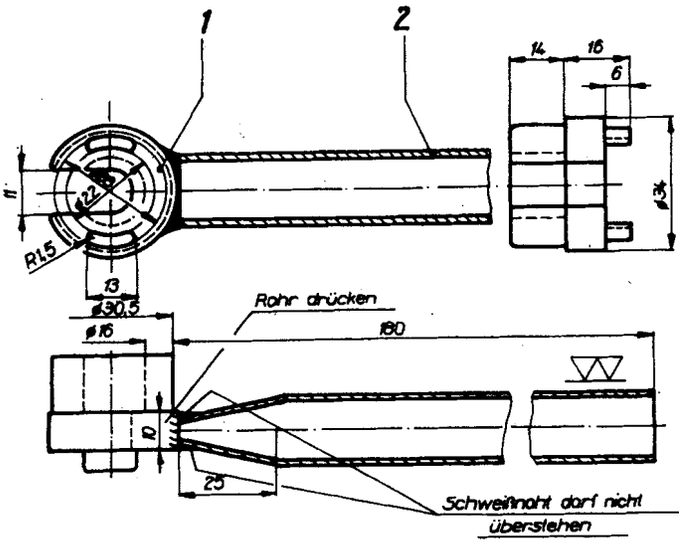
28. Clamping ring for piston rings 05-MW 147-4 (89-99.128)



For this tool also use special pliers 05-MW 141-4

Part	Quantity	Description	Material	Rough Size	Remarks
	1		St 38 u-2	Ø 90 x 15	

29. Special spanner for shock absorber (05-MW 82-4) 89-99.059



Rohr pressen = pipe to be pressed Schweißnaht darf nicht überstehen = weld must not project

Part	Quantity	Description	Material	Rough Size	Remarks
1	1	ring	M ST 3	Ø 35 x 35	welded part
2	1	pipe 18 x 1.5	St 35 hb	185 long	

9. Tightening Torques - Engine

Nuts for the cylinder head	26 Nm (2.6 kpm)
Sparking-plug	40 Nm (4.0 kpm)
Fillister-head screws for casing, dynamo cover and clutch cover	13 Nm (1.3 kpm)
Screws for sealing cap of driving shaft	5 Nm (0.5 kpm)
Screws for retaining cap - dynamo	5 Nm (0.5 kpm)
Screw for armature fastening (dynamo)	20 Nm (2.0 kpm)
Stud bolts for cylinder fastening	20 Nm (2.0 kpm)
Clutch fastening nut	80 to 100 Nm (8 to 10 kpm)
Nut for drive gear 68 teeth	60 Nm (6.0 kpm)
Nut for sprocket wheel at gearbox	60 Nm (6.0 kpm)
Screws for end cap in clutch cover and speedo-meter drive	8 Nm (0.8 kpm)

10. Tightening Torques - Cycle Parts

Nut for control tube	150 Nm (15.0 kpm)
Screw plugs for telescopic fork	150 Nm (15.0 kpm)
Clamping screws at lower clamping head - telescopic fork	20 Nm (2.0 kpm)
Hexagonal socket-head bolt	20 Nm (2.0 kpm)
Clamping screw - front wheel axle	20 Nm (2.0 kpm)
Front-wheel and rear-wheel axle	80 Nm (8.0 kpm)
Nut for flanged bolt- rear wheel drive	80 Nm (8.0 kpm)
Suspension unit fastening, top	26 Nm (2.6 kpm)
Suspension unit fastening, bottom	45 Nm (4.5 kpm)
Engine fastening, rear	26 Nm (2.6 kpm)
Engine fastening at rubber element (cylinder head)	26 Nm (2.6 kpm)
Exhaust pipe fastening to cylinder	150 Nm (15.0 kpm)
M 8 fastening screws for exhaust system	26 Nm (2.6 kpm)
Swing-fork bearing bolt (springs fully extended)	70 to 80 Nm (7.0 to 8.0 kpm)

APPENDIX:

Wiring diagram of the electrical system MZ 6 V / 12 V