simson

Repair Instructions

for

Simson Light Motor-Cycles

of the S 51 and KR 51/2 Type Series

VEB FAHRZEUG- UND JAGDWAFFENWERK
„ERNST THÄLMANN" SUHL · DDR
IFA-KOMBINAT FÜR ZWEIRADFAHRZEUGE

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With 214 illustrations

VEB FAHRZEUG- UND JAGDWAFFENWERK
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Simson light motor-cycles are products from
VEB Fahrzeug- und Jagdwaffenwerk Ernst Thälmann Suhl,
IFA-Kombinat für Zweiradfahrzeuge – German Democratic Republic

The Repair Instructions were written by a group of engineers in the employ of the manufacturer

DESIGN SUBJECT TO ALTERATIONS WITHOUT NOTICE!

VEB FACHBUCHVERLAG LEIPZIG
Dead line: February 1, 1982
Composition and print: Fachbuchdruck Naumburg (Saale) IV/26/14
SG 157/64/82
RA Kleinkrafträder S 51 und KR 51/1, englisch

Preliminary remarks

Tradition and experience,

systematic developmental work ensuring technical progress, modern production equipment,

first-rate material,

diligence and abilities of the working people in

VEB Fahrzeug- und Jagdwaffenwerk
Ernst Thälmann Suhl
IFA-Kombinat für Zweiradfahrzeuge

are the basis of Simson light motor-cycles.

The particular advantages of these light motor-cycles are:

stylishness and efficiency,

requiring almost no maintenance and mode of construction suitable for facilitating repairs,

low operating cost,

high degree of standardisation of replacement parts.

These Repair Instructions give information about the most important operations involved in the servicing and repair of the main subassemblies of the vehicles and instructions for your repair activities, do it yourself.

VEB Fahrzeug- und Jagdwaffenwerk
Ernst Thälmann Suhl
IFA-Kombinat für Zweiradfahrzeuge

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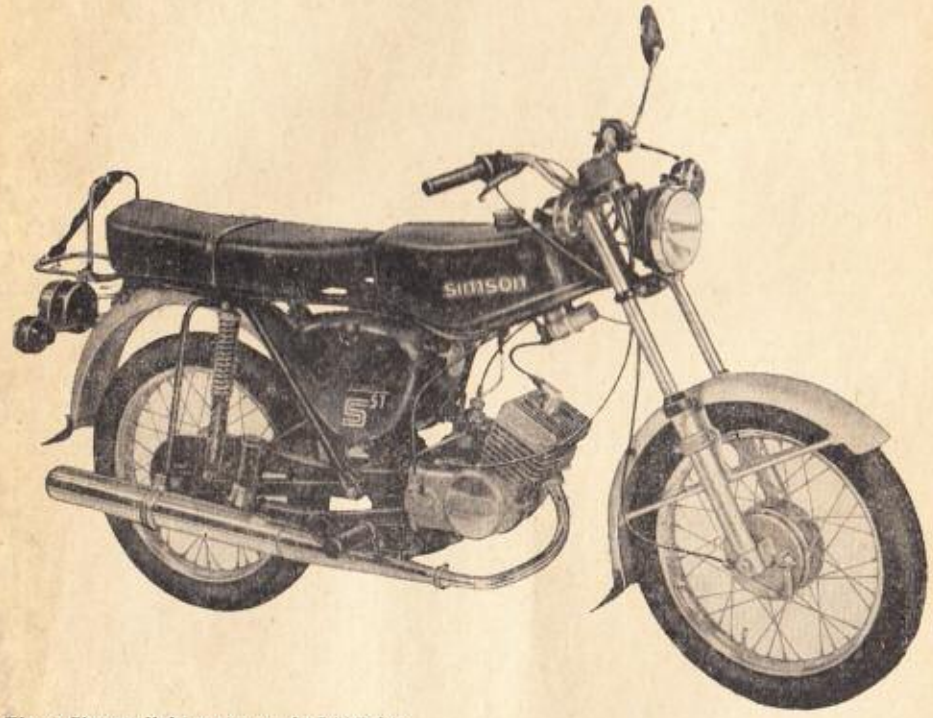


Fig. 1. Simson light motor-cycle S 51 B 2-4

Fig. 2. Simson small scooter KR 51/2 N

1. General Information

The majority of repair operations can be performed with the engine in the mounted position, especially in the vehicles of the S 51 types series.

The engine must be demounted

for the replacement of the engine and the engine casing,
for work at the gearchange mechanism and the kick-starter gear,
for work at the crank assembly.

The following components

exhaust system,
carburetter,
flywheel gegerator ignitor

may remain completely in the vehicle, depending on the circumstances.

The casing halves can be separated without opening the clutch compartment or removing parts accomodated in this compartment. The rear wheel drive is separated from the engine by loosening the driving-chain sprocket. The sprocket remains in the chain.

Notice!

Do not turn the rear wheel when the driving-chain sprocket is removed. The chain ascending on the rear sprocket could cause the plastics chain box to burst.

- The gear oil should be drained when the engine is still in a hot state. For an oil change, flush the gearbox compartment with flushing oil; in the case of gearbox repairs, clean the casing halves and components with pure benzine.

- For the new filling, only use oil of the specified grade and viscosity, namely, lubricating oil
  60 mm^2/s (60 cSt) 7.5 °E at 50 °C 80 SAE

- As a rule, use seals, packings and packing rings only once!
  Before assembling, carefully clean the sealing areas, check them for smoothness and, if specified, provide them with a film of engine sealing compound.
  It is advisable to place new radial seal rings in Diesel fuel a few hours before assembling in order to ensure that they are pliant. When fitting the radial seal rings, take every care; the sealing lips must not be damaged.
  The bearing point for the seal on the shaft must show a proper surface and have the correct diameter.

Mounting must be effected in such a way that the sealing lip points to the compartment to be sealed. For offset shafts, use fitting sleeves, if possible.

- Jamming casing clamping screws can be loosened more easily when the are subjected to a bouncing stroke before screwing them out. For this purpose use a mandrel fitting to the screw head and apply a blow with a hammer on this mandrel.

- Ball bearings should be mounted after heating the seat and the internal ring, if required (overheating the bearing must be avoided in any case). Ball bearings which have already been used must be cleaned by moving them immersed in fuel to and fro several times and then slightly greased. The ball bearing seats must be in proper condition. A poor snug fit in the casing or on the shaft can lead to the deformation of the races and premature wear of the bearing.

- Before mounting, all components must be thoroughly cleaned and checked for proper condition. For all repairs, only use original "Simson" replacement parts! All ball bearings and shafts must fit tightly and up to the stop in the receiving holes.

- The running and sliding surfaces of the components must be provided with a film of the specified lubricant or with sealing lip paste before mounting.
  When mounting, take care that foreign particles do not get into the gearbox or crankcase, otherwise severe damage to the engine may be inevitable.

- Only use tools which are suited as to size and in proper working condition. Stric test cleanliness must be observed at the work bench.

- Plastic parts, especially those of a vitreous character (light emitting panes of lamps, contact carriers in the ignition-light switch, etc.) must not get into contact with fuel, grease or oil because these substances produce a chemically detrimental effect on plastics.

Possibilities of Rapid Repairs

With the engine mounted in the vehicle, the following repairs are feasible:

repairs in the speedometer drive,
replacement of the driving-chain sprocket,
all operations in the electrical equipment of the engine,
all operations in the carburetter and exhaust gas system,
demounting and mounting cylinder head, cylinder and piston,
all operations in the primary drive and the clutch,
all operations in the foot-operated gearchange mechanism including the replacement of the sliding-key shaft and the adjustment of the gearchange mechanism,
all operations in the kick-starter drive excluding the kick-starter gear,
replacement of the shaft seal rings and rubber annular rings by new ones.

1.1. Sectional View of the Engine M 541

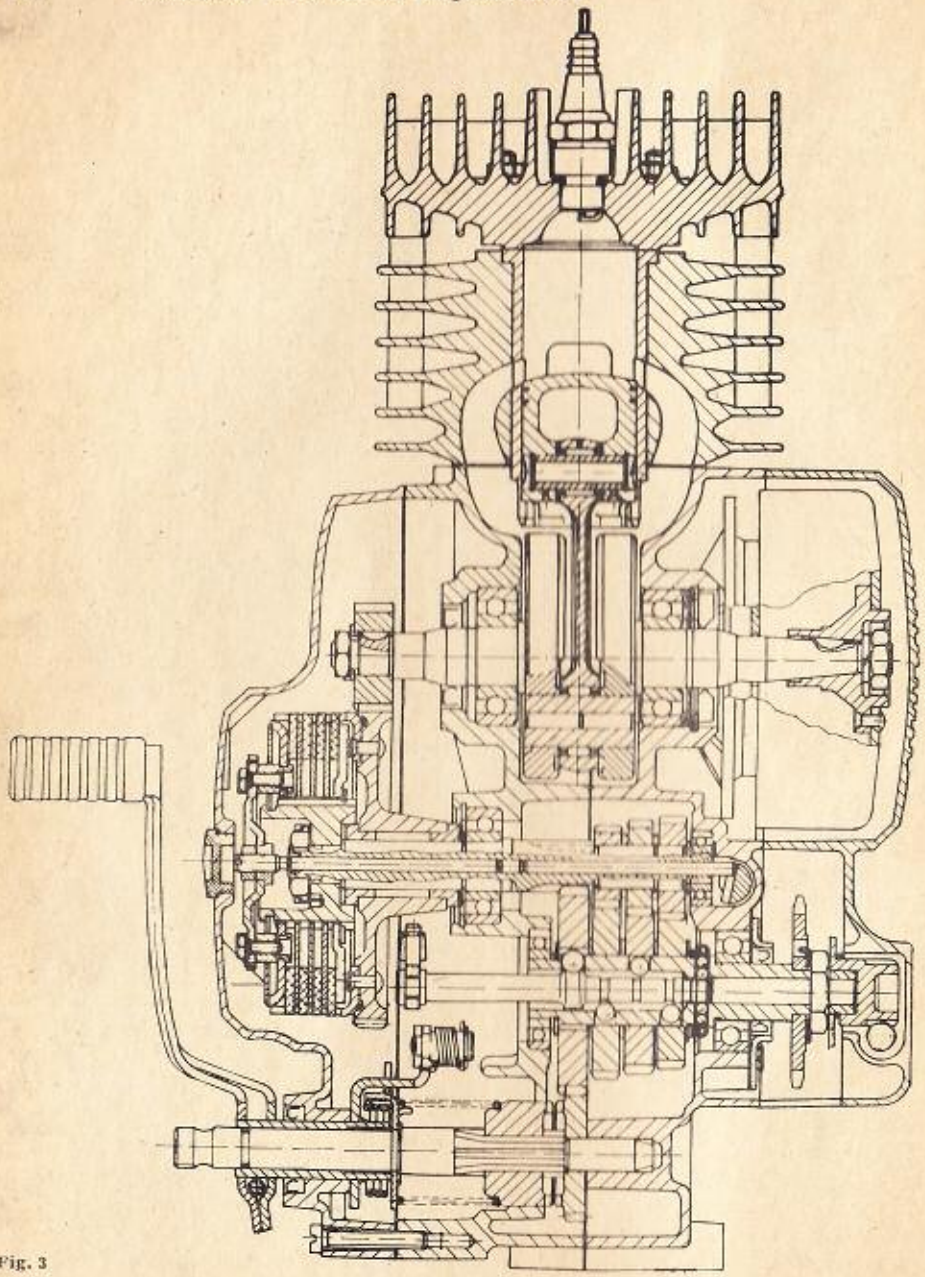


Fig. 3

1.2. Technical Data – Diagrams – Tables of Measures

Engine data

Cycle	two-stroke Otto engine
Combustion chamber	semi-spherical
Maximum torque	
60 km/h (38 mph) variants	5.0 Nm at a speed of 4,800 rpm (equal to 3.69 lb-ft at 4,800 rpm)
50 km/h (30 mph) variants	4.8 Nm at a speed of 4,800 rpm (equal to 3.55 lb-ft at 4,800 rpm)
40 km/h (25 mph) variants	3.7 Nm at a speed of 4,500 rpm (equal to 2.75 lb-ft at 4,500 rpm)
Maximum output	
60 km/h (38 mph) variants	2.72 kW at a speed of 5,500 rpm (equal to 3.7 hp at 5,500 rpm)
50 km/h (30 mph) variants	2.47 kW at a speed of 5,000 rpm (equal to 3.35 hp at 5,500 rpm)
40 km/h (25 mph) variants	1.8 kW at a speed of 4,700 rpm (equal to 2.45 hp at 4,700 rpm)
Compression	9.5
Engine mounting	2-point in rubber in the S 51 2-point rigid in the KR 51/2
Lubrication system	fuel-oil mixture 50 : 1 (during the running-in period 33 : 1)
Lubricant	two-stroke engine oil 20 to 25 mm^2/s (20 to 25 cSt) at 50 °C
Cooling	relative wind
Engine mass	15 kg = 33 lb (engine without oil)
Cylinder arrangement	30° inclination in travel direction
Cylinder material	aluminium casting with shrunk-in liner of grey cast-iron
Cylinder bore	38 mm (1.5 in.)
Piston stroke	44 m (1.7 in.)
Total swept volume	49.8 cm^3 (3.0 cu. in.)
Material of cylinder head	aluminium die casting (AlSi 9 Cu 1)
Gasket for cylinder/cylinder head	metal/metal
Piston material	chill casting AlSi 20 CuNi
Number of piston rings	2
Type and length of connecting rod	steel, case-hardened, 85 mm
Big-end bearing	set of needles K 18 × 24 × 13 F
Small-end bearing	set of needles K 12 × 16 × 13 F
Type of crankshaft	three-part, pressed together
Crankcase	aluminium die casting, split vertically

Data of power transmission

Clutch	4-plate clutch in oil bath; thrust pressure by Belleville spring
Gearshift mechanism	mechanical sliding-key transmission with engine in block
Number of speeds	optionally 3 or 4
Gear ratios	in case of 3-speed gearbox: 1st speed 4.40 : 1 2nd speed 2.23 : 1 3rd speed 1.55 : 1 in case of 4-speed gearbox: 1st speed 4.40 : 1 2nd speed 2.44 : 1 3rd speed 1.89 : 1 4th speed 1.55 : 1
Primary gear ratio	3.25 : 1; helical gears
Secondary transmission	2.27 : 1; (drive-chain sprocket teeth $z = 15$)
60 km/h and 50 km/ variants (38 mph and 30 mph variants)	
40 km/h variants (25 mph variants)	2.42 : 1; (drive-chain sprocket teeth $z = 14$)
	sprocket in rear wheel driver of all types, teeth $z = 34$)
Power transmission	by simple roller chain 086-1-112 (KR 51/2)
	by simple roller chain 086-1-110 (S 51)
Gearbox oil filling	400 cm^3 (0.7 pt)
Grade of gear oil	gear oil SAE 80 / engine oil SAE 30 to 40 — viscosity 60 mm^2/s (60 cSt) at 50 °C
	continuous operating temperature up to 100 °C

Induction system

Carburetter, model, type	BVF needle jet carburetter 16 N 1-11 (1-12)
Main jet	HD 72 [67] (0.01 mm = 0.0004 in.)
Idling jet	LD 35 (0.01 mm = 0.0004 in.)
Needle jet	ND 215 (0.01 mm = 0.0004 in.)
Starter jet	SD 50 (0.01 mm = 0.0004 in.)
Partial-load needle	TN 10 [08]
Needle position	TNS 4th [3rd] notch from top
Fuel level in float chamber	KH 8^{+1} mm ($0.3^{+0.04}$ in.) at 0.5 m (1.64 ft) fuel column
Venturi pipe	16 mm (0.63 in.)
Slow running air adjusting screw	LLS opened for 2 to 3 revolutions
Maximum permissible emission of noxious substances	< 4 Vol.-% of CO
Air filter arrangement	wet air filter with fibre knitted filling; in the KR 51/2: at the inlet of the induction air stilling device in the S 51: in the right-hand half of the casing central part

(in brackets [ ] ≙ KR 51/2)

Other data

Fuel tank capacity	8.7 l = 15.3 pt (S 51 type series) 6.8 l = 11.9 pt (KR 51/2 type series)
Fuel reserve	0.8 l = 0.07 pt (S 51 type series) without (KR 51/2 type series)
Maximum speed	60, 50 or 40 km/h (38, 30 or 25 mph) (depending on equipment)
Continuous speed	60, 50 or 40 km/h (38, 30 or 25 mph) (depending on equipment)

Diagram of the fuel basic consumption

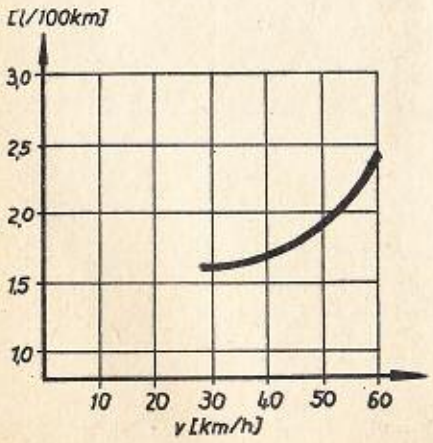


Fig. 4

Consumption per 100 km according to the standard specifications TGL 39-852: 2.5 l/100 km

1.3. Engine Electrical Equipment (General Information)

Dynamo – ignitor	
Flywheel generator primary ignitor 8307.8	incorporated in M 531 KF (Mokick S 51 B 1-3) M 531 KF-51 (Mockik S 51 1-3-GB) M 531 KFR (small scooter KR 51/2 N) M 541 KF (Mokick S 51 B 1-4) M 541 KF-51 (Mokick S 51 B 1-4-GB) M 541/6 KF-51 (Mokick S 51 E-GB) M 541 KFR (small scooter KR 51/2 E)
Flywheel generator primary ignitor 8307.8/1	incorporated in M 531/3 KF-40 (Mokick S 51 N-H) M 541/3 KF-41 (Mokick S 51 B-4-D)
Flywheel generator primary ignitor 8307.8/2	incorporated in M 531/2 KF (Mokick S 51 N) M 541/2 KF (Mokick S 51 E/1)
Flywheel generator electronic ignitor SLEZ 8305.1/1	incorporated in M 541/1 KF (Mokick S 51 B 2-4) M 541/4 KF (Mokick S 51 E and S 51 E-CY) M 541/5 KF (Mokick S 51 C) M 541/1 KFR (small scooter KR 51/2L)
Manufacturer	VEB Fahrzeugelektrik Karl-Marx-Stadt (FEK)
Regulation	self-regulating
Mounting	base plate: by means of two retaining clamps flywheel: on cone of crankshaft 1 : 5 by means of fastening nut M 10 × 1, width over flats 17
Ignition	
Flywheel generator primary ignitor	
principle	primary ignitor
contact breaking	glass-fibre reinforced Miramid lever-type contact breaker (VE 30)
contact gap	0.4 ± 0.05 mm
ignition coil	small ignition coil AB 12 TGL 4481 identification No. 8352.1/2
Flywheel generator electronic ignitor	
principle	magnet high-voltage capacitor ignition

contact breaking	by thyristor which is switched at the instant of igniting by a contact-less inductive control transmitter
ignition coil	small ignition coil AB 6 TGL 4481 identification No. 8351.1/13
Ignition timing	1.8 mm before T.D.C.
Ignition lead plug	water-protected (only for KR 51/2, S 51 E and S 51 E/1)
Sparking-plug	M 14-260
Electrode gap	0.4 mm

1.4. Timing Diagram

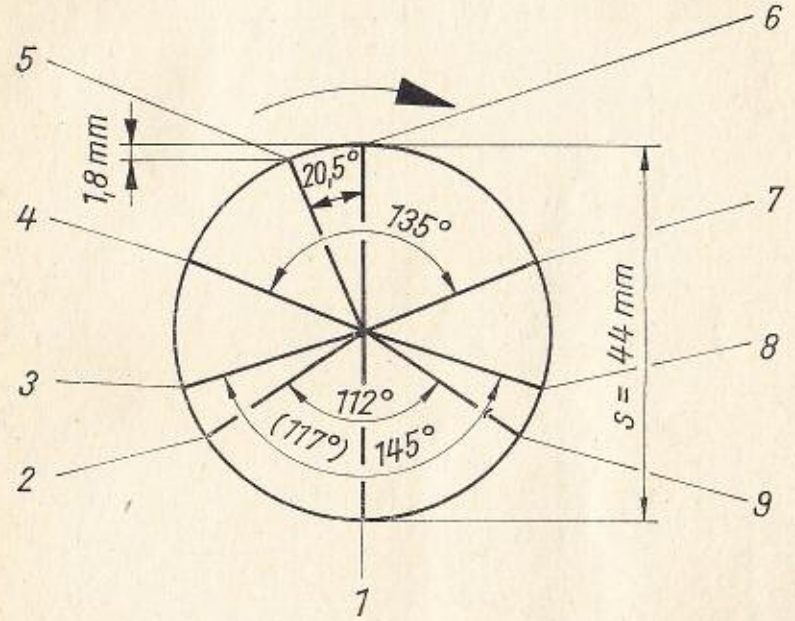


Fig. 5

(1) Bottom dead centre
(2) Overflow port closes
(3) Outlet port closes
(4) Inlet port opens
(5) Firing point
(6) Top dead centre
(7) Inlet port closes
(8) Outlet port opens
(9) Overflow port opens
In parantheses ( )/value for the 40 km/h variants

2. Engine Standard Curves

2.1. Standard Curves for Mokick Engines

2.1.1. 60 km/h Variants

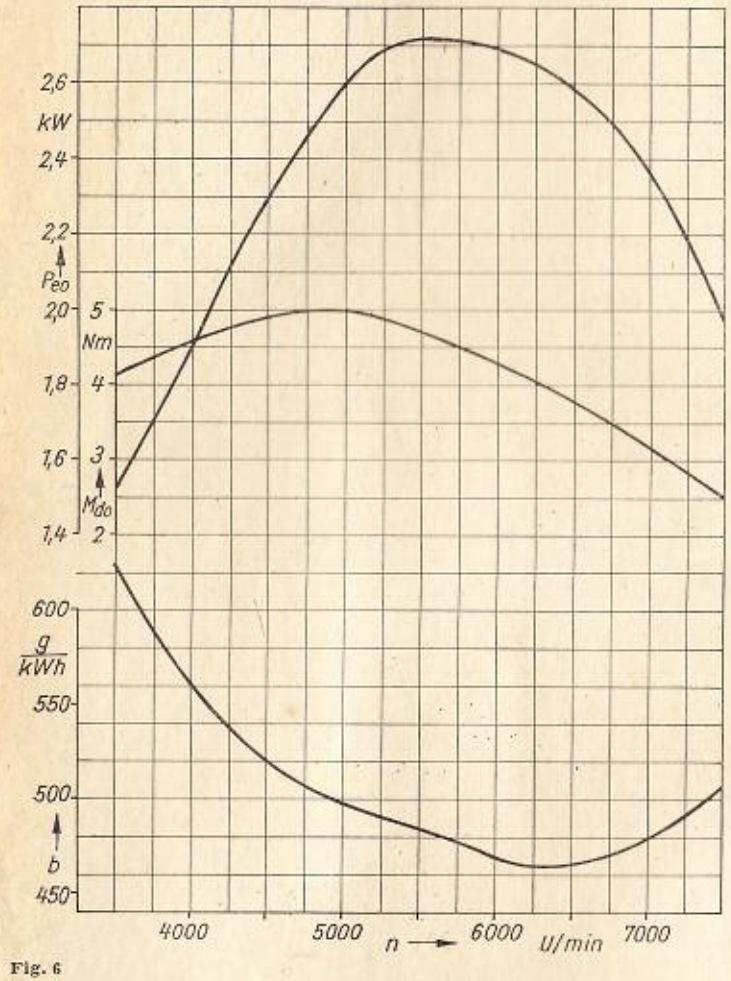


Fig. 6

U/min rpm

2.1.2. 50 km/h Variants

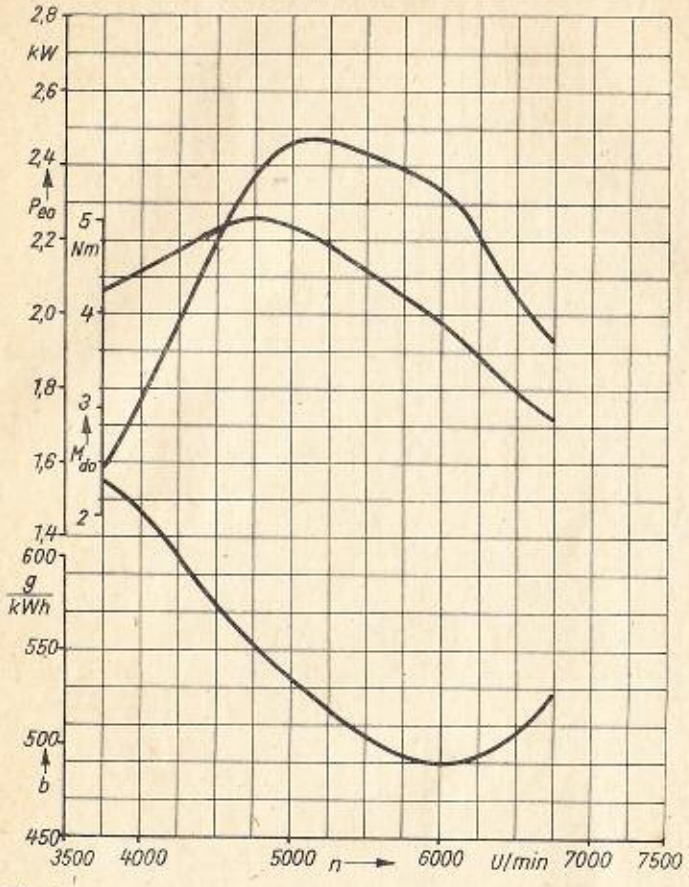


Fig. 7

U/min rpm

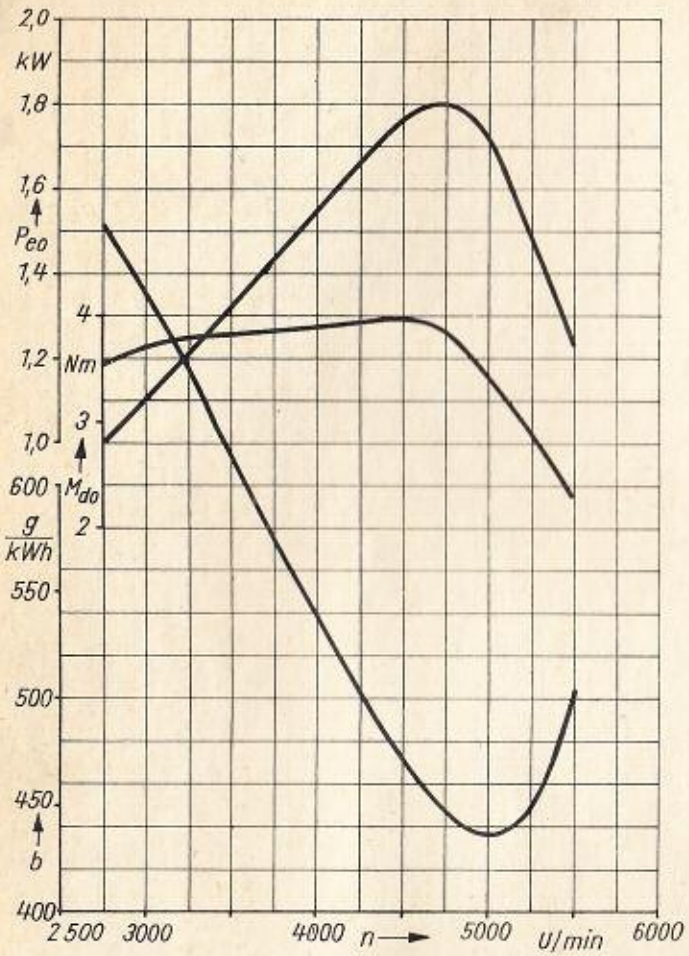


Fig. 8

U/min rpm

2.2. Standard Curves for Scooter Engines

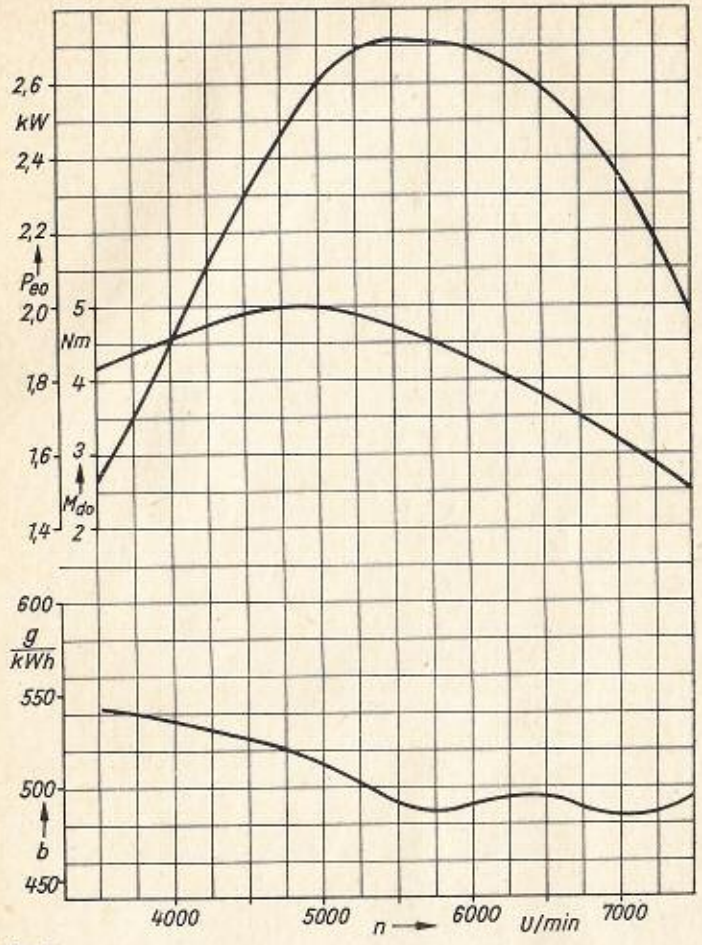


Fig. 9

U/min rpm

3. Normal Performance Diagrams

3.1. 60 km/h Variants

3.1.1. 3rd Speed

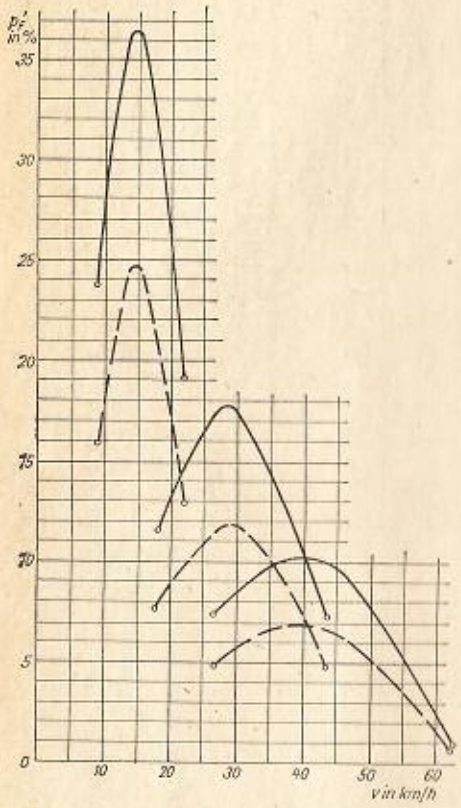


Fig. 10

P_{so} = 2.72 kW (3.7hp)/5,500 rpm
Dyn. tyre diameter d_{dyn} = 0.526 m
Primary gear ratio φ_{prim} = 3.250
Secondary gear ratio φ_{sec} = 2.267 $\left(\frac{34}{15}\right)$

Total gear ratios
φ_1 = 32.413
φ_2 = 16.467
φ_3 = 11.385

Air resistance coefficient $c \cdot A$ = 0.5 m²
——— operating weight empty m_{EO} = 156 kg
(1 person with 75 kg + 5 kg luggage)
– – – – permissible total mass $m_{T\,perm}$ = 260 kg

3.1.2. 4th Speed

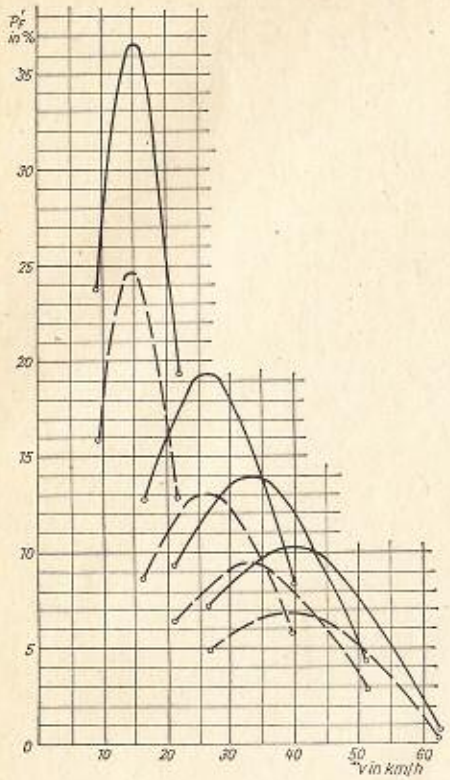


Fig. 11

P_{so} = 2.72 kW (3.7 hp)/5,500 rpm
Dyn. tyre diameter d_{dyn} = 0.526 m
Primary gear ratio φ_{prim} = 3.250
Secondary gear ratio φ_{sec} = 2.267 $\left(\frac{34}{15}\right)$

Total gear ratios
φ_1 = 32.413
φ_2 = 17.956
φ_3 = 13.958
φ_4 = 11.385

Air resistance coefficient $c \cdot A$ = 0.5 m²
——— operating weight empty m_{EO} = 156 kg
(1 person with 75 kg + 5 kg luggage)
– – – – permissible total mass $m_{T\,perm}$ = 260 kg

3.2. 50 km/h Variants

3.2.1. 3rd Speed

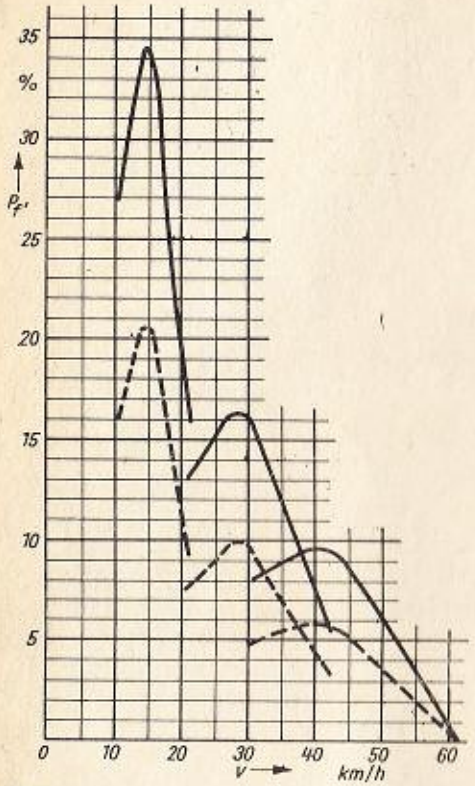


Fig. 12

P_{so} = 2.45 kW (3.34 hp)/5.000 rpm
Dyn. tyre diameter d_{dyn} = 0.526 m
Primary gear ratio φ_{prim} = 3.250
Secondary gear ratio φ_{sec} = 2.267 $\left(\frac{34}{15}\right)$

Total gear ratios
φ_1 = 32.413
φ_2 = 16.467
φ_3 = 11.385

Air resistance coefficient c · A = 0.5 m²
——— operating weight empty m_{SO} = 158 kg
(1 person with 75 kg + 5 kg luggage)
– – – – permissible total mass $m_{T\,perm}$ = 260 kg

3.2.2. 4th Speed

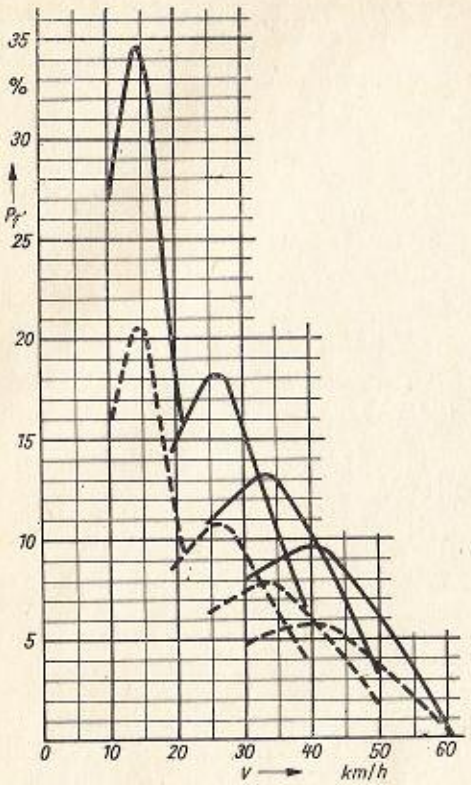


Fig. 13

P_{so} = 2.45 kW (3.34 hp)/5.000 rpm
Dyn. tyre diameter d_{dyn} = 0.526 m
Primary gear ratio φ_{prim} = 3.250
Secondary gear ratio φ_{sec} = 2.267 $\left(\frac{34}{15}\right)$

Total gear ratios
φ_1 = 32.413
φ_2 = 17.956
φ_3 = 13.958
φ_4 = 11.385

Air resistance coefficient c · A = 0.5 m²
——— operating weight empty m_{SO} = 158 kg
(1 person with 75 kg + 5 kg luggage)
– – – – permissible total mass $m_{T\,perm}$ = 260 kg

3.3. 40 km/h Variants

3.3.1. 3rd Speed

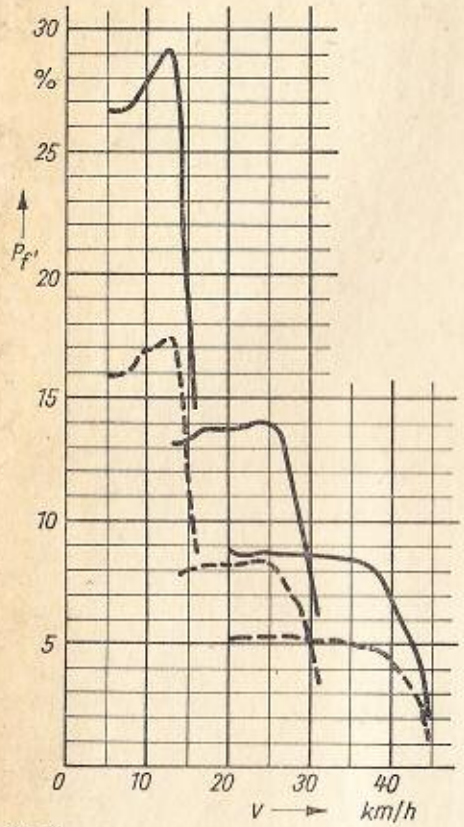


Fig. 14

P_{so} = 1.8 kW (2.45 hp)/4,750 rpm
Dyn. tyre diameter d_{dyn} = 0.526 m
Primary gear ratio φ_{prim} = 3.25
Secondary gear ratio φ_{sec} = 2.429 $\left(\frac{34}{14}\right)$

Total gear ratios
φ_1 = 34.625
φ_2 = 17.589
φ_3 = 12.161

Air resistance coefficient $c \cdot A$ = 0.5 m²
——— operating weight empty m_{EO} = 155 kg
(1 person with 75 kg + 5 kg luggage)
– – – – permissible total mass $m_{T\,perm}$ = 260 kg

3.3.2. 4th Speed

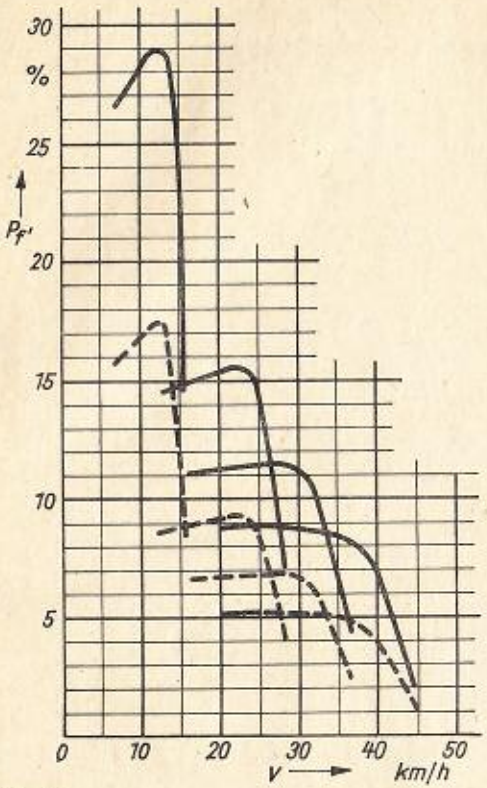


Fig. 15

P_{so} = 1.8 kW (2.45 hp)/4,750 rpm
Dyn. tyre diameter d_{dyn} = 0.526 m
Primary gear ratio φ_{prim} = 3.250
Secondary gear ratio φ_{sec} = 2.429 $\left(\frac{34}{14}\right)$

Total gear ratios
φ_1 = 34.729
φ_2 = 19.239
φ_3 = 14.955
φ_4 = 12.198

Air resistance coefficient $c \cdot A$ = 0.5 m²
——— operating weight empty m_{EO} = 158 kg
(1 person with 75 kg + 5 kg luggage)
– – – – permissible total mass $m_{T\,perm}$ = 260 kg

4. Tables of Dimensions and Mounting Dimensions

4.1. Table of Specified Piston and Cylinder Matings

Denotation	Size of Cylinder				Size of Piston	Mounting Clearance
	Bore			Nominal Diam.	Tolerance	
		from	to			
Series:	38.00	38.00	38.01	37.97		
	38.01	38.01	38.02	37.98		
	38.02	38.02	38.03	37.99		
	38.03	38.03	38.04	38.00		
Grinding out:	38.25	38.25	38.26	38.22		
	38.50	38.50	38.51	38.47		
	38.75	38.75	38.76	38.72	from 0 to −0.011	$0.03^{+0.010}_{0.005}$
	39.00	39.00	39.01	38.97		
	39.25	39.25	39.26	39.22		
	39.50	39.50	39.51	39.47		

Dimensions in the Table in mm
The cylinders are marked on their undersides within the range of the suction port with the bore diameter (1 corresponds to ∅ 38.01).
On the piston head, the pistons are provided with the dimension (stamp).

4.2. Mounting Plan for Set of Needles K 12 × 16 × 13 F in Upper Small-end Boss

Small-end bore ∅ 16		Set of Needles K 12 × 16 × 13 F		
Identification colour	Dimension	TGL	DIN	
green	∅ 16 up to +0.002	−2	−1	−3
	over −0.001	(−3)	(−2	−4)
white	∅ 16 up to −0.001	−4	−3	−5
	over −0.005	(−5)	(−4	−6)
black	∅ 16 up to −0.005	−6	−5	−7
	over −0.009	(−7)	(−6	−8)
blue	∅ 16 up to −0.009	−8	−7	−9
	over −0.013	(−9)	(−8	−10)

When ordering, prefer the sizes not in parantheses!

4.3. Table of Used Grooved Ball Bearings and Variants

For crankshaft:

Grooved ball bearing 6204 TN (C 4) TGL 2981

Identification colour	Bore	
yellow	∅ 20	+0.003 to −0.003 mm
green	∅ 20 below	−0.003 to −0.008 mm
white	∅ 20 below	−0.008 to −0.013 mm

Description	Use	Remarks
Grooved ball bearing 6201 C 3 TGL 2981	4 × for wheel hubs	
Grooved ball bearing 6203 C 3 TGL 2981	1 × for rear wheel drive	
Grooved ball bearing 6000 F C 3 TGL 2981	1 × for clutch shaft, right-hand side	
Grooved ball bearing 6204 TN C 4 TGL 2981	2 × for crankshaft	
Grooved ball bearing 16004 F C 3 TGL 2981	1 × for output shaft, left-hand side	
Grooved ball bearing 6004 F C 3 TGL 2981	1 × for output shaft, right-hand side	
Grooved ball bearing 6203 F C 3 TGL 2981	1 × for clutch shaft, left-hand side	
Set of needles K 12 × 16 × 13 F TGL 11553	1 × for upper small-end boss	steel cage, internally centred
Set of needles K 18 × 24 × 13 F TGL 11553	1 × for lower conrod boss	steel cage
Set of balls P 37.5 TGL 20908	2 × for steering bearing	

4.4. Important Mounting Dimensions, Running Clearances, and Tightening Torques

(shown in the diagrammatic representation of the engine M 541)

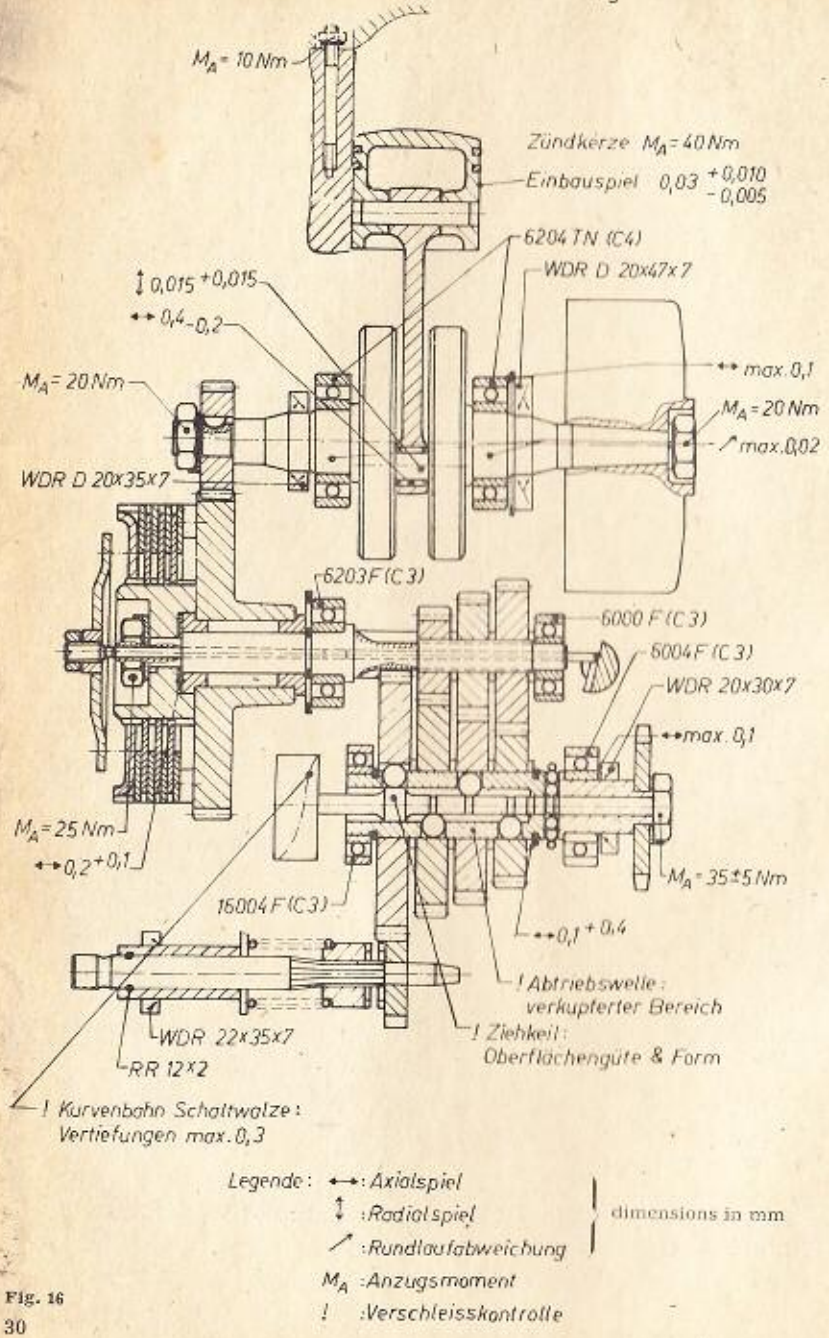


Fig. 16

4.5. Table of Cable Controls Used with Functional Dimensions and Test Loads

Cable control for carburetter, parts No. 11 20 552 500 [11 20 572 504]

Overall length	775 mm [854 mm]
Lenght of sheath	
2.5 mm in dia. TGL 39-285/3	706 mm [786 mm]
Cable diameter	1.6 mm
Free end of cable	58 ± 1 mm (control dimension)
Test load for nipple fastening	45 kg
Adhesion strength	at least 70 kg
Cable control complies with	
E TGL 39-285	

Cable control for clutch, parts No. 11 19 551 501 [11 20 573 505]

Overall length	983 mm [1,023 mm]
Length of sheath	
3 mm dia. TGL 39-285/3	859 mm [899 mm]
Cable diameter	2 mm
Free end of cable	108 ± 1 mm (control dimension)
Test load for nipple fastening	130 kg
Adhesion strength	at least 220 kg
Cable control complies with	
A TGL 39-285	

Legend for fig. 16

Zündkerze	sparking-plug
Einbauspiel	mounting clearance
Abtriebswelle:	output shaft:
verkupferter Bereich	coppered area
Ziehkeil:	sliding key:
Oberflächengüte und Form	surface quality and shape
Kurvenbahn Schaltwalze	cam track of gearshift cylinder
Vertiefung max. 0.3	maximum depression 0.3
Axialspiel	end play
Radialspiel	radial play
Rundlaufabweichung	out-of-true
Anzugsmoment	tightening torque
Verschleißkontrolle	wear control

Cable control for hand brake, parts No. 11 20 554 502 [11 20 575 507]

Overall length	1,099 mm [1,139 mm]
Leength of sheath	
3 mm in dia. TGL 39-285/3	950 mm [990 mm]
Cable diameter	2 mm
Free end of cable	133 ± 1 mm (control dimension)
Test load for nipple fastening	130 kg
Adhesion strength	at least 220 kg
Cable control complies with	
A TGL 39-285	

Cable control for starter actuation, parts No. 11 20 945 508 [11 20 574 506]

Overall length	942 mm [1,020 mm; 860 mm[1]]
Lenght of sheath	
2.5 mm in dia. TGL 39-285/3	838 mm [962 mm; 802 mm[1]]
cable diameter	1.6 mm
Free end of cable	44 ± 1 mm (control dimension)
Test load for nipple fastening	45 kg
Adhesion strength	at least 70 kg
Cable control complies with	
E TGL 39-285	

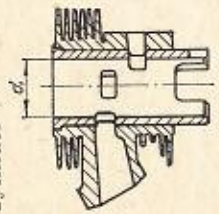
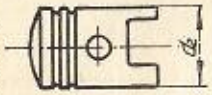
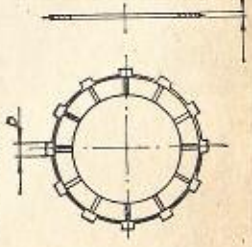
Note:

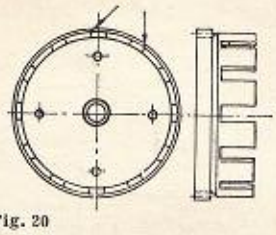
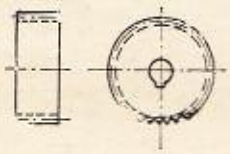
When measuring the control dimension, the sheath must contact the nipple. The cable is riveted and soldered at the nipples.

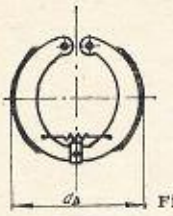
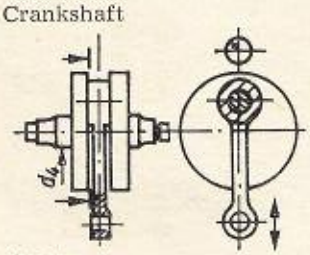
*) Lenghts when installing outside of the front tube

[ ] These values apply to the cable controls at the raised handle bars

4.6. Information about the Evaluation of the State of Wear

Measuring points	Measuring means	Permissible dimensions	Evaluation of general condition	Possibility of regeneration
Cylinder  Fig. 17	Into measuring instrument	At the points of reversal of the piston, the nominal diameter of the cylinder d_1 may be surpassed by max. 0.1 mm	Visual inspection of the liner for the formation of ridges or damage; visual inspection of the cylinder body for damage at the sealing areas and at the exhaust port	see Grinding Table
Piston  Fig. 18	micrometer	Checking the nominal dimension d_2 about 10 mm above the lower piston edge (see Piston Table); permissible max. d_2 —0.1 mm	Evaluation of the piston appearance. Intense weakening of the piston skirt is indicative of a large running clearance. Observe condition of the piston rings	none
Clutch disk  Fig. 19	vernier caliper	b = 9 mm s = 3.3 mm	Checking with respect to thermal overload on the lining; evenness of the clutch disk	none

Measuring points	Measuring means	Permissible dimensions	Evaluation of general condition	Possibility of regeneration
Clutch gear  Fig. 20	—	—	To be checked: wear marks in the grooves of the clutch basket which must not exceed ≈ 0.5 mm	none
Pinion  Fig. 21	micrometer	Thickness of the squeezed lead wire is equal to backlash. It may be max. 0.2 mm	To be checked: backlash, pinion/clutch gear by means of a lead wire; the condition of the tooth flanks with respect to wear marks and formation of burr	none
Driving chain  Fig. 22	rule	span 700 mm, sag h_1 = 180 mm	Checking the chain with respect to breaks of links and breaks of rollers	none

Measuring points	Measuring means	Evaluation of general condition	Permissible dimensions	Possibility of regeneration
Brake shoe  Fig. 23	vernier caliper	d_3 = 123.6 mm	To be checked: the faces of the brake shoes and the surface condition of the brake linings	Insertion of intermediate layers at the face. Have the shoe provided with new linings by the regenerating enterprise
Crankshaft  Fig. 24	measuring bridge with dial gauges	Bearing seats 20 j 6 Seat WDR 20 d 10 Radial play of lower big-end bearing maximum 0.03 mm	To be checked with respect of thermal overload on big-end bearing (temper colours); deformation of conrod, of the bearing areas of the sealing rings, of the thread and the keyways	is given in a regenerating enterprise (Crankshaft Service)

Sliding key shaft	Inspection of the central elevation of the shaft (for the detent balls of the gears); surface quality and shape must be in proper condition showing no visible signs of wear
Gear-shift cylinder	The cam track for the pin of the slewing lever must not exhibit any distinct wear marks (depressions maximum 0.3 mm) or other surface flaws
Output shaft	The coppered area of the shaft must be checked (running area of loose wheels) for proper condition of the surface of the galvanised layer and for spots of material removal (points of seizure). The running area of the loose wheels for the 1st speed is exposed to a particularly high degree.

5. Dismantling and Assembling Operations

5.1. Demounting and Mounting the Engine

Do not turn the rear wheel when the drive-chain sprocket is removed. The chain ascending on the sprocket might break the plastic chain box.

(1) Withdraw the ignition line plug

(2) Loosen the exhaust system

(3) Disconnect the carburetter cable controls or remove the carburetter completely

(4) Remove the dynamo cover (for this purpose, disconnect the clutch cable control and the speedometer shaft; the cover is seated on a locating pin)

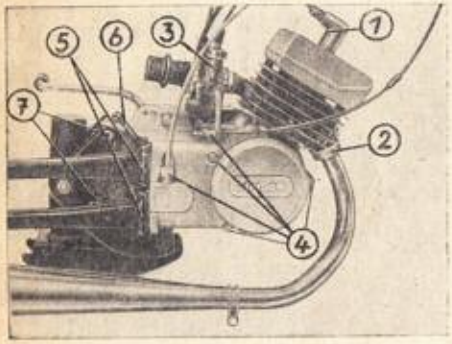


Fig. 25

(5) Remove the driving chain (pull the spring clip from the helical pinion of the speedometer drive and remove the pinion; bend up the locking plate at the fastening nut of the drive-chain sprocket, unscrew the nut and remove the sprocket together with the chain from the seat; when loosening the fastening nut, the foot-operated brake is used for retaining)

(6) Loosen the engine cable or remove the flywheel generator ignitor

(7) Remove the engine fastening screws and take the engine out of the engine bearing

Mounting is to be performed in the inverse order of the demounting operations, taking the following items into consideration:

proper and safe tight-fit of all screwed connections:

the locking plates at the driving-chain sprocket and at the nut for the exhaust pipe are effectively mounted,

the specified torque for the fastening nut of the driving sprocket of 35.5 Nm (equal to about 3.5 kpm) must be observed, the clamps for the base plate mounting have the correct mounting position and must be properly tightened.

observance of the specified adjusting values and mounting dimensions:

firing point 1.8 mm before T.D.C.,
play of the cable control sheaths 2 to 3 mm.

The concentric seat of the ignitor base plate and the observance of the specified air gap between pole shoes of the coils and the magnetic wheel interior of 0.3 to 0.5 mm are of particular importance otherwise ignition troubles will occur. When the magnet wheel is sliding, total damage to the flywheel generator primary ignitor may be inevitable.

5.2. Dismantling the Engine

For any repair work at the engine removed from the vehicle, use the assembly stand with clamping device V 001. If, exceptionally, such a stand is not available, provide a suitable support (wooden frame, supporting blocks or the like) in order to avoid damage to the sealing areas or shafts.

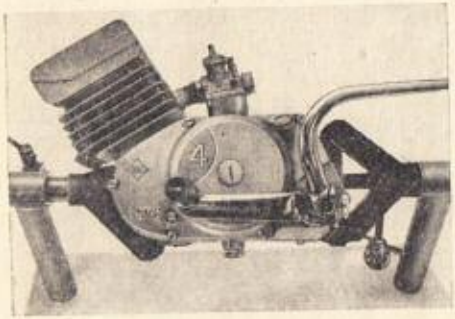
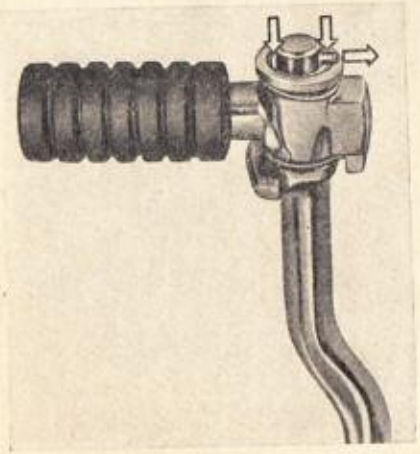


Fig. 26

5.2.1. Dismantling the Straight, Folding Kick-starter



Clamp the kick-starter in a vice. Press down the supporting disk and, at the same time, push out the locating pin.

Fig. 27

5.2.2. Dismantling the Electrical Equipment of the Engine

For working at the electrical equipment of the engine, the special repair advice given in the "Repair Instructions for Simson light motor-cycles" must be observed. The electrical circuit diagram belonging to the vehicle must be used for checking the correct wiring.

When the engine electrical equipment is in perfect working order, the functional position of the ignitor base plate is marked by scribing or by opposite punch marks on base plate and engine casing in order to facilitate work and save time. In this case, the cable connections are not separated; thus, the base plate remains at the vehicle and it is advisable to tie it up at the engine in a protected place.

Fut the retaining band for the "DV 37" flywheel in such a way that the loop contacts the circumference of the magnet wheel when it is turned anti-clockwise.

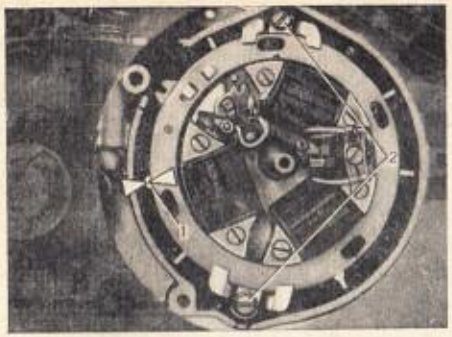
Unscrew the fastening nut M 10 × 1 of the magnet wheel by means of a socket wrench or a box spanner, offset and width over flats 17, and remove the spring washer A 10 from underneath.

Fig. 28

Screw the puller "DV 38" into the hub of the magnet wheel; retain the lower part at the spanner areas by means of a spanner having awidth over flats of 19 mm.

Tighten the pressure spindle by means of a spanner, width over flats 19 mm; the magnet wheel will get loose all of a sudden from its conical seat; when removing it, take care of the disk spring 2 × 3.7 in the keyway of the right-hand crankshaft end.

Fig. 29

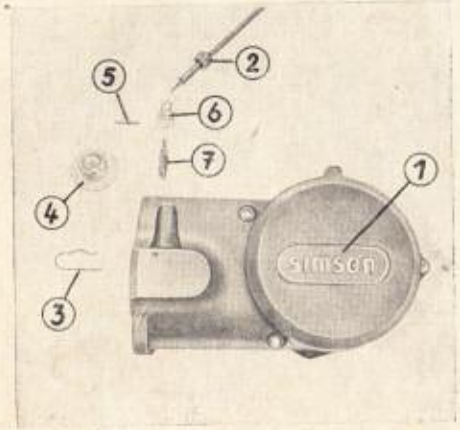


(1) Mark the position of the base plate
(2) Loosen the retaining clamps and remove the base plate

Fig. 30

5.2.3. Dismantling and Assembling the Speedometer Drive

(1) The dynamo cover is removed and
(2) the speedometer drive shaft unscrewed
(3) Press the clip out of the annular groove in the drive shaft and
(4) pull the plastic pinion form the shaft end
(5) Push the notched fitting pin 3 × 20 from the interior out of the dynamo cover
(6) Remove the bearing piece and
(7) helical gear



Mounting is performed in the inverse order; the helical gear must be fitted with grease in its place and then it must be checked that it is free to move easily; the speedometer shaft must be oiled and placed in a wide arc (too small radii of curvature lead to breakage!)

Fig. 31

5.2.4. Removal of the Clutch and of the Driving Pinion

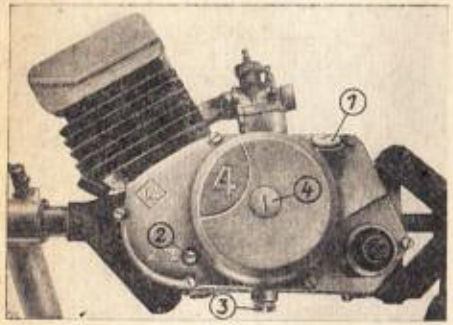
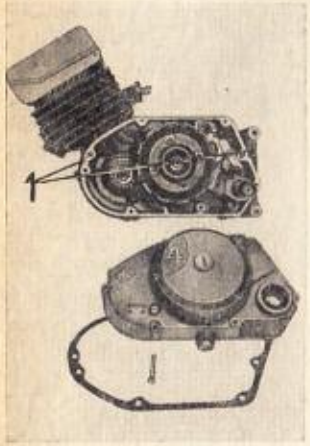


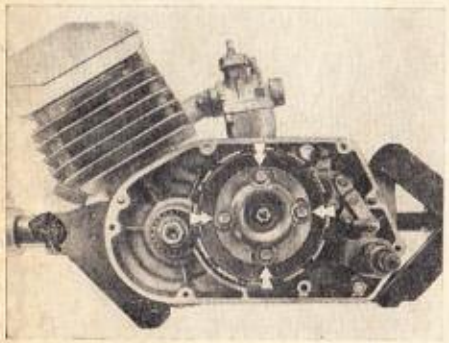
Fig. 32

(1) Oil filler screw
(2) Oil control screw
(3) Oil drain screw plug
(4) Screw plug for adjustment opening in clutch cover



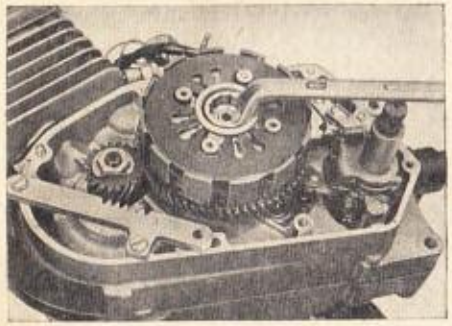
– Drain the gear oil.
Remove six fillister-head screws from the clutch cover and press off the cover from the engine; for this purpose, insert a screw-driver into the lifting pockets (1) of the casing and use it as a lever acting against the cover; the cover fits tightly on locating pins.

Fig. 33



– Unbend the locking plates on the four fastening screws of the thrust piece, unscrew the screw by means of a spanner, width over flats 8 mm, and remove the thrust piece.

Fig. 34

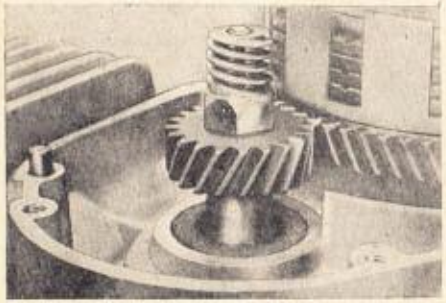


– Mount the holding device for driving pinion "V 011" and screw it tight.
– The drive of the mechanical revolution counter is effected via a helical pinion screwed on the left-hand crank pin of the crankshaft.
– This helical pinion is secured by means of a threaded pin with its point against the crank pin.

Note:

The driving pinion used is distinguished from the conventional driving pinion by a centring turned in for the helical pinion.

Fig. 35



The helical gear of the revolution counter drive is arranged in the clutch cover and operates analogously to the speedometer drive. Helical pinion and helical gear of the revolution counter drive are **not** identical with those of the speedometer drive.

Fig. 36

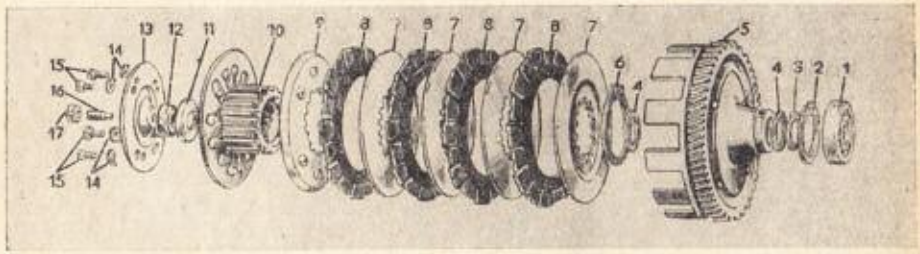


Fig. 37
(1) Grooved ball bearing 6203 F (C3)
(2) Lock ring 40
(3) Lock ring 17
(4) Thrust washers
(5) Clutch gear with 2 collar bushes
(6) Lock ring 45
(7) Clutch segments
(8) Clutch disks
(9) Clutch plate
(10) Driver with Belleville spring
(11) Safety cap
(12) Hexagon nut M 12 × 1.5
(13) Thrust piece
(14) Locking plates
(15) Hexagon head screws M 5 × 12
(16) Pressure screw
(17) Hexagon nut M 6

– Bend up the safety cap for the retaining nut of the dog and remove the nut by means of a socket wrench, width over flats 19 mm; remove the clutch parcel (take care of the thrust washer underneath).
– Pull off the clutch gear (again take care of the thrust washer under the gear).
– Release the locking plate and remove the fastening nut of the driving pinion by means of a spanner, width over flats 17 mm; pull off the driving pinion (take care of the disk spring 3 × 3.7 in the keyway of the left-hand tail of the crankshaft).
– Remove the two clutch pressure pins and the appertaining intermediate cylinder from the longitudinal bore of the clutch shaft.
– Unhook the torsion spring from the clutch lever and draw the complete assembly upwards out of the engine casing.

Note

The two collar bushes in the hub of the clutch gear are exchangeable.

Dismantling and assembling the clutch parcel

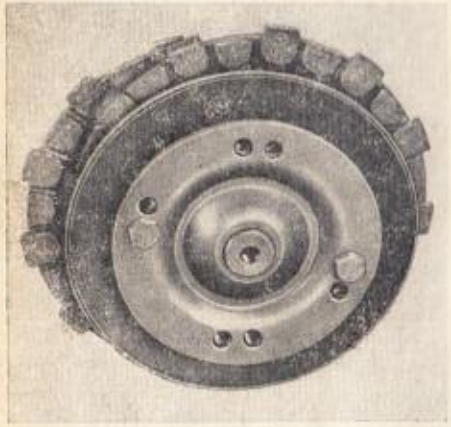


Fig. 38

Screw the pressure member, **with the bulge downward** (this is opposite to the mounting position) on the clutch plate and thus relieve the clutch parcel from the pressure of the Belleville spring.
Remove the snap ring 45 from the dog.
Dismantle the clutch parcel; unscrew the pressure member.

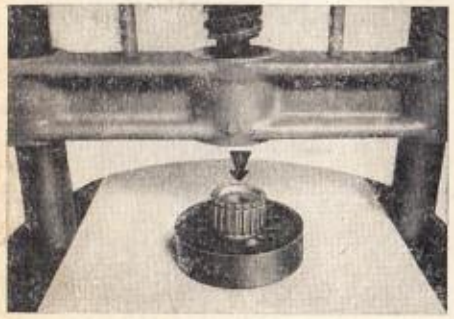


Fig. 39

If the Belleville spring must be separated from the dog, then it must be broken. The new Belleville spring is, with the crown downward, pressed into the annular groove of the dog provided for this purpose by means of a pressing ring.

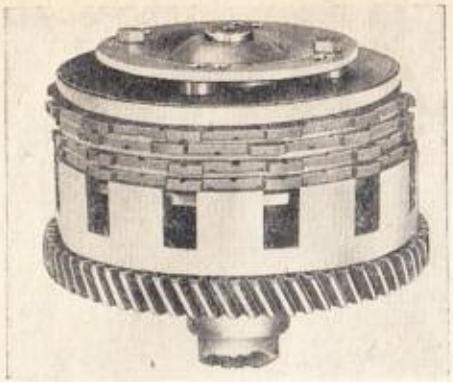


Fig. 40

The assembling is carried out in the inverse order of the dismantling operations, again using the pressure member as a tool. The relieveing of the Belleville spring for providing the correct functional position of the friction disks is only effected after the placing of the clutch parcel into the basket of the clutch gear while the latter is already put on the clutch shaft.

5.2.5. **Removal of the Foot-operated Gearchange Mechanism and of the Kick-starter**

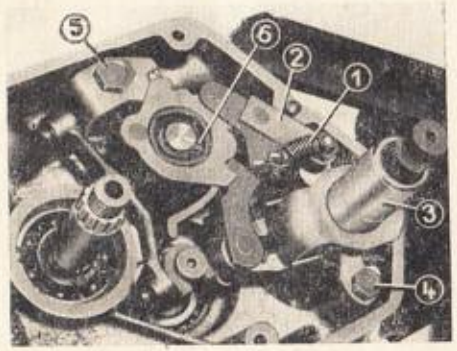


Fig. 41

Unhook the tension spring (1) of the catch lever and unscrew the hexagon nut under it from the threaded pin of the casing.
Remove (2) lever, cover strap and spacer sleeve.
Remove the hollow shaft (3) with attached gearchange lever and kick-starter shaft.
Remove the gear-shift spring.

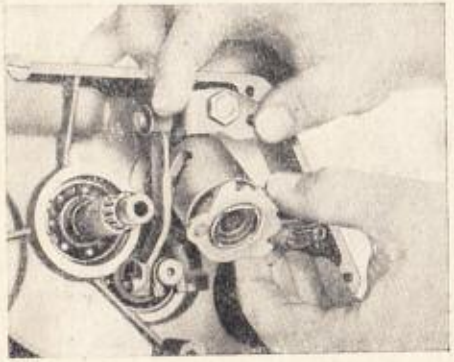


Fig. 42

Loosen (4) the fastening screw of the tensioning plate.
Retain the tensioning plate in place (it is loaded by the kick-starter spring) and remove the screw; remove the tensioning plate with kick-starter spring, kick-starter dog and kick-starter shaft from the casing.
Unscrew the hexagon nut M 8 from the threaded pin of the bearing angle (5).
Remove the locking ring (6) from the bearing bolt of the gear-shift cylinder.
Remove the bearing angle with attached slewing lever and the gear-shift cylinder (take care of the thrust washer of the gear-shift cylinder).
Note: The bearing bolt is exchangeable.

If necessary, push the sliding-key shaft (1) out of the output shaft by means of the "fitting mandrel for gear-shift mechanism V 009" (2); leave the fitting mandrel in this place otherwise the detent balls of the speed wheels or the balls and rollers of the sliding key retention fall out of their guides so that complete dismantling of the engine becomes necessary.

Fig. 43

5.2.6. Replacement of the Shaft Seal Rings and Annular Rings

The following shaft seal rings and rubber annular rings are used:

Shaft seal rings

D 20 × 35 × 7 TGL 16454 Ws 1.018 (oil and petrol resistant) for crankshaft, left-hand side
D 20 × 47 × 7 TGL 16454 Ws 1.018 (oil and petrol resistant) for crankshaft, right-hand side
D 20 × 30 × 7 TGL 16454 Ws 1.018
for output shaft, right-hand side
D 22 × 35 × 7 TGL 16454 Ws 1.018
for hollow shaft

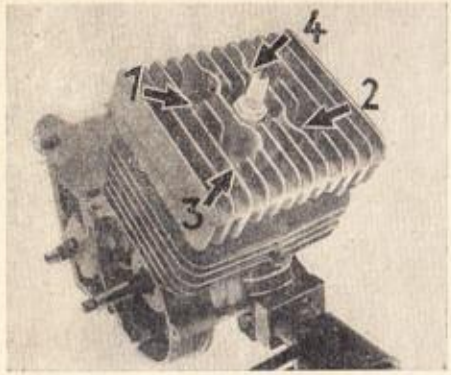
Annular rings

10 × 2 TGL 6365
for shaft of clutch lever
12 × 2 TGL 6365
for kick-starter shaft

When removing defective shaft seal rings, take care that the seat of the ring, the sliding surface on the shaft in question or the ball bearings, if any, under the ring are not damaged. As a rule, use the fitting sleeves provided for this purpose when fitting new shaft seal rings. As a makeshift, the sharp edges of the shaft steps can be covered with adhesive tape of a smooth type in order to protect the sealing lip of the ring.
Shaft seal rings must not be deformed, brittle or soaked. Only use rings of the specified material, condition and dimension. For fitting, shaft seal rings must be provided with grease (water pump grease, if possible) at the sealing lip.

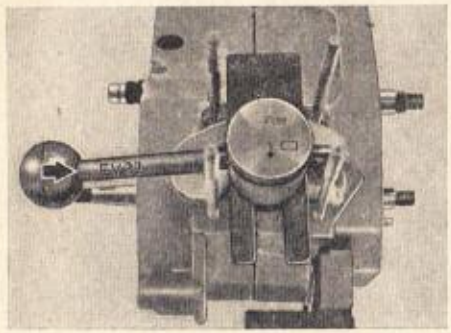
Annular rings must be treated in a similar way.

5.2.7. Dismantling Cylinder Head, Cylinder and Piston



Carburetter and exhaust pipe have already been removed.
Remove four hexagon nuts from the cylinder head; pull off cylinder head and cylinder.

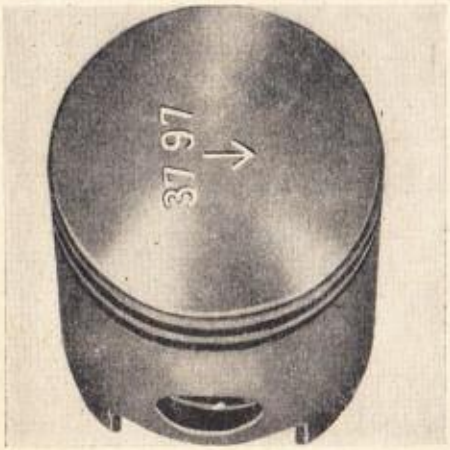
Fig. 44



Cover the crank chamber by means of a clean rag to protect it from foreign particles (this is of particular importance when the engine is not to be dismantled further).
Remove the hooked circlips from the piston bosses and push the gudgeon pin out of its seat by means of the special tool "EV 32" (take care of the two check plates and the upper needle bearing of the connecting rod).

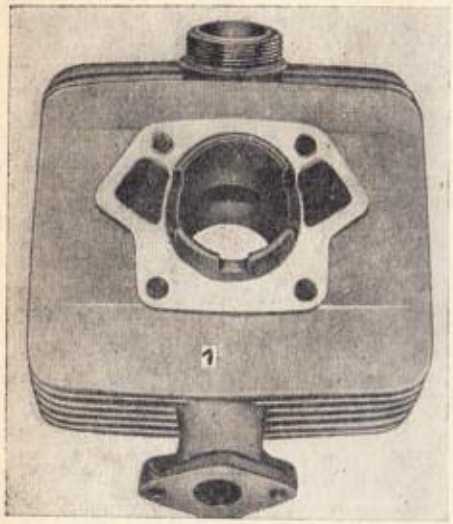
Fig. 45

5.2.8. Marking of Piston and Cylinder



The number stamped in is the piston diameter. The arrow-head indicates the mounting direction of the piston, that is to say, when mounting the piston, the arrow points in the direction of the exhaust port.

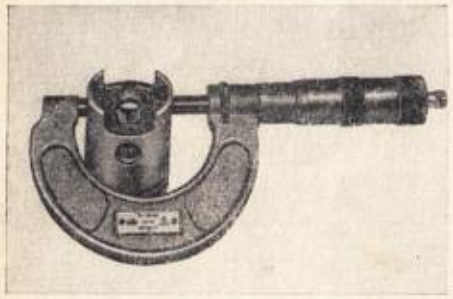
Fig. 46



Cylinder diameter (only the last figure is stamped in, e.g. a cylinder of the nominal size of 38.01 mm bears the figure 1).
The mounting clearance piston/cylinder must be 0.03 mm, this means that, for example, for the above cylinder a piston with a diameter of 37.98 mm has to be used.

Fig. 47

5.2.9. Measuring Piston and Cylinder



The measurement of the effective diameter is taken at a distance of 10 mm from the lower edge of the piston skirt. When the actual dimension falls 0.1 mm below the nominal diameter, then the piston must be replaced by a new one.

Fig. 48

The measurement is taken by means of an internal measuring instrument (Into instrument); the Operating Instructions of the instrument must be strictly observed.
The measurements are taken at three planes, namely,

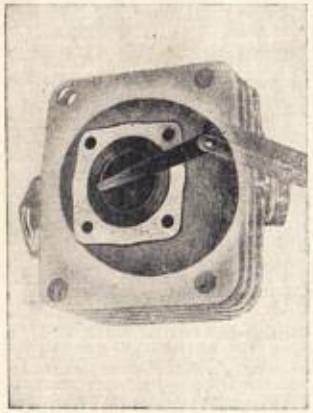
$a = 25$ mm
$b = 50$ mm
$c = 75$ mm

from the top edge of the cylinder liner and in two directions, namely,

1. in the longitudinal axis of the cylinder
2. at an angle of 90° to the longitudinal axis of the cylinder.

When the measured diameter deviate by 0.1 mm from the nominal size, the cylinder must be re-honed to the next specified grinding-out size.

Fig. 49

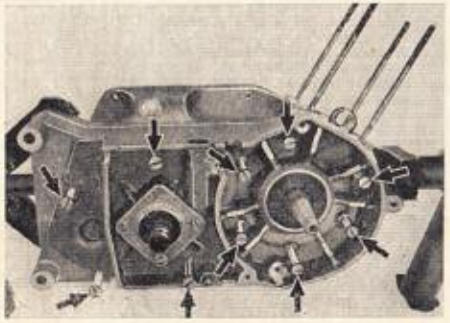


Piston-ring gap

New condition	Wear limit
0.1 mm to 0.2 mm	0.7 mm

Fig. 50

5.2.10. Separating the Engine Casing

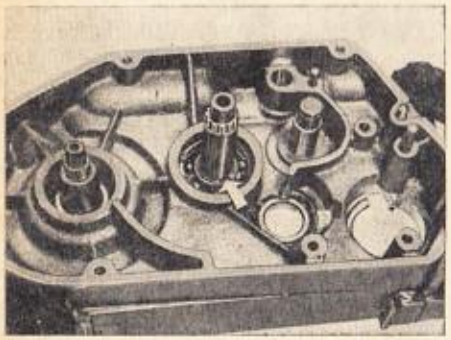


Unscrew ten casing clamping screws.

Fig. 51

Put the separating device for engine casing "V 002" on the assembly, uniformly and alternatingly tighten the pressure spindles.
Remove the lock rings from the output shaft and the cord spring and then remove the gearbox gears. (In this connection, take care of the intermediate disks and the gear detents; the set of gears on the output shaft may remain in the mounted position, and in this case, the sliding-key shaft and the fitting mandrel "V 009" also remain in the output shaft.)

Fig. 52

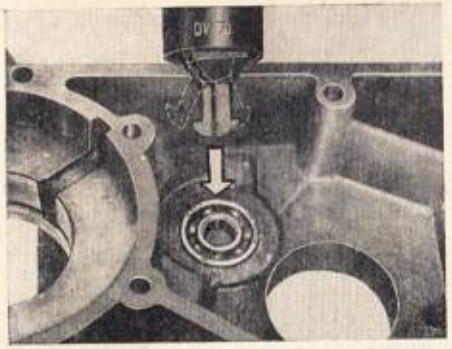


Remove the gearbox shafts; for this purpose, remove the lock ring 17 of the clutch shaft.

Fig. 53

Put the pushing device for crankshaft "V 006" in place and press the crankshaft out of the left-hand casing half (tighten the pressing spindles by means of a spanner, width over flats 19 mm).

Fig. 54



Remove the lock ring 40 for the 6203 bearing of the clutch shaft from the left-hand casing half and the lock ring 47 of the 6204 crankshaft bearing and the shaft seal ring from the right-hand casing half.
Heat the engine casing halves to a temperature of about 100 °C; remove the bearings from their seats; if necessary, use the device "DV 70" for dismantling the ball bearings 6000 F (C 3) (for clutch shaft, right-hand side).

Fig. 55

5.3. Assembling the Engine

Before assembling, all parts which are to be re-used must be subjected to inspection and thorough cleaning.
The following items have to be checked in particular:

Degree of wear

especiall of the parts which are marked as parts subject to wear in the spare parts catalogue,
of the bearing seats of the drive parts subjected to high stresses;

Condition of the sealing surfaces:

evenness and true running,
surface quality;

Castings must be free from cracks and shrink holes;
Tight fit of locating pins and bearings bolts;
Proper range and quality of the antifriction bearings to be used;

Proper condition

of the safety and locking elements,
of the threads,
of the springs,
of the insulations.

According to the machining in pairs, the casing halves have to be used in mating pairs. Standardised parts must comply with the specifications as to quality and condition given in the spare parts catalogue.

5.3.1. Mounting the Crankshaft and the Change-speed Gearbox

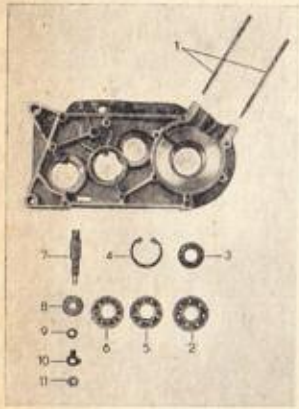


Fig. 56

(1) Stud bolts for cylinder mounting
(2) Grooved ball bearing 6204 TN (C3) – silent
(3) Shaft seal ring D 20 × 35 × 7 (oil and petrol resistant)
(4) Lock ring 40
(5) Grooved ball bearing 6203 F (C3)
(6) Grooved ball bearing 16004 F (C3)
(7) Bolt
(8) Bearing plate
(9) Washer 8.4
(10) Locking plate B 8.4
(11) Hexagon nut M 8

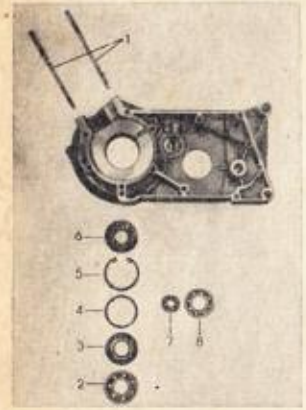


Fig. 57

(1) Stud bolts for cylinder mounting
(2) Grooved ball bearing 6204 TN (C3) – silent
(3) Oil guide plate
(4) Shim Ø 47
(5) Lock ring 47
(6) Shaft seal ring D 20 × 47 × 7 (oil and petrol resistant)
(7) Grooved ball bearing 6000 F (C3)
(8) Grooved ball bearing 6004 F (C3)

Fit the lock ring 40 into the annular groove of the seat for the left-hand ball bearing (6203) of the clutch shaft and heat the left-hand engine casing half to a temperature of 100 °C; fit the ball bearing into the casing half up to the stop.

Insert the heated mushroom for the crankshaft bearing "V 017" into the inner ring of the left-hand ball bearing (6204) of the crankshaft and allow to act for 2 to 3 min.

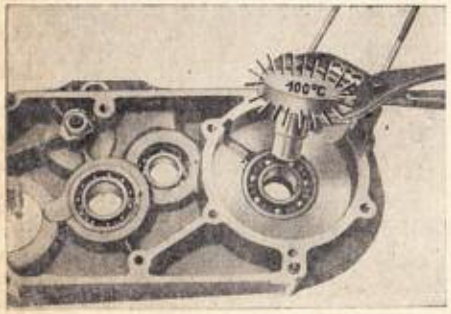


Fig. 58

Check the crankshaft for proper state, especially
for true running (permissible diviation: 0.02 mm),
for the condition of the bearing seats and sliding surface of the two radial seal rings,
for end play of the big-end bearing cage (permissible error: $0{,}4_{-0.2}$ mm),
for correct allocation of bearings (according to Table of sorted groups),
for static balancing (for balancing, a weight of $G = 26$ g is suspended at the complete crankshaft).

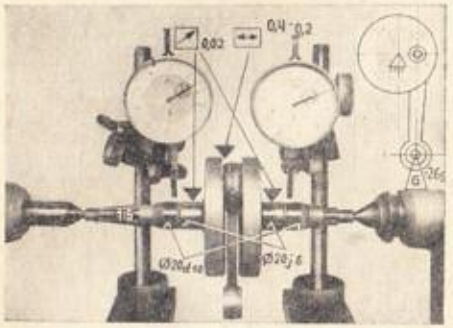


Fig. 59

When the crankshaft is out of true, it must be aligned according to the following diagrammatic representations:

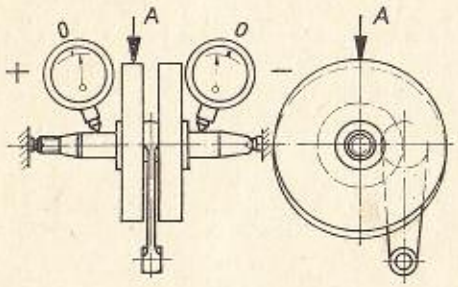


Fig. 60

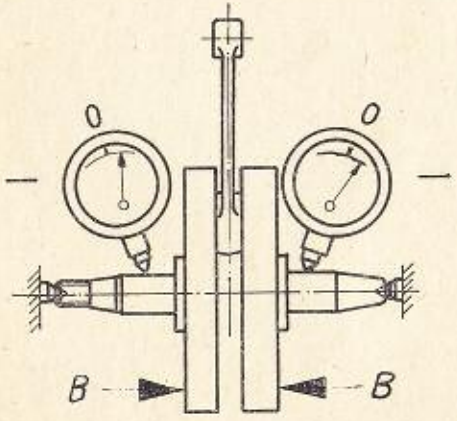


Fig. 61

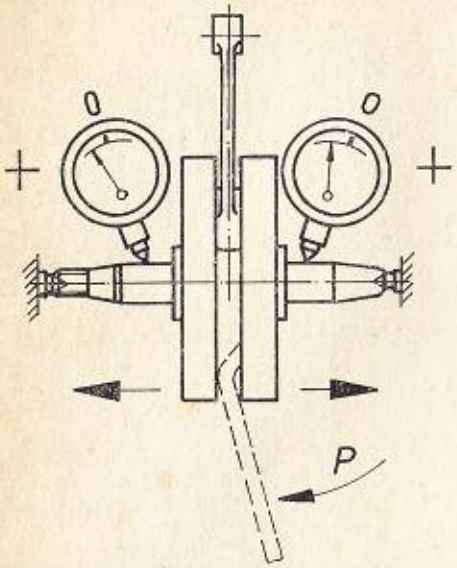


Fig. 62

Fig. 63

– Insert the left-hand tail of the crankshaft (is cylindrically stepped) into the heated internal ring of the bearing and screw the fitting device "V 003" on the threaded pin of the crankshaft; by turning clockwise the nut up to the stop, draw the shaft into the left-hand crankshaft bearing.

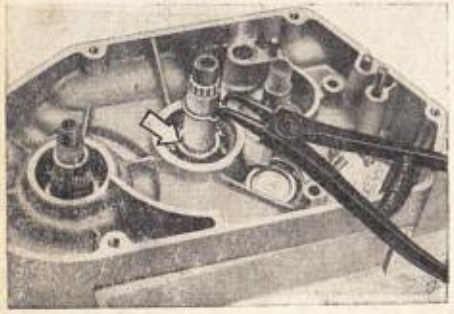


Fig. 64

– Mount the clutch shaft and lock it by means of lock ring 17.

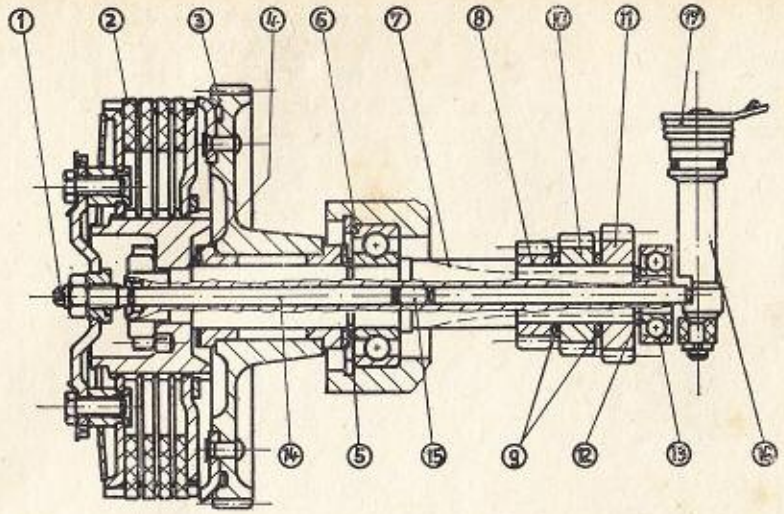


Fig. 65

(1) Clutch pressure screw
(2) Clutch parcel
(3) Clutch gear
(4) End play
(5) Lock ring 17
(6) Grooved ball bearing 6203
(7) Clutch shaft
(8) Fixed wheel for 2nd speed (number of teeth = 16) (for 4-speed engine)
(9) Spacer
(10) Fixed wheel for 3rd speed (number of teeth = 19) (for 4-speed engine)
(11) Fixed wheel for 4th speed (number of teeth = 22) (corresponds to fixed wheel for 3rd speed in 3-speed engine)
(12) Thrust washer
(13) Grooved ball bearing 6000
(14) Clutch pressure pin
(15) Roll 5 × 8
(16) Shaft for clutch lever (clutch actuation)
(17) Torsion spring for clutch lever

Fig. 66

– Provide the output shaft with lock ring 20 and thrust washer 20/32 mm in diameter; insert the sliding-key shaft up to position "4th speed" into the output shaft; carefully clamp the assembly at the end of the sliding-key shaft into a vice in vertical position; provide the corss bores with highly viscous grease (water pump grease) and put the detent balls (except for balls for the last gear) into the holes.

Fig. 67

– Alternately place gears and thrust washers on the output shaft (the oil pockets of the gears pointing in one direction); during the mounting of the last gear, bring the sliding-key shaft into neutral position, fit the still missing detent balls and bring the gear into functional position.

– Check the end play (1) between the last gear and lock ring 24 by means of a feeler gauge and bring it to the specified dimension of $0.1^{+0.4}$ mm by inserting a spacer washer having a diameter of 24/35 mm as required.
– Put the fitting sleeve for the cord spring "V 013" (2) in place; insert two balls (3) into each of the cross bores, size 4 mm, provided for this purpose in the output shaft and slip the cord spring over it.

Note:

The ends of the cord spring hooked into each other should not be located over the balls.

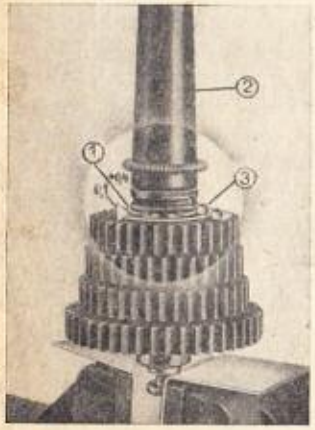


Fig. 68

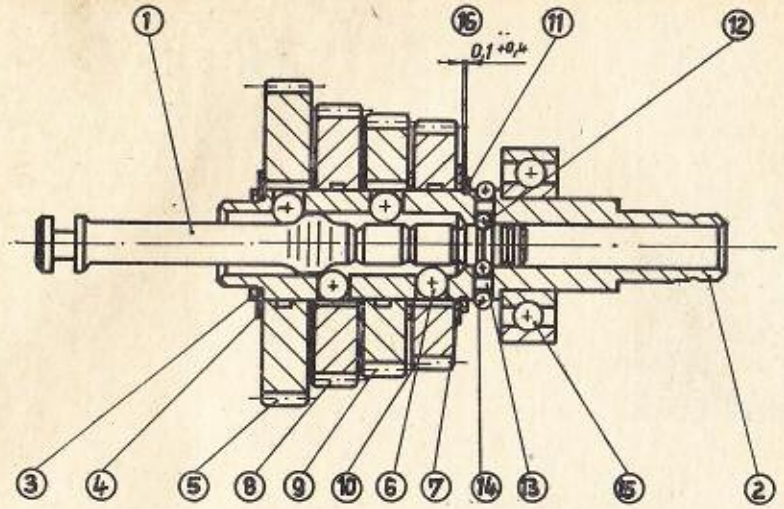


Fig. 69

(1) Sliding-key shaft
(2) Output shaft (for 4-speed engine)
(3) Lock ring 20
(4) Thrust washer ∅ 20/32 mm
(5) Loose gear for 1st speed (number of teeth = 44)
(6) Ball 7 II (3 balls per gear)
(7) Spacer ∅ 24/35 mm (1 mm thick, for the last washer, thickness as required)
(8) Loose gear for 2nd speed (number of teeth = 39) (for 4-speed engine)
(9) Loose gear for 3 rd speed (number of teeth = 36) (for 4-speed engine)
(10) Loose gear for 4th speed (number of teeth = 34) (for 4-speed engine)
(10) Loose gear for 4th speed number of teeth = 34) (corresponds to loose gear for 3rd speed in threespeed engine)
(11) Lock ring 24
(12) Ball 4 III
(13) Cord spring
(14) Ball 4 III
(15) Ball bearing 6004
(16) End play

Fig. 70

The readily mounted output shaft is now mounted into the left-hand casing half (ball bearing 16004).
The clutch shaft is now mounted.
Put together the gear set of the clutch shaft in the order described.
In a 3-speed gearbox, secure it with lock ring 15.

Fig. 71

In a 4-speed gearbox, place the thrust washer ∅ 10.5/18 mm (1 mm thick) on the gear for the 4th speed.

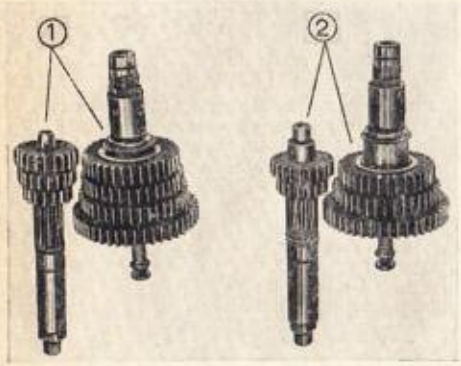


Fig. 72

(1) Set of gears for four-speed engine
(2) Set of gears for three-speed engine

Notes for the three-speed gearbox:

Output shaft

In the 3-speed engine, the loose wheel $z = 38$ for the 2nd speed (3-speed engine) is used in the place of the loose wheels for the 2nd and 3rd speeds. Further, the output shaft is distinguished by the omission of the three cross bores having a diameter of 7.2 mm and the appertaining three balls as detent for the loose wheel of the 4th speed. The annular groove for the lock ring 24 is displaced to the left (as seen in functional position) for one gear-shift step (about 11 mm).

Clutch shaft

In the gear set on the clutch shaft, the fixed wheel for the 2nd speed $z = 17$ is used in the place of the fixed wheel for the 2nd speed $z = 16$ and the fixed wheel for the 3rd speed $z = 19$. In the 3-speed gearbox, a spacing sleeve is mounted in the place of the gear for the 4th speed.

Gear ratios:

Engine M 531 (3-speed gearbox)

	clutch shaft		output shaft	
1st speed	10	:	44	$i = 1 : 4.40$
2nd speed	17	:	38	$i = 1 : 2.23$
3rd speed	22	:	34	$i = 1 : 1.55$

Engine M 541 (4-speed gearbox)

	clutch shaft		output shaft	
1st speed	10	:	44	$i = 1 : 4.40$
2nd speed	16	:	39	$i = 1 : 2.44$
3rd speed	19	:	36	$i = 1 : 1.89$
4th speed	22	:	34	$i = 1 : 1.55$

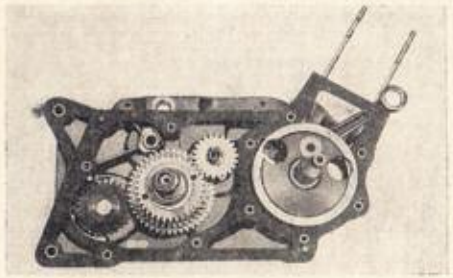


Fig. 73

Place the kick-starter wheel with the ratchets downwards on the through hole for the kick-starter dog.
Put the gasket for the engine casing in place.

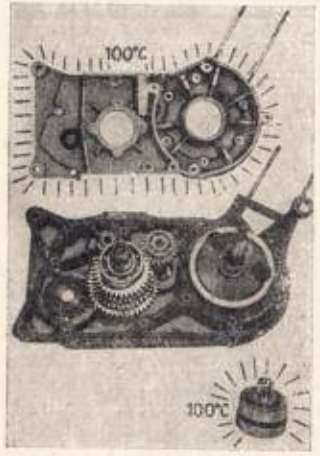


Fig. 74

Put the ball bearings on the shaft ends in question (for this purpose heat the internal rings of the crankshaft bearings to a temperature of about 100 °C). Heat the right-hand casing half to about 100 °C and put the two halves together.

Rapidly and reliably screw 10 casing tightening screws properly in place. Alternately tighten the screws with the largest distance between them in order to ensure a uniform pressing together of the sealing surfaces. It is advisable to choose the order indicated in Fig. 75; when the casing has cooled down, the screws must be re-tightened.

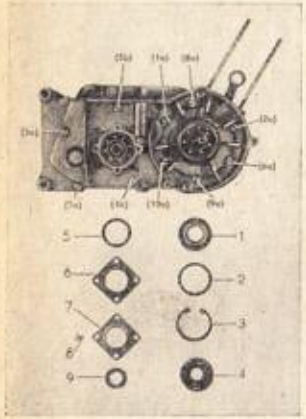
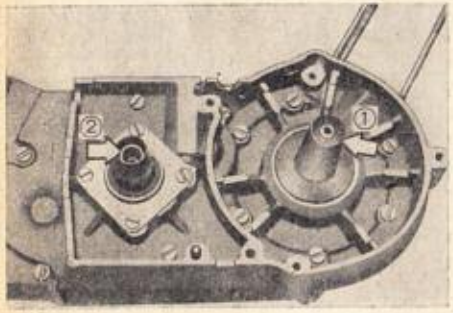


Fig. 75

(a) Fillister-head screws BM 6 × 40
(b) Fillister-head screws BM 6 × 50
(1) Oil guide washer
(2) Spacer ∅ 47
(3) Lock ring 47
(4) Shaft seal ring D 20 × 47 × 7 (for crankshaft, right)
(5) Spacer ∅ 42
(6) Packing for sealing cap
(7) Sealing cap
(8) Hexagon-head srew BM 5 × 10 (4 screws)
(9) Shaft seal ring D 20 × 30 × 7 (for output shaft, right)



Put the oil guide disk (with the embossing upwards) in its place; check the end play to the annular groove for lock ring 47 by means of a feeler gauge and adjust it to the dimension of maximum 0.1 mm; for this purpose, insert the spacer ∅ 47 and fit the lock ring 47; mount the shaft seal ring 20 × 47 × 7, use fitting sleeve V 013 (1).

Fig. 76

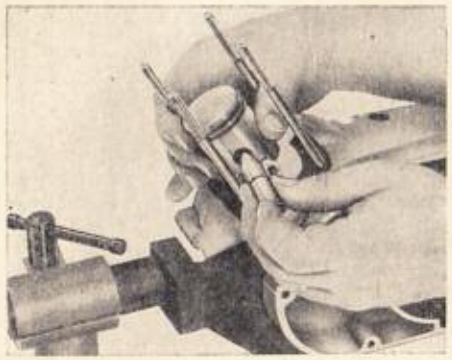
In the same way, using the shim having a diameter of 42 mm, adjust the right-hand ball bearing of the output shaft to maximum 0.1 mm, taking the thickness of the packing to the sealing cap into consideration; mount the pre-assembled sealing cap; fit the fastening screws. Use the fitting sleeve "V 015" (2) for mounting the shaft seal ring.

Check crankshaft and gearbox shafts that they are free to move easily; if required, relieve them of slight stress due to mounting.

5.3.2. Mounting Piston, Cylinder and Cylinder Head

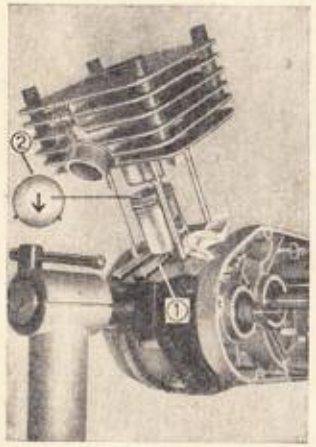
For selection and mounting of piston and cylinder, the "Table of Specified Matings" (see Section 4.1.) should be used. All sliding and bearing surfaces have to be checked for corrosion and other defects before mounting and – their proper condition provided – then mounted with a thin film of oil.

The cylinder head of the KR 51/2 types has a shortened cooling rib on the right-hand side.



Stick the thrust washers on either side of the small-end boss in place with some grease.
Fit the piston in the specified mounting direction (the arrow on the piston head points in travel direction), put the oiled gudgeon pin on the guide mandrel "EV 33" and insert it into the needle bearing. Retain the piston properly in this operation in order that the aligned connecting-rod is not displaced.
Carefully insert the hooked circlips into the annular grooves of the gudgeon-pin bosses and make sure of their proper seat.

Fig. 77



Wet the cylinder foot gasket with water and apply it to the sealing surface.

(1) Insert the retaining fork for piston "EV 20".

(**Notice!** The piston ring gap must coincide with the locking pins in the piston ring grooves)

(2) Position of the locking pins

Carefully put the cylinder in place and turn the crankshaft several times to achieve the proper functional seat of the cylinder.

Fig. 78

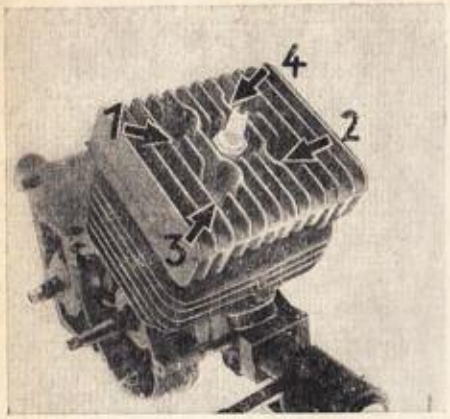


Fig. 79

Put the cylinder head in its place. Mount four washer 6.4 and four hexagon nuts M 6 by means of a socket wrench, width over flats 10 mm; uniformly and crosswise tighten the nuts.

5.3.3. Mounting the Kick-starter and the Foot-operated Gearchange Mechanism

Fig. 80

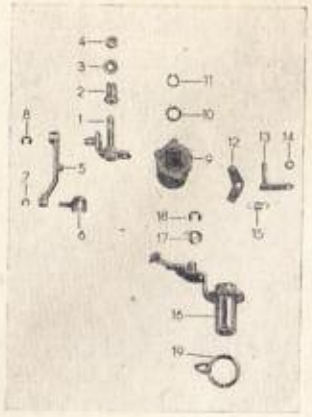


Fig. 81

(1) Bearing angle
(2) Slotted nut
(3) Washer 8.4
(4) Hexagon nut M 8
(5) Slewing lever
(6) Selector fork
(7) Lock washer 4
(8) Lock washer 6
(9) Gearshift cylinder
(10) Thrust washer
(11) Lock ring 12
(12) Catch lever
(13) Link
(14) Sleeve
(15) Tension spring
(16) Control lever
(17) Pawl spring
(18) Lock washer 7
(19) Control spring

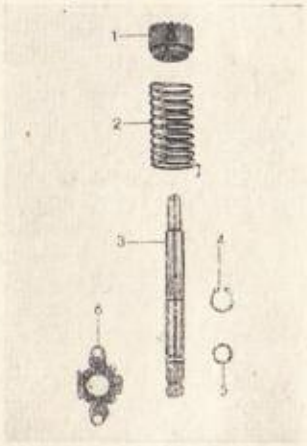


Fig. 82

(1) Kick-starter dog
(2) Kick-starter spring
(3) Kick-starter shaft
(4) Lock ring 16
(5) Annular ring
(6) Tensioning plate

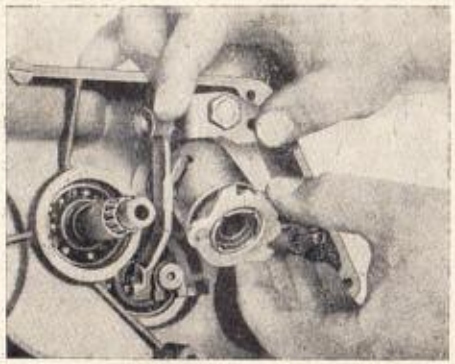
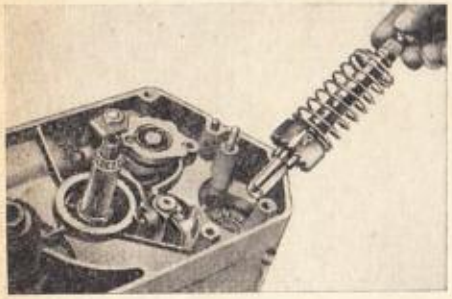


Fig. 83

Insert the selector fork of the pre-assembled slewing lever into the annular groove of the sliding-key shaft (for this purpose, bring the gearbox into the shift position of "1st speed") and mount the slewing lever together with the gear-shift cylinder appropriate for the number of speeds of the gearbox.
Put the thrust washer on the bearing bolt and lock the gear-shift cylinder with lock ring 12.

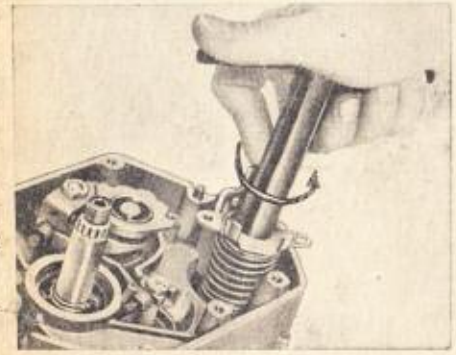
Characteristic features of the gear-shift cylinders for 3-speed and 4-speed gearboxes

	3-speed gearbox	4-speed gearbox
number of lock notches	4	5
number of control pins	2	3
length of cam track	≈ 40 mm	≈ 60 mm



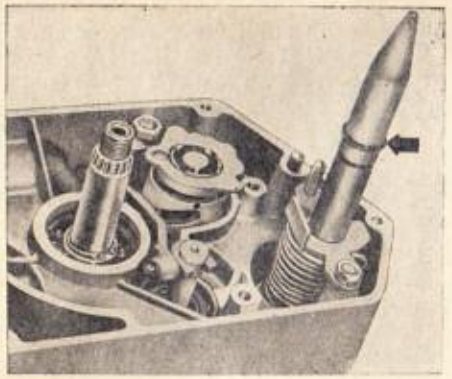
Insert the offset end of the kick-starter spring into the lateral bore of the kick-starter dog and insert the kick-starter shaft into the internal profile of the dog.
Fit the component in such a way that the lower end of the kick-starter shaft holds the kick-starter wheel and enters the bearing hole of the right-hand casing half; the lateral pin of the dog points downward (seen in functional position) to the end of the lifting taper.

Fig. 84



Fit the tensioning plate in such a way that the small pair of the offset lugs points downward and centres the kick-starter spring; the wide one of the three lugs pointing upwards must point to the rear when the kick-starter spring is not tensioned.
Push the socket wrench "W 004" over the kick-starter shaft and turn it through 180° to the left (anti-clockwise); press the tensioning plate down, the threaded pin of the casing will in this way enter the bore of the upper side lug; fasten the lower side lug with a hexagon-head screw M 6 × 14 and spring washer B 6.

Fig. 85



Mount the annular ring 12 × 2 by means of the fitting sleeve "V 014".

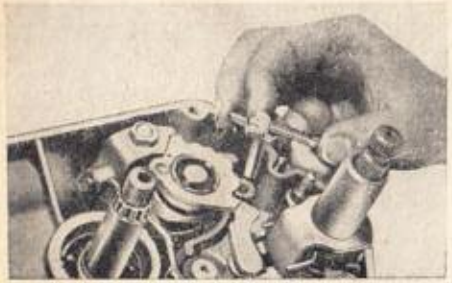
Fig. 86

Put the gearshift spring on the tensioning plate (the spring ends are spread by the wide tensioning plate angle).

Fig. 87

Mount the pre-assembled gearshift lever (consisting of hollow shaft, pawl and torsion spring) in such a way that the gearshift pawl moves past the first and second lock notch of the cam disk on the gearshift cylinder.

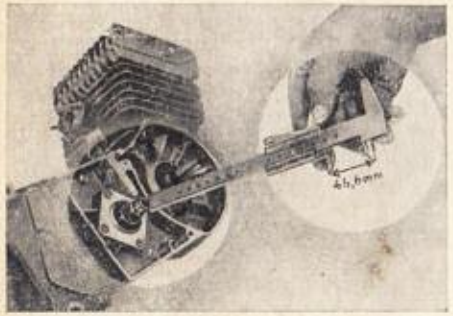
Fig. 88



Put the spacer sleeve on the M 6 threaded stud of the casing and insert the strap with catch lever (the threaded stud enters the bore as soon as the pin of the strap enters the appertaining bearing hole of the casing).
Screw the M 6 nut on the threaded stud; hook tension spring with catch lever and threaded stud together.

Fig. 89

Adjustment of the Gearchange Mechanism



Bring the gearbox into the shift position "1st speed" (catch lever is in the uppermost notch of the cam disk). The distance from the face of the sliding-key shaft to the face of the driving shaft should be 46.6 mm. This dimension is also fixed on the mounting mandrel for the gearchange mechanism V 009.

Fig. 90

Insert the mounting mandrel V 009 into the driving shaft.
Then turn the slotted nut anti-clockwise until a lateral displacement towards the outside is felt at the inserted mounting mandrel which is kept with a slight pressure against the sliding-key shaft. From this position, turn the slotted nut again through about 1.5 revolutions but to the right. Put washer 8.4 on the bearing bolt and screw on the nut M 8.
The adjustment of the gearchange mechanism can also be checked at the end play of the selector fork in the annular groove which must be equal to the left and right.

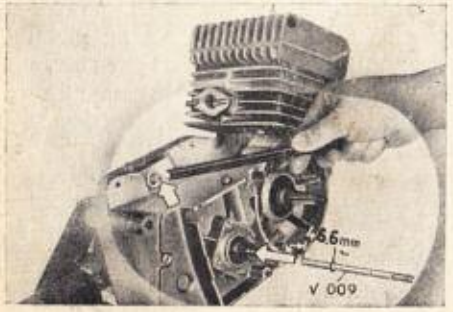


Fig. 91

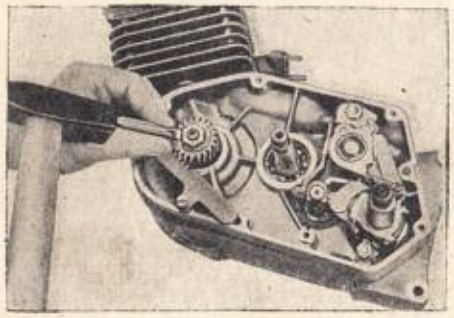
Note:

Without carrying-out a new basic adjustment of the gearchange system, a correction of the assembly can be achieved in the following way:

Fault	Correction
a) When changing up, the gear fails to engage properly (clatters) or jumps out of engagement under load	– loosen the M 8 hexagon nut (for bearing angle) – turn the slotted nut **anti-clockwise** for 1/2 to 1 revolution – again fasten the M 8 hexagon nut
b) When changing down, the gear fails to engage properly (clatters) or jumps out of engagement under load	– loosen the M 8 hexagon nut – turn the slotted nut **clockwise** for 1/2 to 1 revolution – again fasten the M 8 hexagon nut

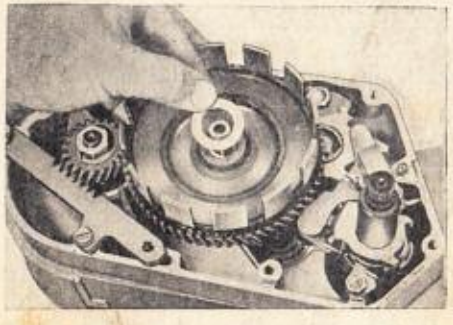
If such corrections alternately lead to the faults a) or b), excessive play (abnormal wear, defective parts, or the like) is in the gearchange system.
On the test bench, shift all gears by hand without putting the engine into operation. While the rear wheel is pulled vigorously, no clattering (gear not completely engaged) must occur in the gearbox.

5.3.4. Mounting the Driving Pinion and the Clutch



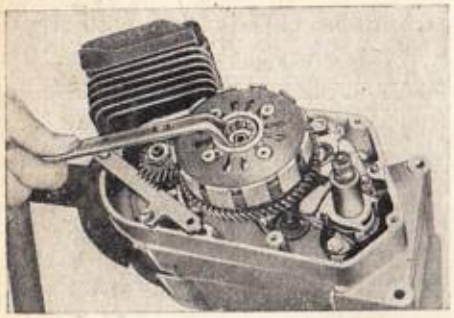
Insert the disk spring (3 × 3.7 mm) into the groove for this spring in the crankshaft tail, put the driving gear in place. Fit the locking plate and nut M 10 × 1, arrest the driving gear by means of the "Holding device V 011". Tighten the nut and lock it [torque 20 Nm (2 kpm)].

Fig. 92



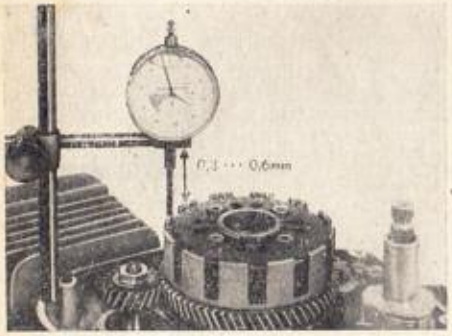
Push the thrust washer, 28 mm in diameter and 1 mm thick, on the clutch shaft, mount the clutch gear and, using another shim having a diameter of 28 mm (thickness as required) ensure an end play of maximum 0.2 mm between clutch gear and clutch dog.

Fig. 93



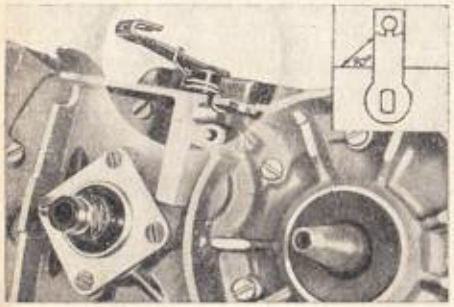
Mount the pre-assembled clutch parcel, fit the safety cap and fasten the dog of the clutch parcel by means of nut M 12 × 1.5 [torque 25 Nm (2.5 kpm)]; lock the nut.

Fig. 94



The end play of the clutch, with the dog properly tightened, is checked by means of a dial gauge and a self-made stand for the dial gauge.
The end play of the clutch may be minimum 0.3 mm and maximum 0.6 mm.

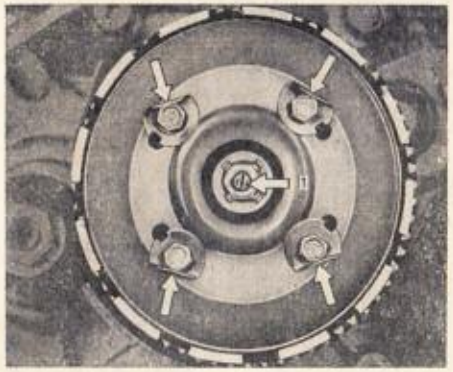
Fig. 95



Insert the pre-assembled shaft for the clutch lever into the casing opening provided for this purpose and hook in the respective torsion spring.
Fit the clutch pressure pins with intermediate roll into the central hole of the clutch shaft.

Fig. 96

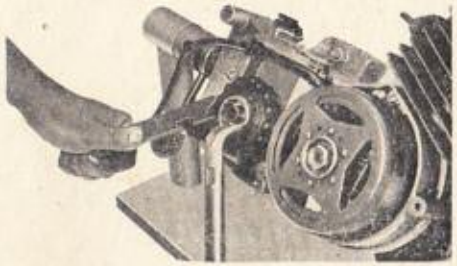
Put the thrust member in place, screw it tight by means of the 4 fastening screws and lock them.
Loosen the binder nut M 6 and adjust the clutch clearance at the adjusting screw (1) while the clutch lever is perpendicular to the casing sealing surface. Tighten the binder nut M 6. It must be



possible to slew the clutch lever for about 4 to 5 mm. Check that the clutch is in perfect working order.
Put the packing for the clutch cover and the cover on the assembly (for this purpose use the fitting sleeve "V 016" for he prevention of damage to the sealing lip of the shaft seal ring); pay particular attention to the correct fit of the cylindrical pins and screw on the 6 fillister-head screws of size M 6 × 35.
Mount the gearshift lever and the kick-starter lever.

Fig. 97

5.3.5. Mounting the Chain Sprocket



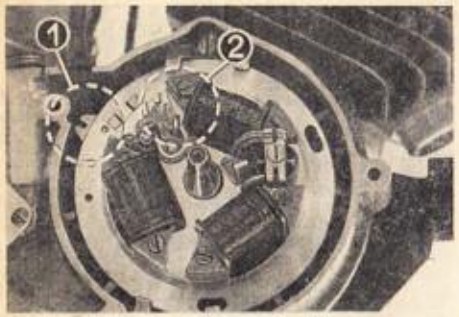
Put the chain sprocket on the square of the output shaft and fit the locking plate (take care that the sprocket fits without clattering); apply the holder-on "V 012" and tighten the fastening nut by means of a spanner, width over flats 24 mm, and the specified torque of 35.5 Nm (≙ about 3.5 kpm).
Bend the locking plate so that it contacts one of the flat sides of the nut; mount the helical pinion for the speedometer drive and fit the clip spring.

Fig. 98

5.3.6. Installing the Engine Electrical Equipment

Mount the base plate, taking markings, if any, (1) into consideration; carefully tighten the paw-type fasteners (2), taking care that the fasteners contact the base plate evenly. When tightening the fasteners, the base plate must not be distorted.

Fig. 99. Base plate of the electronic ignitor



Adjusting devices for (1) base plate and (2) contact breaker.
Put on the magnet wheel, taking the correct position of the keyway into consideration (in contact-breaker ignitors, the range of the cam contact surface nera the centre points to the contact lever otherwise there is the danger of damage to the contact lever).
Put on the retaining band "DV 37".
When the magnet wheel is turned **clockwise,** the loop of the band must make contact; tighten the fastening nut M 10 × 1 together with spring ring 10 with a torque of 20 Nm (≙ about 2 kpm).

Fig. 100. Base plate of the primary ignitor

6. Work at the Needle-jet Piston-valve Carburetters 16 N 1-11 (Mokick S 51) and 16 N 1-12 (Small Scooter KR 51/2)

6.1. Design of the Carburetters

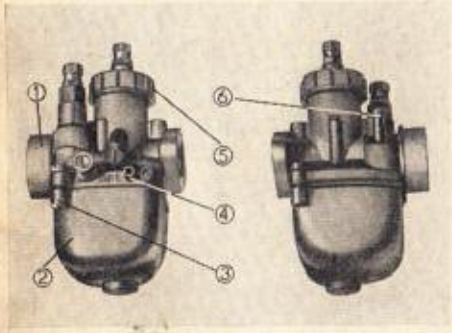


Fig. 101

(1) Carburetter casing upper part
(2) Float chamber
(3) Fastening screw for float chamber
(4) Overflow and ventilating opening
(5) Carburetter casing cap
(6) Hose nipple

The carburetters of the 16 N series are needle-jet piston-valve carburetters with an induction width of 16 mm. The control of the amount of the fuel-air mixture sucked up by the engine is effected by a piston valve which is actuated by means of a cable control against the closing force of a compression spring.

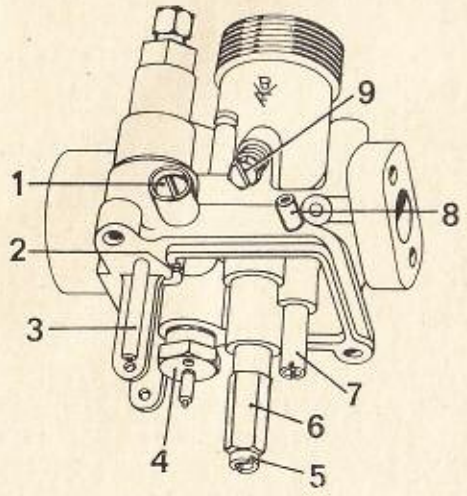


Fig. 102

(1) Slow-running air screw
(2) Starting air inlet
(3) Starting mixing tube
(4) Float needle valve
(5) Main jet
(6) Needle jet
(7) Slow-running jet
(8) Overflow and ventilating opening
(9) Throttle adjusting screw

6.2. Spheres of Influence of the Regulating Parts of the Carburetter

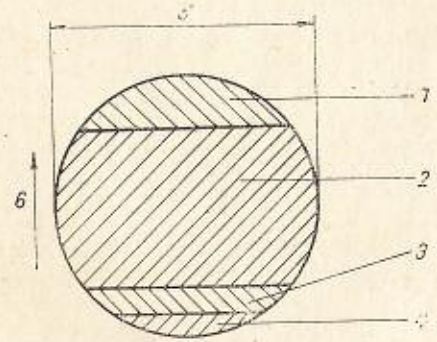


Fig. 103

(1) Main jet (HD)
(2) Partial-load needle position (TNS)
(3) Piston valve opening (DS)
(4) Slow-running air screw (LLS)
(5) Induction port
(6) Piston valve travel

The partial-load needle is arrested in the piston-valve by the needle holder. The possibility of adjusting various compositions of the mixture within the partial-load range is given by changing the position of the partial-load needle. For this purpose, the partial-load needle is provided with several notches.

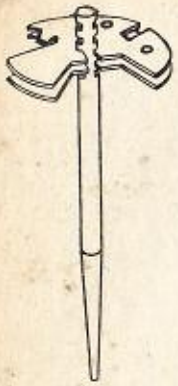


Fig. 104. Partial-load needle with needle holder

For suspending the partial-load needle that notch from top counts in which the lower plate of the needle holder is engaged

When suspending the partial-load needle at a lower notch, the fuel-air mixture becomes leaner within the partial-load range and when suspending the needle at a higher notch, the mixture becomes richer; it should be noted, however, that the partial-load needle position specified by the manufacturer is the optimum position which has been determined by comprehensive tests.

6.3. Maintenance of the Carburetter

To avoid disturbances of the carburetter function, it is advisable to clean the carburetter from time to time. Cleaning should be carried out at an interval equal to a distance covered of 10,000 km or once a year at least. For cleaning, the carburetter must be dismantled. As detergent, pure benzine, Per or Tri, and compressed air have to be used only. The use of any other detergent is not allowed. Cleaning (or checking) the jets by means of drills, wires or the like is not allowed because this will always entail a change in the jet flow values which may impair the carburetter function.

6.4. Float Mounting Dimensions

The adjustment of the float must be effected at the two float pots. The distance between the float pots is 16 $\pm$ 0.2 mm. The float mounting dimensions are **without** the rubber chamber packing.

A correction of the float mounting dimension can be achieved by slightly bending the float hinge lever. The above described adjustment of the float does not dispense from a measurement of the actual level of the fuel in the float chamber.

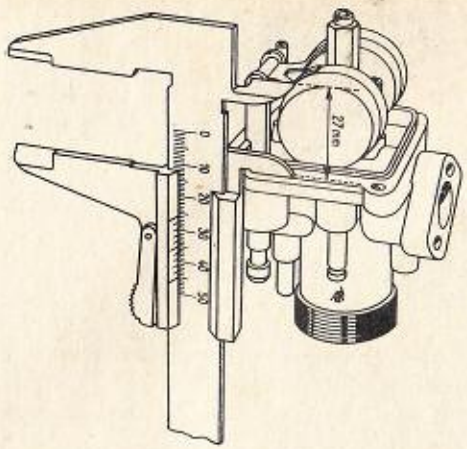


Fig. 105

Measuring the float mounting dimension 27 $\pm$ 0.5 mm from the supporting surface of the float chamber to the float top edge with the shock-absorber bolt of the float needle **pressed in** (or 29 $\pm$ 0.5 mm with this bolt **not** pressed in)

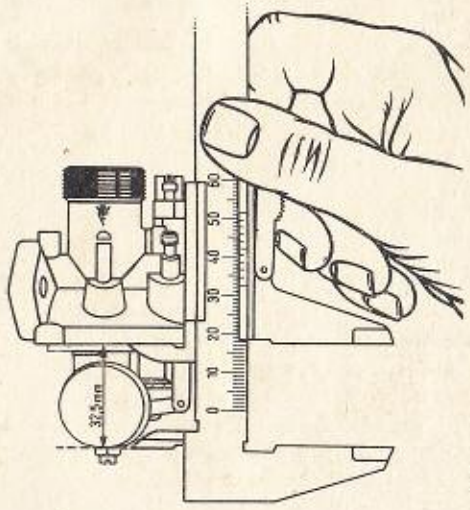


Fig. 106

Measuring the maximum float travel 32.5 $\pm$ 0.5 mm form the supporting surface of the float chamber to the float edge

6.5. Measurement of the Fuel Level

The measurement of the actual fuel level can only be taken with the help of a float chamber specifically prepared for this purpose and outside of the vehicle. An about 2 mm thick Piacryl plate, 20 $\times$ 20 mm in size, is glued to a narrow side of the float chamber to be used. A suitable adhesive, among other types, is the two-component adhesive. When the adhesive has cured, the tolerance limits of the fuel level must be scribed on the Piacryl plate, starting from the float chamber edge (7 mm and 9 mm with a fuel level of 8 $\pm$ 1 mm).

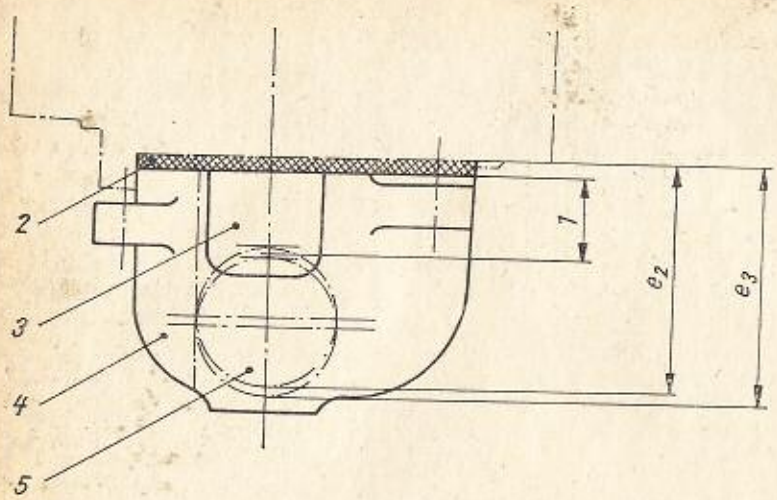


Fig. 107

(1) Level
(2) Packing
(3) Placryl plate
(4) Float chamber
(5) Float

The float mounting dimensions (e_2, e_3) are only applicable when the fuel level (KH) is taken into account:

e_2 – float needle valve closed, spring plunger **not** pressed in
e_3 – fuel needle valve open, float hinge lever at stop (maximum float stroke)
KH – fuel level measured from the float chamber top at a fuel column of 500 mm

Type of carburetter	Fuel Fuel level	Float mounting dimensions		Float needle valve packing ring d × D × s in mm	Identification No. of float chamber to be used
	KH in mm	e_2 in mm	e_3 in mm		
16 N 1-11 16 N 1-12	8 ± 1	29 ± 0.5	32.5 ± 0.5	10 × 14 × 1.5	16 14164 004

On the test float chamber prepared in this manner, the readily assembled carburetter housing (including rubber casing packing) is mounted. During the test, the carburetter must be kept horizontal and must not be tilted. The fuel column must be 500 mm (measured from the fuel level in the fuel tank to the hose nipple of the carburetter); that is why the test should be carried out with the fuel tank completely filled.
After connecting the fuel line and opening the fuel shut-off cock, the actual fuel level will be obtained in the test float chamber; the level must be between the two

marks scribed on the plate. A correction can be achieved by bending the float hinge lever or by changing the thickness of the sealing ring arranged below the float needle valve. Since the float has a transmission ratio of 1 : 2.5, a change of the thickness of the sealing ring by 0.5 mm causes a change of the fuel level by 1.25 mm provided that the float has not been distorted during the repeated dismantling operation. Care should be taken that, for corrections, the test float chamber must be discharged and re-filled from the fuel tank with the carburetter casing mounted between the tests so that it is not advisable to screw the test float chamber to the carburetter casing.
The fuel level must remain constant for a period of at least 3 min. When the fuel level rises slowly, this is indicative of a leaky (dirtly, loose) float needle valve. A rapid rise of the fuel level (carburetter overflow) is caused by a jamming float or a float needle jamming due to contamination.
For workshops it is more favourable to use a stationary test equipment according to Fig. 108 for testing the fuel level. The test procedure is the same as that described above but an additional fuel shut-off cock for emptying the test float chamber is required because the latter is permanently attached to the test equipment. The separate fuel tank with fuel shut-off cock must be installed in such a way that a fuel column of 500 mm is ensured.

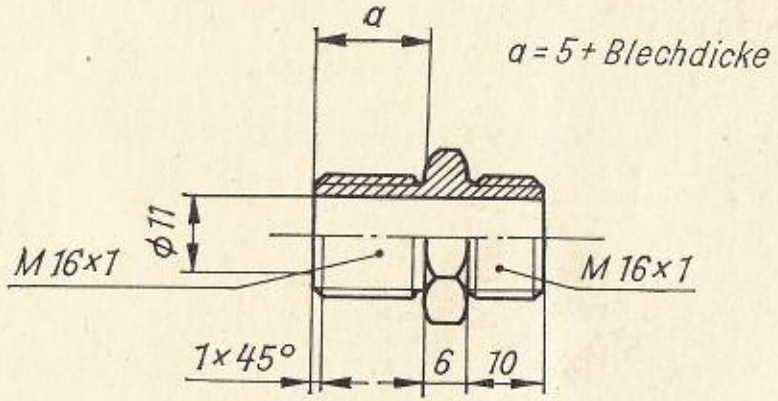


Fig. 109. Sketch of the connecting socket

a = 5 + Blechdicke a = 5 + sheet-metal thickness

6.6. Adjustment of Slow-running

A pre-condition of an optimum slow-running adjustment is a correctly adjusted ignition, a proper spraking-plug (electrode gab) and a good sealing of the engine with respect to secondary air (among other things, shaft seal rings on the crankshaft, carburetter flange). According to legal provisions, slow-running adjustment has only

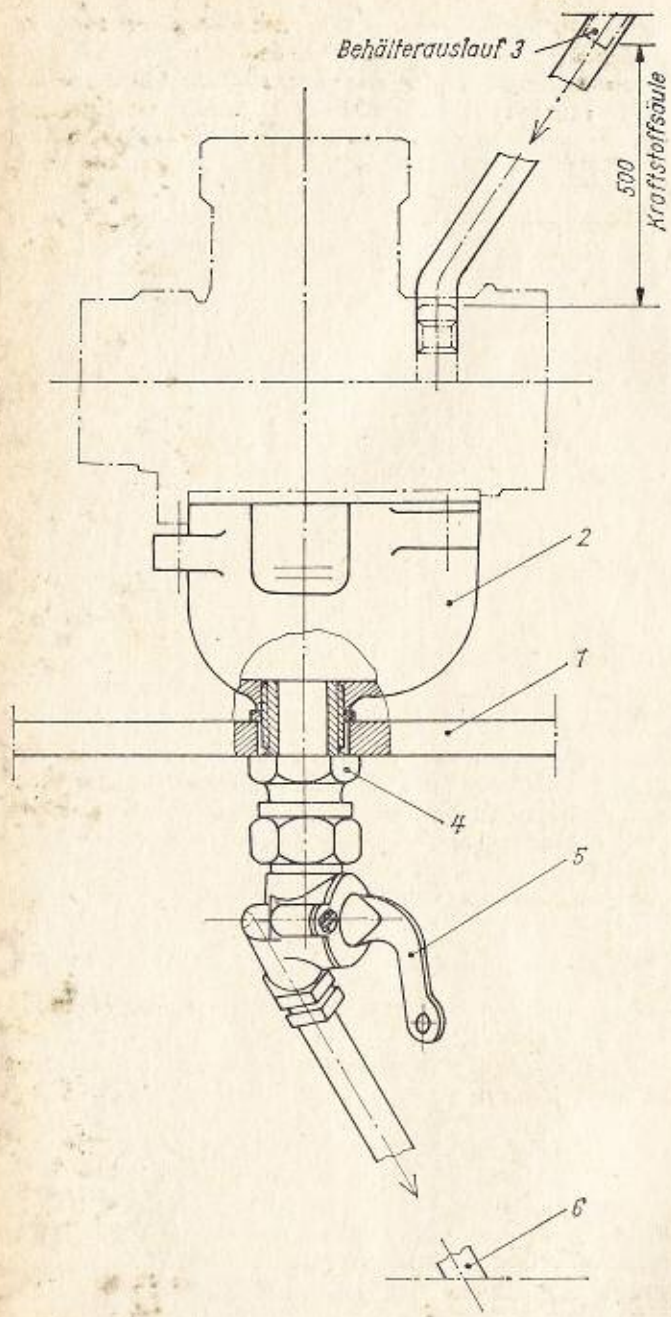


Fig. 108. Sketch of the test equipment

(1) Holder
(2) Test float chamber
(3) Fuel feed from the fuel tank with interposed fuel shut-off cock
(4) Connecting socket (see Fig. 109)
(5) Fuel shut-off cock
(6) Collecting vessel for fuel flowing out

Behälterauslauf
outlet of container

Kraftstoffsäule
fuel column

to be carried out in an engine still having operating temperature and using the necessary measuring devices (exhaust gas tester, engine speed counter)!
By means of the slow-running air screw, the composition of the idling-fuel-air mixture and by means of the piston-valve setting screw, the idling speed is regulated. Slow-running adjustment must be effected in such a way that, with an idling speed of $n = 1{,}250 \pm 150$ rpm, the CO proportion in the exhaust gases is 3,8 to 4.0 Vol.-%.
When screwing down the slow-running air screw, a leaner mixture of fuel/air is provided for slow running and when slackening back the screw, the mixture becomes richer.

7. Work at the Induction and Exhaust Systems

7.1. Induction System

7.1.1. Induction System of the S 51 Series

The induction system is arranged in the right-hand half of the central container. The volume of the induction container is of particular importance to the performance of the engine and must not be reduced by the use of the container for other purposes (e.g. keeping spare inner tubes, cleaning rags and the like). Dust separation is effected by means of a wet air filter.
The systems does not require particular maintenance.

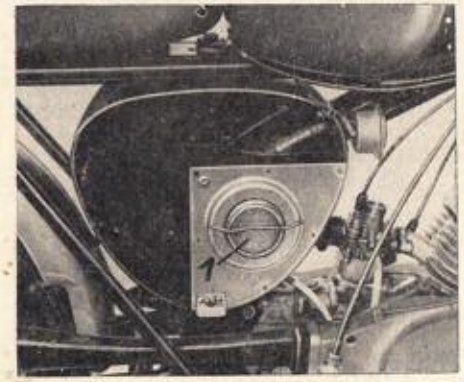


Fig. 110

Wash the air filter cartridge FLP 62/1 (1) with pure benzine.
Then wet the filter element with thin oil.
Allow the filter element to trickle out.

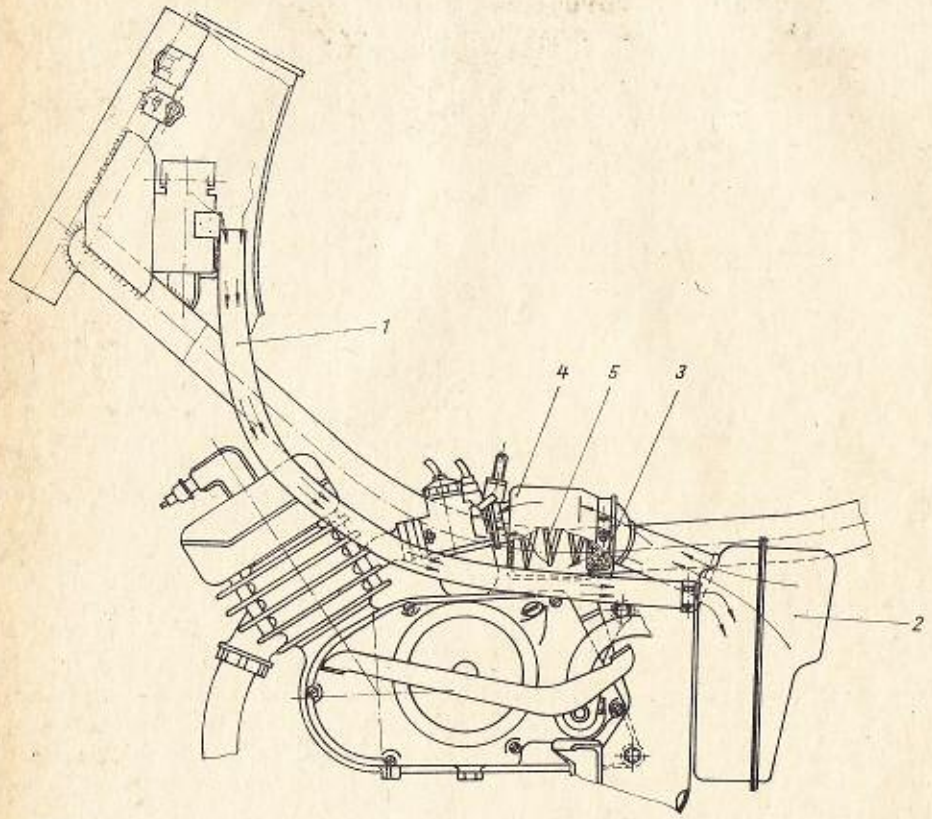


Fig. 111

(1) Intake hose
(2) Intake silencer
(3) Air filter cartridge FLP 62/1
(4) Intermediate vessel
(5) Spring for air filter

Dust separation is effected by a wet-air filter. The system does not require particular maintenance. Wash the air filter cartridge FLP 62/1 (3) with pure benzine. Then wet the filter element with thin air.
Allow the filter element to trickle out.

7.2. Exhaust System

In the exhaust system, items of particular importance are the tightness of the connection points and the cleanliness of the silencer insert. An increased back pressure due to passage openings narrowed down leads to reduced performance. When the passage

openings are increased, the fuel consumption and the noise level will also increase. It is very probable, at the same time, that the engine performance is also reduced. The exhaust pipe should be plugged in the silencer for a length of 317 mm.

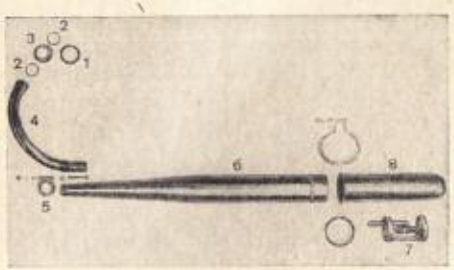


Fig. 112

(1) Locking plate
(2) Packings
(3) Union nut
(4) Exhaust pipe
(5) Clip
(6) Inlet funnel
(7) Silencer insert
(8) Tail piece

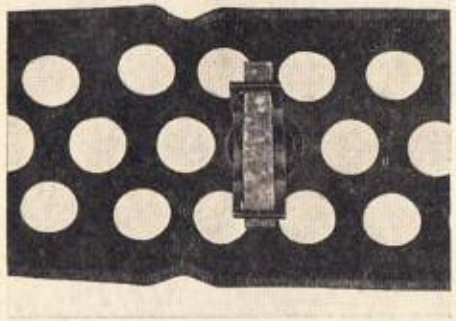


Fig. 113

To ensure proper heat protection in the raised exhaust system, take care that the intermediate layer clamps in the clip which is arranged in the centre between the two fastening points.

Elbow and Plugged-in Lengths

Variant	stretched-out length of elbow	plugged-in length in inlet funnel
40 km/h	650 mm	290 mm
50 km/h	460 mm	250 mm
60 km/h	360 mm	200 mm

Note:

The exhaust muffler of the 40 km/h variant is marked by a 40 stamped in the inlet funnel.

8. Work at the Electrical Equipment

8.1. Flywheel Generator Primary Ignitors 8307.8, 8307.8/1 and 8307.8/2

8.1.1. Design

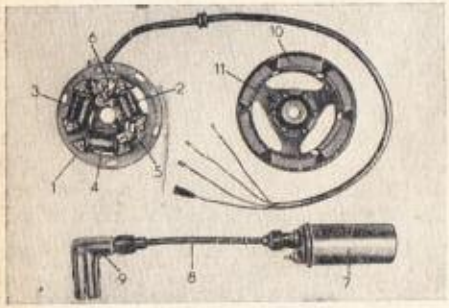


Fig. 114. Main parts of the flywheel generator primary ignitor

(1) Base plate
(2) Primary coil
(3) Light coil
(4) Light coil
(5) Capacitor
(6) Contact breaker
(7) Ignition coil AB 12 V
(8) Ignition line
(9) Ignition line connector
(10) Flywheel
(11) Contact-breaker cam

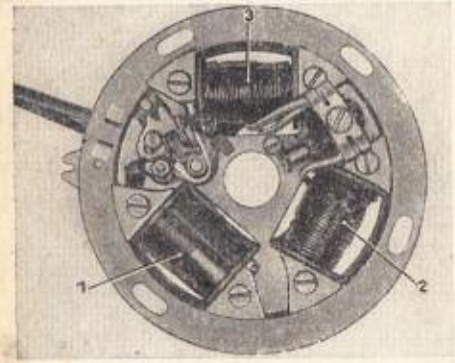


Fig. 115

(1) Primary coil

	Light Coil	
Type of Ignitor	(2)	(3)
8307.8	21 W for stop light, tail light, speedometer illumination and battery charging	25 W for headlamp
8307.8/1 (without charging unit)	21 W for stop light	21.2 W for headlamp, tail light and speedometer illumination

	Light Coil	
Type of Ignitor	(2)	(3)
8307.8/1 (with charging unit)	21 W for stop light and speedometer illumination	21.2 W for headlamp, tail light and speedometer illumination
8307.8/2	21 W for stop light	31.2 W for headlamp, tail light and speedometer illumination

(The full headlight beam control lamp incorporated in various export designs is fed by the 21-W light coil.)

The flywheel generator primary ignitor consists of the following two main assemblies:

Identification No.	Base plate, complete	Flywheel, complete
8307.8	8307.8-100	8307.8-010
8307.8/1	8307.8/1-100	8307.8-010
8307.8/2	8307.8/2-100	8307.8-010

The flywheel 8307.8-010 possesses 6 anisotropic oxidceramic magnet segments which require neither a remagnetisation nor a magnetic short-circuit when the flywheel is removed. The hub of the flywheel has the shape of a cam. In addition, it is provided with a thread for the device for pulling the flywheel from the crankshaft (M 27 × 1.25).

The base plate has the following cable connections:

Terminal designation	Cable colour	
59	red/white	flywheel generator primary ignitor 8307.8 light coil 25 W for the twin-filament bulb in headlamp
		flywheel generator primary ignitor 8307.8/1 light coil 21.2 W for the electric bulb in headlamp, the tail light and the speedometer illumination
		flywheel generator primary ignitor 8307.8/2 light coil 31.2 W for the twin filament bulb, the tail light and the speedometer illumination

Terminal designation	Cable colour	
59a	red/yellow	tapping at light coil 21 W, connection for battery charging
59b	grey/red	light coil 21 W for stop light or via the tail light inductor for the 5-W tail light and the 1.2-W speedometer illumination
2	brown/white	primary coil for ignition

Ignitor type 8307.8:

For the adaptation of the low power requirements of tail light (5 W) and speedometer illumination (1.2 W) to the light coil power of 21 W, a choke coil, which is arranged in the charging unit, is connected in series with these loads. For changing the battery, the terminal 59a (red/yellow) is connected with the charging unit via a miniature fuse F 3, 15 TGL 041571.

The common supply to:

stop light, tail light — via the tail light choke
speedometer illumination, battery charging — via the charging unit

from one light coil involves the following:

with the stop light switched on (actuation of the pedal brake), the tail light, speedometer illumination and the charging unit are inoperative;
with the tail lamp switched on and the speedometer illumination (driving during the night) also switched on, the charging current to the battery is reduced.

Ignitor type 8307.8/1:

In this type of ignitor, the electric bulb of 15 W for the headlamp, the 5-W tail light and the 1.2-W speedometer illumination are supplied by the light coil which is designed for the total load of 21.2 W.

Ignitor type 8307.8/2:

In this type of ignitor, the twin-filament bulb 25/25 W for the headlamp, the 5-W tail light and the 1.2-W speedometer illumination are supplied by the light coil designed for the total load of 31.2 W.

8.1.2. Ignition Side

8.1.2.1. Ignition Timing according to Firing Point

The primary current generated by the flywheel generator primary ignitor for ignition has a changing intensity due to the physical laws involved. For achieving a spark of the necessary magnitude, advantage must be taken of the maximum of the primary current which corresponds to a certain position of the primary coil in the magnetic field of force of the flywheel. At this instant, the contact breaker must open in order to initiate the induction process in the ignition circuit. The optimum breaking time is determined by the manufacturer by careful measurements, defined dimensionally as a certain position of the flywheel with respect to the primary coil on the base plate, and fixed by a marking on the flywheel and on the base plate (firing point marking). For the flywheel generator primary ignitors 8307.8, 8307.8/1 and 8307.8/2 the following dimensioned sketch is applicable.

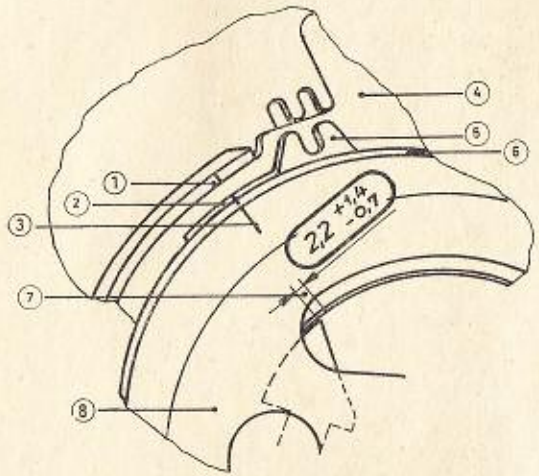


Fig. 116
(1) Marking of the firing point on the engine casing
(2) Marking of the firing point on the base plate
(3) Marking of the firing point on the flywheel
(4) Engine casing
(5) Adjusting plate
(6) Base plate
(7) Point of ignition (control dimension)
(8) Flywheel

When timing the ignition according to the firing point, proceed as follows:
Check the specified electrode gap in the sparking-plug of 0.4 mm.
Slightly slacken back the screws of the fastening clamps or paws of the base plate.
Move the flywheel into ignition position, that is to say, turn it in the sense of rotation until the line marking on the flywheel coincides with the firing point marking on the engine casing (namely, 1.8 mm before T.D.C.).
Using the adjusting plate, turn the base plate until the line mark on the base plate coincides with the firing point marking on the engine casing.
With the base plate fixed in this position with respect to the flywheel, adjust the contact breaker in such a way that it is just about to open. For this purpose, loosen the fastening screw of the contact breaker and turn the contact breaker as required. The instant of lifting (contact-breaker opening) is indicated by the ignition timing device.

Fig. 117. Ignition timing by means of the ignition timing device

Note:

When an ignition timing device is not available, the opening of the contact can be checked with the help of a clean strip of sheet metal having a thickness of 0.03 mm (tin foil) which is clamped between the closed contacts and which is released upon the commencement of opening so that it just can be drawn out.
After adjusting, the fastening screw of the contact breaker must be tightened.
For checking the setting operation carried out as described above, the contact points gap of the contact breaker can be determined at the instant of the highest point on the cam lobe (desired value: 0.4 $\pm$ 0.05 mm).

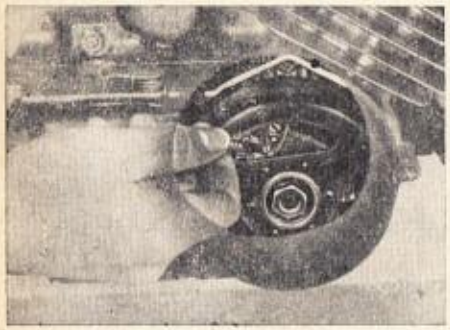


Fig. 118. Checking the contact-breaker points gap

Properly tighten the screws for the fastening paws of the base plate.

Note:

If a firing point marking is missing on the engine casing, or if it is no longer applicable because of a repair (e.g. incorporation of a new crankshaft), a useful marking is to be applied as follows:

Screw the firing point measuring instrument (dial gauge) into the plug thread in the cylinder cover
Find the T.D.C.
Set the piston to the firing point (1.8 mm before T.D.C.). Turn the crankshaft anti-clockwise. It is advisable to turn the crankshaft anti-clockwise just a little further in order to find the correct firing point by turning the crankshaft clockwise (equalisation of play).
Transfer the marking from the flywheel to the engine casing.

8.1.2.2. Maintenance Instructions

Contact breaker

Contact breakers whose contacts are badly worn (remarkable pitting and the like) must be replaced by new ones. Smaller elevations can be removed by smoothing by means of finest emergy stone. The contact surface shall obtain a polished finish. Oiled up contacts should be cleaned by means of a non-fuzzy cloth soaked in carbon tetrachloride or benzine.
Lever bearing bolts must be greased with a suitable lubricating grease.

Cam lubrication

The proper condition of the lubricating felt pad is of particular importance to the service life and serviceability of the contact breaker. It is employed to ensure an economical and permanent lubrication of the cam track.
The lubricating felt pad should touch only the cam lobe and a part of the ascending and descending curve.
(Approximate dimension for setting: between lowest point of the cam and lubricating felt pad surface 0.5 to 0.8 mm.)
The lubricating felt has to be provided with a special oil for ignition contact breakers M 31112. Felt pads that have become too short, dirty or crusty must be replaced by new ones. After putting the vehicle into operation, the lubricating system does not require any maintenance for a period equal to 5,000 km of road operation. When the distance covered of 5,000 km has been reached and then every 3,000 km the lubricating system must be checked and the lubricating felt pad provided with special oil for ignition contact breakers. For this purpose, use a screw-driver (about 2 to 3 mm wide) and apply 3 to 4 drops of special oil to the felt.
The oil catch piece of felt serves for protecting the contact breaker from being contaminated with oil.

8.1.2.3. Test Values of the Ignitor

When checking the ignitor by means of the test equipment, the following values must be observed.

Temperature of the ignitor: 20 °C ± 5 K

Speed in rpm	Spark gap TGL 4481/60 in mm
300 or less	5, irregular spark
350 or less	5, regular spark
3,000 or less	7, regular spark
up to 7,000	7, regular spark

The main light (terminal 59) must be loaded according to the Table in Section 8.1.3.

8.1.3. Testing the Light Side

When testing the light side by means of the test equipment, the following values must be observed:

Type of ignitor	Terminal	Voltage at n = 4,000 rpm	n = 7,000 rpm	Load resistance
8307.8	59	6 V	7.8 V	1.82 ohm
	59a	6 V	25 V	without load
	59b	6 V	7.8 V	1.75 ohm
8307.8/2	59	6 V	7.8 V	1.46 ohm
	59a	6 V	25 V	without load
	59b	6 V	7.8 V	1.75 ohm

The test is carried out at a temperature of 20 °C ± 5 K.

When taking these measurements, the ignition side must be loaded with a sparking distance of 7 mm.

The voltage is measured by means of an effective-value voltmeter separately at each terminal according to the Table; the terminals not subjected to testing must not be loaded. The load resistors must be non-inductive (bifilar winding) and independent of temperature.

Resistance values of the light coils (approximate values):
Type of ignitor 8307.8:

25 W coil (terminal 59 against earth): 0.22 ohm
21 W coil (terminal 59 b against earth,
terminal 59a not connected): 0.22 ohm

Type of ignitor 8307.8/2:

31.2 W coil (terminal 59 against earth): 0.13 ohm
21 W coil (terminal 59b against earth): 0.22 ohm

It is possible to check the light side of the ignitor in the vehicle by an orienting voltage control by means of a multirange instrument (e.g. UNI 7) at the individual loads. No remarkable deviations from the values given in the Table must occur.

8.1.4. Mounting Dimensions and Instructions

The core surfaces of the coils must correspond to the diameter of
$84^{-0.12}_{-0.26}$ mm.

The coils must be mounted on the base plate exactly centrally (centring diameter of the base plate is 110 mm). Between the core surfaces of the coils and the internal diameter of the flywheel, an air gap of from 0.3 to 0.5 mm must be ensured on all sides. Take care that the seat of the coils is properly plane and that the nuts are tightened as specified.
Loose coils and coils not properly seated with respect to planeness and centred condition lead to rubbing and thus to the failure of the coils.

8.2. Electronic Magnet-Ignition System 8384.5/1

8.2.1. Design and Mode of Operation

The magnet high-voltage capacitor ignition operates without contact and does not require any maintenance. The ignition current is induced in the external 6 V ignition coil by controlled capacitor discharge. The current for charging the capacitor and the control pulse is generated by the charging coil and the control transmitter of the ignitor, respectively.

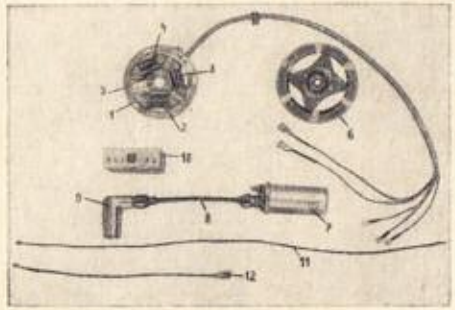


Fig. 119. Main parts of the flywheel generator electronic ignitor

(1) Base plate
(2) Light coil 35 W
(3) Light coil 21 W
(4) Charging coil (for ignition)
(5) Control transmitter
(6) Flywheel
(7) Ignition coil AB 6 V – IPOO
(8) Ignition line
(9) Ignition line connector
(10) Control part
(11) Line from control part to ignition coil
(12) Line from control part to ignition-light switch

The electronic magnet ignition system consists of:
flywheel generator electronic ignitor identification No. 8305.1/1
control part identification No. 8309.12
ignition coil AB 6 V – TGL 4481 – IPOO identification No. 8351.1/13

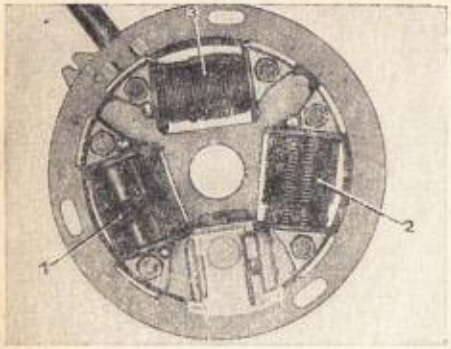


Fig. 120

(1) Charging coil
(2) Light coil 35 W for the twin-filament bulb in the headlamp
(3) Light coil 21 W for stop light, tail light, speedometer illumination and battery charging

The flywheel contains 6 oxidceramic permanent magnets which require neither a remagnetisation nor a magnetic short-circuit when the flywheel is removed. The ignition is controlled contact-less by virtue of a special design of the pole plate. The hub of the flywheel is provided with a thread for the device for pulling-off the flywheel from the crankshaft (M 27 × 1.25).

Terminal designation	Cable identification colour	
Terminal 59	red-white	connection of the 35 W light coil
Terminal 59a	red-yellow	tapping the 21 W light coil for the charging unit; interposed: miniature fuse F 3,15 TGL 0-14571
Terminal 59b	grey-red	connection of the 21 W light coil for the stop and for the tail light (tail light connection via the rear light choke arranged in the charging unit)
Terminal 14	red	connecting cable of the charging coil for the ignition after connection (14) of the control part
Terminal 3	blue	transmitter line, after connection (3) of the control part

The common operation of stop light, tail light and charging unit from the 21 W coil entails that, with the stop light switched on, the charging unit is inoperative and the tail light and the speedometer illumination are switched off. When the tail light and the speedometer illumination are switched on (night operation), the charging current for the battery is reduced.

Notice!

The terminals (14), (2) and (15) carry operating voltages up to 400 V. For any work, the engine must be stationary and the ignition switched off!

8.2.2. Adjustments

List of necessary adjustments:

Repair measures	Necessary adjustment
mounting paired ignition systems	basic ignition setting
mounting new control parts	speed of initiation is pre-set; check speed of initiation, adjust it, if required
installation of new flywheel generator electronic ignitors	basic setting of the ignition, check speed of initiation, adjust it, if required
mounting new base plates	check the speed of initiation and adjust it, if required; then perform dynamic spark setting
mounting new flywheels	check the speed of initiation and adjust it, if required; then perform dynamic spark setting, newly mark the base plate
installation of new light and charging coils	basic setting of the ignition

Note:

On the occasion of any repair in the ignition system, check the specified electrode gap of 0.4 mm in the sparking-plug.

8.2.3. Basic Ignition Setting

The basic setting of the ignition is performed as follows:

Fig. 121. Basic adjustment of ignition

Slightly loosen the fastening claws for the base plate.

Turn the base plate by means of the adjusting plate until the line mark of the base plate coincides with the firing point marking (corresponds to 1.8 mm before T.D.C.) on the engine casing.
Properly tighten the screws for the fastening claws of the base plate.

8.2.4. Adjustment of the Speed of Initiation

Definition of the speed of initiation

The "speed of initiation" is the speed at which the transmitter voltage is sufficient to release the electronic switch (thyristor).
It is indicated by the commencement of spark transmission with a small spark gap (e.g. electrode gap of the sparking-plug at normal pressure).
The speed of initition should be between 400 and 600 rpm.

Procedure of adjusting

Adjustment should be carried out with the engine in a cold state. To check the speed of initiation, the sparking-plug is unscrewed, put into the ignition line connector, then earth contact is established (at the engine practically), and then the ignition switched on.
By means of a revolution counter (e.g. a hand tachometer) and with the 3rd gear in engagement, while the kick-starter is uniformly actuated or the rear wheel turned, find out at which speed the commencement of ignition – indicated by the first spark appearing in the sparking-plug – takes place.

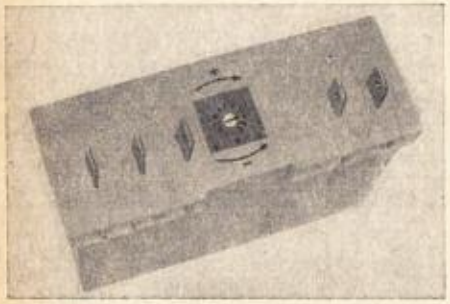


Fig. 122

The speed of initiation is adjusted by means of the adjustable regulator of the control part.
In case of a speed of initiation **below** 400 rpm, the regulator must be turned **clockwise.**
In case of a speed of initiation **over** 600 rpm, the regulator must be nurned **anticlockwise** (Fig. 122).
The criterion of a correctly adjusted speed of initiation is good startability with normal kick-starter actuation and non-erratic operation in the upper speed range of the engine.

If, proper ignition timing provided, starting the engine is only possible with vigorously actuating the kick-starter (in this case the engine speed is about 1,700 rpm), the speed of initiation must be reduced in the manner specified above, If, on the one hand, good startability is given and, on the other, intermittent spark emission at high engine speeds occurs, the speed of initiation must be increased. A trial ride must be carried out.

8.2.5. Dynamic Ignition Timing

Dynamic ignition timing or, in other words, spark setting is effected at an engine speed of 3,000 rpm with the help of a stroboscope lamp.

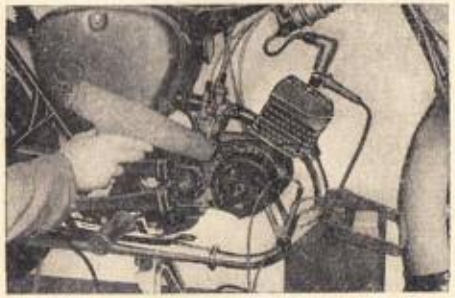


Fig. 123

Sequence of operations:

Slightly loosen the fastening claws and then turn the base plate in such a way that the noses of the adjusting plate are opposite to the adjusting recesses at the engine.
Allow the engine to run at $n = 3{,}000$ rpm and expose the markings on flywheel and engine casing to flashes from the stroboscope and turn the base plate until these markings coincide.
Properly tighten the screws for the fastening claws of the base plate.

Notes:

When the firing point marking, i. e. 1.8 mm before T.D.C., is missing on the engine casing, then it must be provided in accordance with the information given in Section 8.2.3. (basic adjustment of the igition) with the help of a firing point measuring device (dial gauge).
When the flywheel alone is replaced, the marking provided on the base plate is no longer valid and can only be used as a clue. After the dynamic ignition timing, the base plate must be marked according to the markings provided on the engine casing.

Notice!

When carrying out adjusting operations while the engine is running, the risk of injuring by the rotating flywheel is given.

8.2.6. Information for Repairs

Repairs of the electronic magnet-ignition system **should be left to the expert** who not only has the required knowledge but also disposes of the necessary testing and measuring equipment. Makeshift methods should only be used in case of emergency.
The following basic repair variants are possible:
Dismantling and re-assembling (replacement) of the complete system.
The components paired into sub-assemblies by the manufacturer have to be used only. The appropriate combination of electronic ignitor and control parts ensures optimum values of timing.
A basic adjustment of the ignition is required.
Replacement of the base plate or of the flywheel
Replacement base plates have no marking for the release of the control pulse in the control transmitter. On the replacement flywheels, a marking related to the keyway in the hub is provided. Therefore, base plate and flywheel must be adjusted with respect to each other when one original part has been replaced and then the base plate must be provided with a new marking. Normally, this is done by dynamic ignition timing with the help of a stroboscope lamp at an engine speed of $n = 3{,}000$ rpm.

Replacement of the control part
Adjustment of the firing point as a makeshift
Determination of the speed of initiation as a makeshift.

8.2.7. Adjustment of the Firing Point as a Makeshift

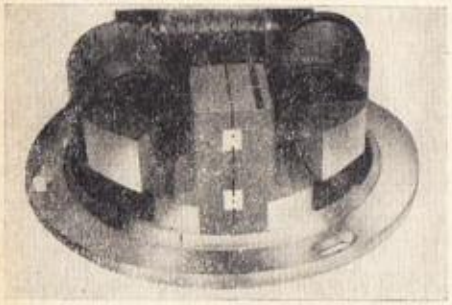


Fig. 124. Coil core centre of the control transmitter to be marked on the front of the latter

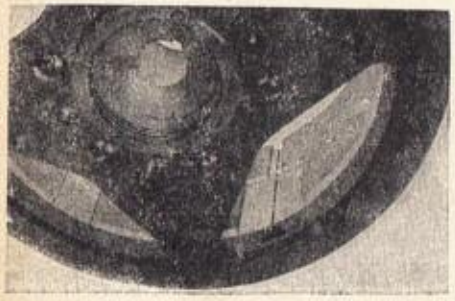


Fig. 125. Centre distance of the control pole plates in the flywheel to be marked on the casing of the latter or on the cardboard insert visible from outside

Fig. 126. Plug the flywheel on the base plate in such a way that the two markings coincide

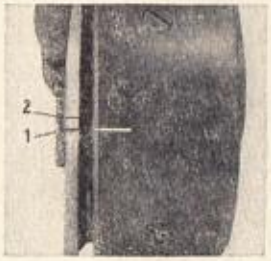


Fig. 127. Mark the base plate according to the marking provided on the flywheel

Replacement of the control part

Check the speed of initiation of the electronic magnet-ignition system, which has been provided with a new control part, by means of a revolution counter and correct the setting, if required.

Range of adjustment: 400 to 600 rpm.

8.2.8. Makeshift Determination of the Speed of Initiation

A speed of about 420 rpm of the crankshaft is obtained when the rear wheel is **steadily** turned through half a revolution within 1 s (corresponds to moderate effort) with the 3rd gear in engagement.

Procuedure of adjusting:

Jack up the vehicle and engage the 3rd speed.
Grip the lower end of the rear wheel tyre with one hand and uniformly turn it through 180° with moderate expenditure of energy; at the same time check whether a spark flashes across the electrode gap.
If a spark occurs while the wheel is turned distinctly slower, the regulator must be adjusted clockwise.
If no sparks occur while considerably greater efforts are made in turning, the regulator must be adjusted anti-clockwise.

Tools:

screw-driver 6 mm
screw-driver 2.5 mm
ignition point measuring device
revolution counter
stroboscope lamp
scriber

8.2.9. Test Values of the Ignitor

When testing the ignitor by means of the test equipment, the following values must be observed:

Temperature of the ignitor: 20 °C ± 5 K
Speed of initiation: 400 to 600 rpm (here, the test is carried out with a small spark gap — 2 to 3 mm)

Sparking distance

Speed in rpm	Spark gap acc. to TGL 4481/06 in mm
600 or larger	6 mm, regular spark flashover
3,000 to 7,000	7 mm, regular spark flashover

The light side must not be loaded during the test.

Charging coil

Resistance values
type with a core height of 15 mm: 500 to 600 ohm
type with a core height of 18 mm: 650 to 780 ohm
(terminal 14 disconnected, measured against earth)

Charging voltage during ignition operation

nominal value 150 to 190 V at $n = 2{,}000$ rpm
(measured against earth at terminal 14 or 2 by means of a multirange instrument)

Control transmitter

Total resistance: 24 to 30 ohm
(terminal 3 disconnected, measured against earth)
Resistances of the partial coils
Partial resistance R_1 between terminal 3 (disconnected and measuring point at transmitter top: $R_1 = 12$ to 15 ohm)
Partial resistance R_2 between measuring point at the transmitter top and earth: $R_2 = 12$ to 15 ohm.
R_1 and R_2 may vary from each other by a maximum of 0.5 ohm.

8.2.10. Testing the Light Side

When testing the light side by means of the test equipment, the following values must be observed:

Terminal No.	Voltage at $n = 4{,}000$ rpm	$n = 7{,}000$ rpm	Load resistance
59	6 V	7.8 V	1.14 ohm
59a	6 V	25 V	without load
59b	6 V	7.8 V	1.75 ohm

The test is performed at 20 °C ± 5 K

During these measurements, the ignition side must be loaded with a sparking distance of 7 mm.

The voltage is measured by means of an effective-value voltmeter at each terminal according to the Table and separately while the terminals not subjected to the test must be unloaded. The load resistances must be non-inductive (bifilar winding) and independent of temperature.

Resistance values of the light coils (approximate values):

35 W coil (terminal 59 against earth): 0.15 ohm
21 W coil (terminal 59b against earth,
terminal 59a not connected): 0.29 ohm

Testing the light side of the ignitor in the vehicle is possible by an orienting voltage control by means of a multirange instrument (e.g. UNI 7) at the individual loads. No considerable deviations from the values given in the Table must occur.

8.2.11. Mounting Dimensions and Instructions

The core surfaces of the coils must correspond to the diameter of

$$84\ ^{-0.12}_{-0.26}\ \text{mm}.$$

The coils must be mounted on the base plate exactly centrally (centring diameter of the base plate is 110 mm). Between the core surfaces of the coils and the internal diameter of the flywheel, an air gap of from 0.3 to 0.5 mm must be ensured on all sides. Take care that the seat of the coils is properly plane and that the nuts are tightened as specified. Loose coils and coils not properly seated with respect to planeness and centred condition lead to rubbing and thus to the failure of the coils.

8.3. Design and Testing the Function of the Charging Unit

The charging units contain a rectifier, which rectifies the alternating current generated by the flywheel generator primary ignitor, and a choke coil which ensures that an almost constant a.c. voltage is fed to the semi-conductor surface contact rectifier. The charging unit contains a choke coil which serves for the compensation of the power level between loads (tail light and speedometer illumination) and generator (21 W light coil). This choke coil (terminal designation 59b – cable identification colour grey/black) operates without maintenance. In case of troubles, a test for continuity must be performed between the choke connections. The test voltage to be applied should not exceed 2 V. The charging units incorporated in the various vehicle variants should be looked up in the wiring diagrams.

8.3.1. Information about the Treatment of the Rectifier Diode

This component is susceptible to overvoltage, excessive current intensities and high rises in temperature. When soldering the terminal and especially when replacing the rectifier, the soldering iron must be disconnected from the mains.

Removal from the charging unit is effected in the following way:

Disconnect the charging unit and remove it.

Separate the soldered joint between rectifier and charging choke (it is covered by insulating hoses). The soldering iron to be used should have a power input of 60 W, the soldering time should not exceed 4 s. A flat-nose pliers should be applied to the assembly between rectifier and soldering joint in order to reduce the heat flow to the rectifier.

Press out the rectifier.

Mounting is to be effected in the inverse order.

(Legend for fig. 128)

(1) Charging rectifier
(2) Cooling plate
(3) Series reactor for rectifier (for limiting the charging current)
(4) Tail light choke for limiting the current for the rear light (omitted in the S 51 N)
(5) Connection for choke coil
(6) Cable clip
(7) Lug
(8) Minimum distance of the wire bend from the glass bushing (wire diameter 1.5 mm)
(9) Insulating hose for set of cables
(10) Start of charging choke twisted with connection wire from rectifier and soldered; subsequently insulating hose pushed over the soldered joint
(11) Cable drawn in straight installation (cable clip not yet fitted)
(12) Soldered
(13) Cable clip bent
(14) Projecting end of the connecting wire in question cut off
(15) The connecting wire of the choke inserted in the cable lug, cable lug bent down and soldered

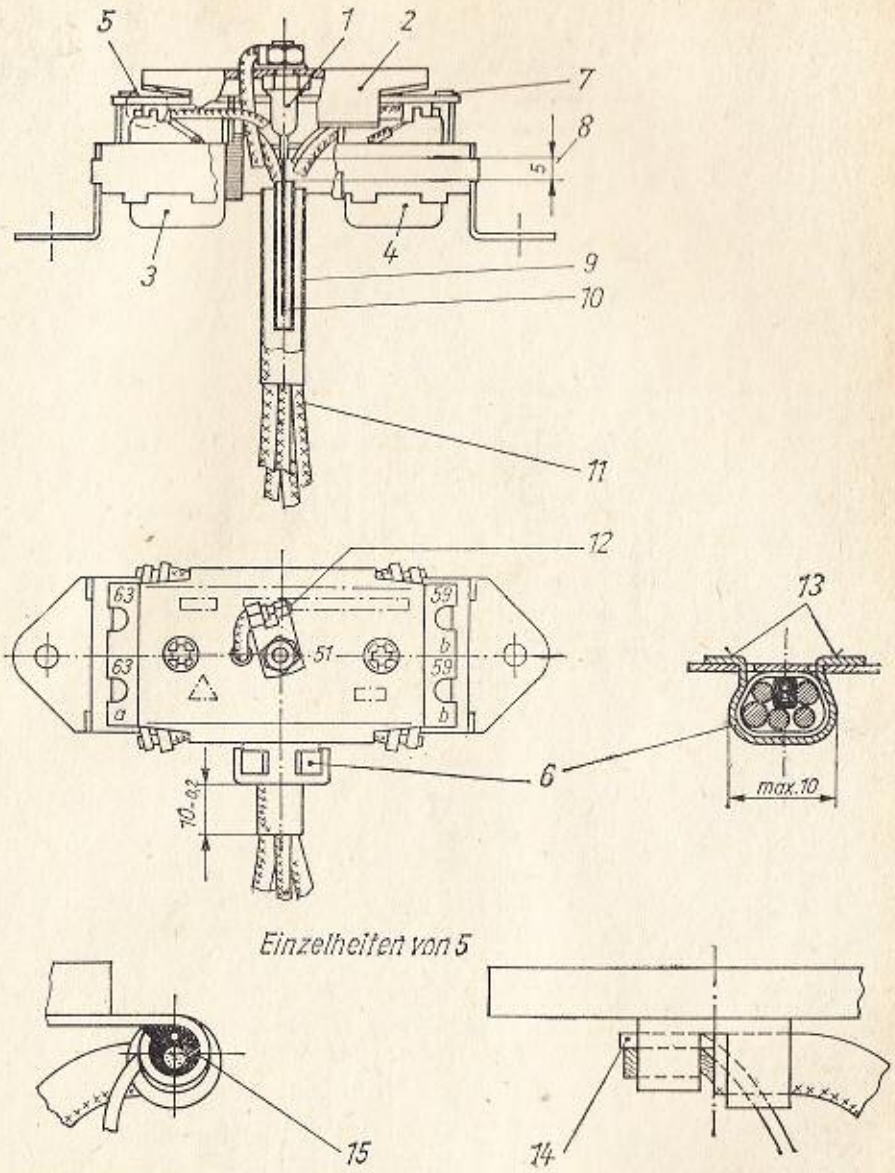


Fig. 128. Sectional view of parts of the charging unit

Einzelheit von 5 detail of 5

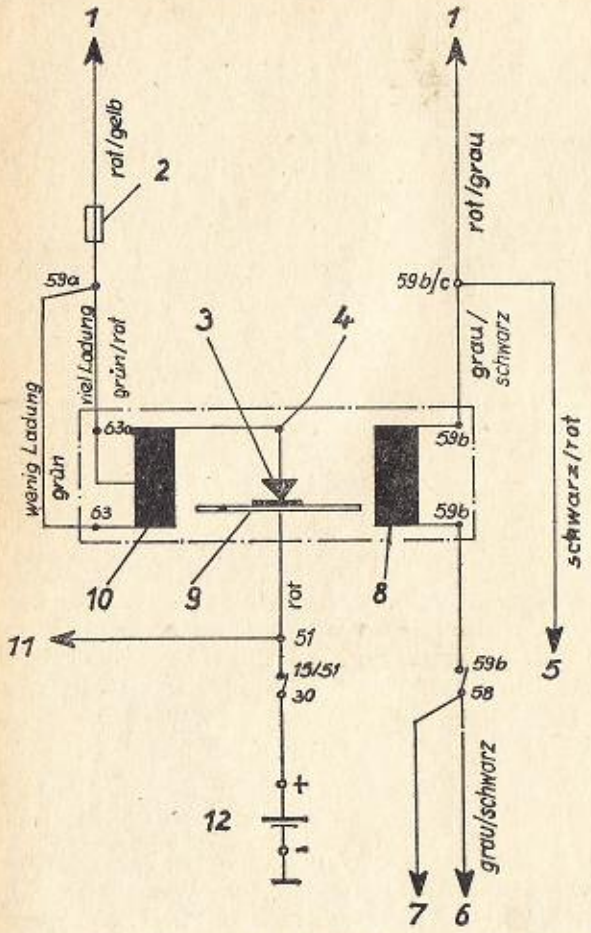


Fig. 129. Circuit diagram of the charing unit 8871.5, 8871.5/1, 8871.6 and 8871.6/1

(1) to ignitor
(2) Miniature fuse, G fuse links F 3,15 – TGL 0-41571, medium time delay type
(3) Rectifier diode SY 171/1
(4) Soldered joint
(5) to stop light (21 W)
(6) to tail light (3 W)
(7) to speedometer illumination (1.2 W)
(8) Tail light chocke
(9) Cooling plate
(10) Charging choke
(11) to fuse for d.c. loads
(12) Battery (6 V, 12 Ah)

wenig Ladung	low charge	rot	red
viel Ladung	high charge	grau/schwarz	grey/black
grün	green	rot/grau	red/grey
grün/rot	green/red	schwarz/rot	black/red
rot/gelb	red/yellow		

In the charging units 8871.5/1 and 8871.6/1, the connection "high charge" is omitted.

8.3.2. Functional Test

Testing the charging process in the vehicle

For d.c. voltage and direct current, moving-coil instruments should be used while for a.c. voltage moving-iron meters or rectifier instruments have to be employed. Proposed instrument: multirange instrument.

Checking the blocking action of the rectifier in the vehicle

When the engine is stationary (ignition-light switch in position "OFF"), interpose the ammeter with the negative connection pointing to the rectifier in the charging line 51/red (measuring range up to 6 A), check the 3.15-A fuse and the battery for correct connection. Move the ignition-light switch into operating position. The pointer must not be deflected at the instrument otherwise the rectifier fails to produce a blocking action and must be replaced by a new one.

Checking the charging current

Interpose an ammeter with the positive connection pointing to the rectifier in the charging line 51/red. Select the measuring range for 3 A direct current and operate the engine at maximum speed for a short time. When connecting the line "high charge" (terminal 63a green/red), the instrument must indicate about 2.4 A. When connecting the line "low charge" (terminal 63), the instrument must indicate about 1.1. A of charging current. When the result is negative, proceed in the following way.

Checking the battery voltage at the charging unit

With the ignition-light switch in operating position, the battery voltage (positive pole) must be applied to the cooling sheet of the rectifier and it must be possible to measure it to earth. If this is not the case, there is a fault in the electrical connections, charging unit terminal 51 — ignition light switch terminal (15/15-30) battery connections — earth.

Checking the a.c. voltage in front of the charging unit

See Sections 8.1.3. and 8.2.10.

Checking the voltage behind the charging unit (without battery charging!)

For this purpose, disconnect the line 51/red from the terminal in the fuse box and connect a d.c. voltmeter with its positive pole to the loosened line. Apply the negative pole of the instrument to earth. Bring the engine to maximum speed for a short time. The voltage measured should be between 5 and 7 V. If the result is negative, the rectifier may have an interruption or a line may be broken in the charging unit.

Checking the system outside of the vehicle

Checking the blocking action of the rectifier outside of the vehicle

Connect the negative pole of a 2-V battery to the terminal 51/red. Connect the negative connection of the ammeter (measuring range at least 2 A) to terminal 63/green. Connect the positive connection of the instrument with the positive pole of the battery. As a consequence, a current of about 1 to 1.5 A must flow. If no current flow can be observed, the charging choke must be checked for continuity. There must be continuity between terminal 63/green and the soldered joint (resistance about 0.7 ohm, test voltage not more than 2 V).

8.4. Treatment of the Battery

The vehicles of the S 51 series (except for S 51 N, S 51 E/1 and S 51 N-H) are provided with a lead battery of 6 A 4 (6 V, 12 Ah), the vehicles of the KR 51/2 series generally with a lead battery of 6 A 1 (6 V, 4.5 Ah).
The battery serves for the supply to the d. c. loads flashing-light direction indicators and horn. In the vehicle, the battery is charged from the generator coil for the stop light (6 V, 21 W) of the flywheel generator primary or electronic ignitor via a rectifier diode.

Putting into operation and first charging

When putting a new battery into operation, it must be filled with accumulator sulphuric acid, having a density of 1.28 g/cm³ (in the tropics 1.23 g/cm³); the acid level must be 1 cm on top of the plate. Naturally, the plugs closing the filler necks must be removed for filling.
Allow the battery to stand for two to three hours; then charge it according to its capacity (4.5 Ah with 0.5 A; 12 Ah with 0.6 A). The battery is charged when all cells evolve gas uniformly, the charging voltage has reached 7.5 to 7.8 V, remains unchanged during the following three consecutive hours (to be measured every hour), and the acid density is 1.28 g/cm³. Top up the cells with distilled water only, keep the acid level 5 mm on top of the plates.
The box must be protected from fuel and impacts. Since degassing takes place through the central vent ledge through the PVC-hose, vent plugs have to be used only which are provided with two vent holes below their head.

Charging the battery mounted in the vehicle

Charging the battery built in the vehicle is effected by the flywheel generator primary ignitor producing alternating current via the rectivier diode. This system is designed for changing over from high charge to low charge and vice versa in order that a certain adaptation to various modes of operation is possible [the system is connected to "high charge" (S 51 series) or "low charge" (KR 51/2 series) by the manufacturer]. When connected to the line "high charge" (terminal 63a green/red), the battery is charged with 2.4 A, when connected to the line "low charge" (terminal 63 green), it

is charged with 1.1 A. Since charging the battery is effected from the generator winding for stop light (6 V, 21 W), the charging process is interrupted when the brake is actuated.

Charging the battery outside of the vehicle

A discharged battery should be charged outside of the vehicle because the charging time in operation is too long even with the connection of "high charge" and when all d.c. loads remain inoperative for the charging period. Charging should be effected with 1/10 of the total capacity of the battery. This means that the batteries provided by us have to be charged with 1.2 A (S 51) or 0.6 A (KR 51/2).
The battery must be connected to a direct current supply. When connecting, take care to see to it that the correspondent poles of battery and charging line are connected together, i.e. + with + and − with −.

State of charge at a temperature of 20 °C:

Charged battery	acid density 1.28 g/cm³ for the tropics 1.23 g/cm³
half-charged battery	acid-density 1.20 g/cm³ for the tropics 1.16 g/cm³
discharged battery	acid density 1.12 g/cm³ for the tropics 1.08 g/cm³

Maintenance of the battery

The proper function of the complete direct-current circuit in the vehicle largely depends upon the state of the battery. With a well-attended battery, the acid density is a measure of the state of charge. Maintenance is restricted to a check of the liquid level once a month; the level should be a few millimetres on top of the separators. For topping up, distilled water is only used; acid should be used for replenishing when it has been lost due to spilling or foaming of the battery. The connecting poles of the battery must be cleaned by means of water and a brush and then provided with a thin film of an acid-free grease.
When mounting the battery, take care that the cables are properly connected (black cable to the negative pole) otherwise the rectifier may be damaged.
In winter take care that the state of charge of the battery is always correct because oa non-charged battery will freeze up at −10 °C and may be damaged in this way.
When the vehicle is inoperative for a prolonged period of time, it is advisable to remove the battery from the vehicle and to keep it in a place free from frost in the charged state. Every four weeks, the battery must be recharged until all cells uniformly and briskly evolve gas — on no account should the battery be overcharged. At the same time check the liquid level.
At intervals of 3 to 4 months, before charging, the battery must be decharged for ten hours with the discharging current until the cell voltage has dropped to 1.8 V. Then the battery must immediately be recharged.
In the mounted state, the battery must not be capable of moving. It must be protected from fuel and impacts.

When the battery is discharged relatively quickly, the miniature fuse of 3.15 A, which serves for protecting the rectifier and is of the medium time delay type, must be checked and, if required, replaced by a new one.

Caution!

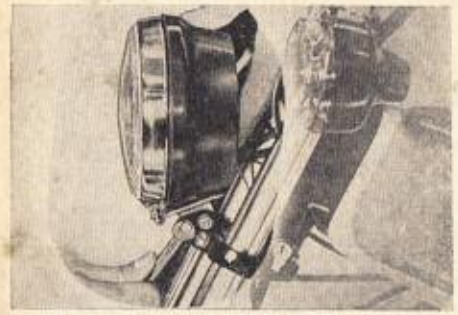
An insufficient charge of the battery leads to a sulphatising of the sets of plates and, thus, to the total failure of the battery. When the battery is subjected to extreme stresses, it must be re-charged stationarily in a 4-week cycle.

8.5. Lighting, Signalling and Flashing-light System

When working at the lighting, signalling and flashing-light systems, the relevant legal regulations must be observed, and all of the systems have to be checked that they comply with these regulations, and they have to be put in order, if required.

Headlamp adjustment and replacement of headlamp bulb

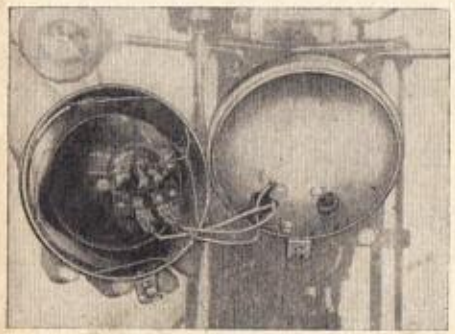
The headlamp is adjusted by means of the focussing board while the vehicle is fully loaded or with the help of an adjusting device. The passing beam is adjusted by tipping the headlamp shell.



Loosen the clamping screw M 6 × 12 (with spring washer 6) and hinge bolt M 6 × 16 (with spring ring B 6 and hexagon nut M 6) and adjust the headlamp through the required angle and then tighten the screw and nut again.

T o o l : spanner, width over flats 10 mm,
spanner, width over flats 13 mm.

Fig. 130

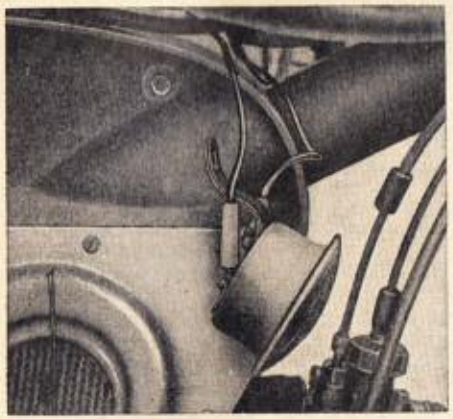


For the headlamp, the electric bulbs of the specified type and wattage have to be used only.
Loosen the retaining screw from the reflector ring and remove the headlamp insert, pull the lampholder from the reflector and replace the bulb (bayonet holder). Grip the new bulb with the help of a clean piece of cloth.

Fig. 131

Signalling equipment

The horn is a d.c. load. In the S 51 N, S 51 N-H and S 51 E/1 light motor-cycles, it is supplied by a combination of four monocells (dry batteries R 20 TGL 7487-B) and in the other vehicles of the S 51 and KR 51/2 series by a lead battery.
It is elastically suspended at a spring stirrup (to improve the emission of sound).



For the replacement of the horn, withdraw the cable connector, open the container for accessories and remove the retaining screw M 6 × 12 (with spring washer 6 and hexagon nut M 6).
Remove the horn.

Fig. 132

Flashing-light direction indicator system

The flashing-light direction indicator system also uses direct current and is supplied by the lead battery. The flasher unit employed is a thermally controlled electromagnetic device. In any case, an 8 A fuse has to be used only for the protection of this device. It is suspended in a damping casing of sheet steel where the flasher unit is accomodated with the help of two foam rubber disks to protect if from vibrations.
For any work in the flashing-light direction indicator system, the battery must be disconnected in order to avoid any inadvertent short-circuit.

Possible faults:

Irregular flashing:
too slow
- undervoltage, i.e. the battery is not fully charged or contact resistances in the line,
- flasher unit not correctly adjusted;

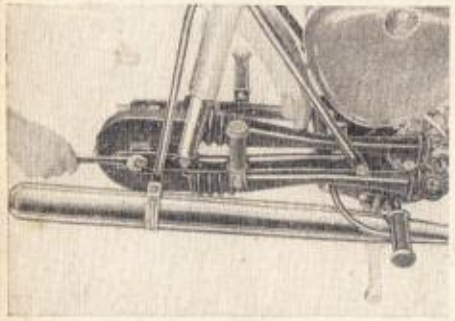
too quick
- overvoltage, i.e. rated voltage has not been observed,
- flasher unit not correctly adjusted,
- current coil of the flasher unit burnt out due to a short-circuit in the flashing-light direction indicator system.

Causes of short-circuit:

Terminal screws in the flasher switch loosened or fallen out.
Connecting wires pushed too far through the terminals in the flasher switch.
Cable 49a at the flasher switch abraded or cable squeezed between casing and switching insert.
Accidental earth of the cable 83 L/R.
Switching insert in the flasher switch is tilted during switching on so that a short-circuit occurs between terminal and switch casing (missing rubber pad or loose switching insert).
Arresting disk for switch lever too large or displaced on a side so that temporarily a short-circuit with the switch casing is produced.

9. Work at the Rear Wheel Drive

9.1. Dismantling



The rear wheel is already removed and the driving chain sprocket loosened. Unscrew the nut M 12 × 1.5 from the axle extension and remove the rear wheel drive from the swing arm.

T o o l : spanner, width over flats 19 mm.

Fig. 133

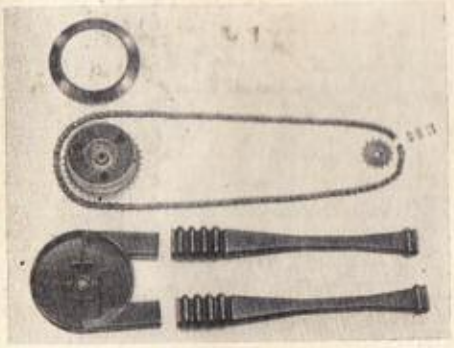
Opening the chain protection

Lift out the cover for the chain protection (1).

T o o l : Screw-driver 6 mm.

Fig. 134

Removing the driving chain

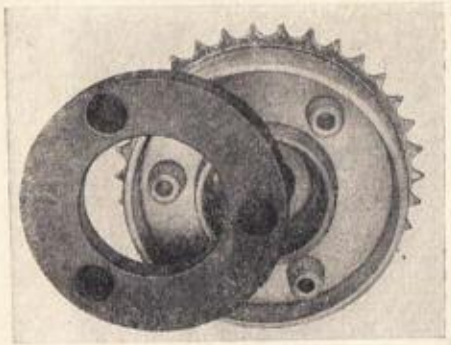


Open the locking link of the chain connector, pull the chain out of the enclosure and remove the chain protecting hoses.

T o o l : flat-nosed pliers.

Fig. 135

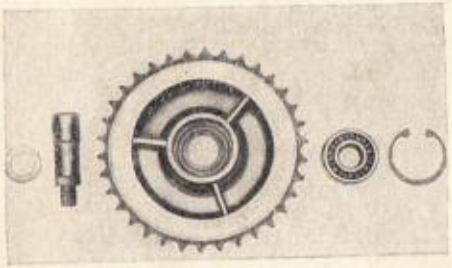
Dismantling the rear wheel driver



Remove the elastic ring.

T o o l : screw-driver

Fig. 136



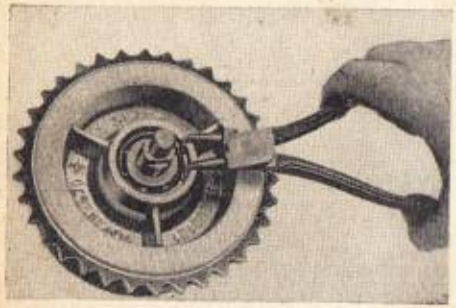
Remove the lock ring 40. Remove the grooved ball bearing 6203 and the axle extension.

T o o l : mandrel, fitter's hammer.

Fig. 137

9.2. Assembling

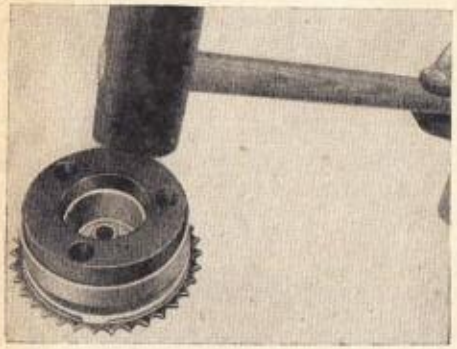
Assembling the driver



Heat the driver, mount the ball bearing 6203 with an amount of 2 cm^3 of anti-friction bearing grease and fit the lock ring, also known as snap ring.

T o o l : heating plate,
drift,
fitter's hammer,
taper-nose pliers.

Fig. 138



Mount the axle extension and the elastic ring (with the letters pointing upwards).

T o o l : rubber mallet

Fig. 139

Mounting the driver into the chain protection

Draw the driving chain into the chain protection hoses and insert the two chain ends into the connecting socket of the chain protection.
Lock the chain connector.

T o o l : wire hook,
flat-nosed pliers.

Fig. 140

Insert the chain connector opposite to the chain sense of rotation into the grooves of the locking pins.

T o o l : flat-nosed pliers.

Fig. 141

Note:

The sag of the chain (lower strand of the chain) should be about 20 mm when the vehicle is loaded with one person.

Completing the rear wheel drive

Place the chain on the gear ring of the driver. Inject lubricating grease into the chain protection hoses and put the cover for the chain protection in place, applying some pressure.

T o o l : grease gun

In further work at the rear wheel drive take care that the chain does not jump off the gear ring (if necessary, secure the chain by means of the pinion).

9.3. Replacement of the Chain at the Vehicle

Remove the cover from the electrical equipment,
loosen the rear wheel drive,
open the chain connector,
attach a new chain with its connector to the old chain, draw out the old chain and separate it from the new chain, place the tail piece of the chain over the driving sprocket, pull together the final links of the chain by means of tapernose pliers and fit the chain connector.

Final remarks:

The driving chain is among those parts of the transmission system which are subjected to highest stresses. Therefore, it must be checked for state of wear at regular intervals (see Section 4.6.). On this occasion, also check the two sprockets (one at the engine and one at the driver).

A badly worn tooth profile causes a new chain to wear out rapidly.
The chain protection hoses must always be in a proper condition and provided with a sufficient amount of lubricating oil (in order to reduce friction between chain and internal profile of the protective hose) because they not only protect the chain from dirt and its effects but also damp the oscillating motion of the chain which is a particular cause of rapid wear.

10. Work at the Internal-expanding Shoe Brake

10.1. Dismantling the Brake Cover Plate (Rear Wheel)

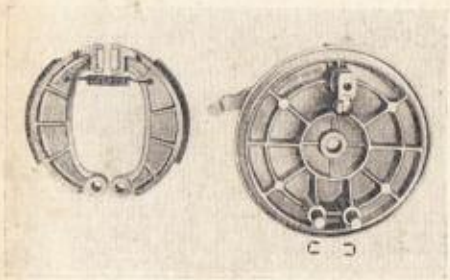


Fig. 142

Remove two lock washers, unhook the return spring and remove the brake shoe.

T o o l : flat-nosed pliers.

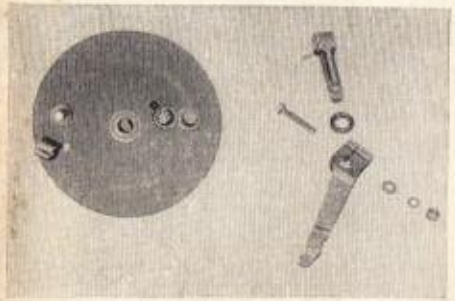


Fig. 143

Remove the transverse bolt M 6 × 35 from the brake lever, for this purpose loosen the hexagon nut M 6 and remove it together with spring washer B 6 and washer 6.4.
Draw the brake lever from the serration of the brake cam. Pull off the packing ring and push the brake cam out of the bearing hole.

T o o l : spanner, width over flats 10 mm.

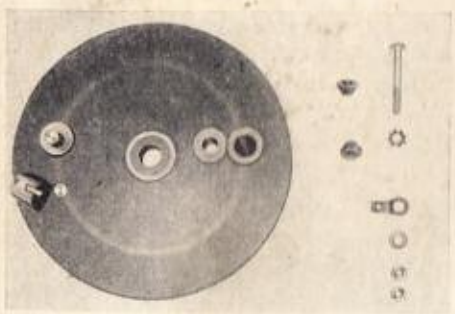


Fig. 144

Remove the stop light switch. Remove the hexagon nuts M 5, spring washer 5, plug lug and toothed lock washer A 5. Take out the contact screw and the insulating bushes.

T o o l : screw-driver 6 mm, spanner, width over flats 10 mm.

10.2. Assembling the Brake Cover Plate

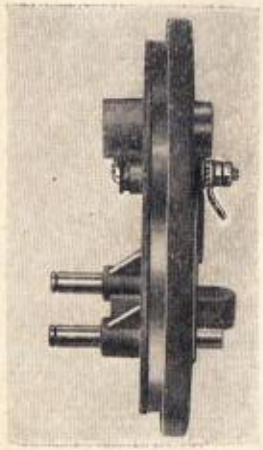


Fig. 145

Insert the insulating bushes into the cover plate of the brake, insert the contact screw and provide it with toothed lock washer A 5.
Screw on contact lug, spring washer 5 and two hexagon nuts M 5 and lock them.

T o o l : spanner, width over flats 8 mm.

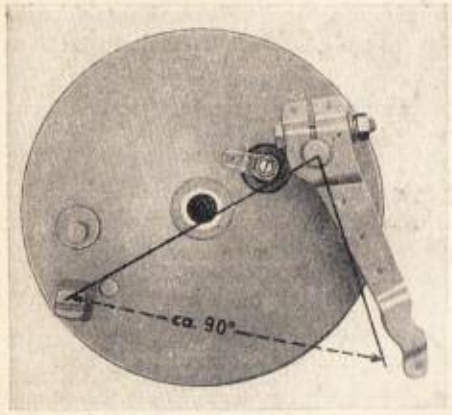
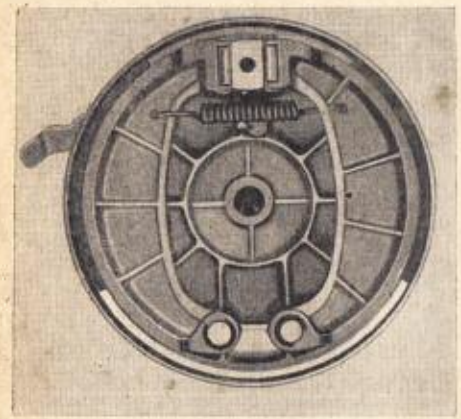


Fig. 146

Fit the brake cam (slightly grease the bolt), mount the rubber disk and brake lever (inclination about 90°), then mount the transverse bolt M 6 × 35, washer 6.4, spring washer B 6, and the hexagon nut M 6.

T o o l : spanner, width over flats 10 mm.

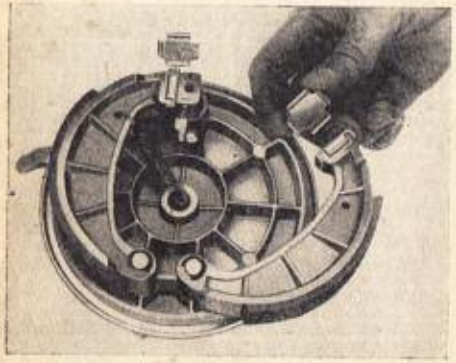


Provide the brake shoes with return spring and plug the pair of brake shoes on the brake cam and bearing bolts. Provide the bearing bolts with snap rings. Before mounting, slightly grease the brake cam and bearing bolts.

T o o l : flat-nosed pliers.

Fig. 147

Insertion of intermediate layers for brake shoes



When the brake lining is worn down to a high degree, intermediate layers of three different thicknesses, namely intermediate layer I 1 mm in thickness (mounted in series production), intermediate layer II 2 mm in thickness and intermediate layer III 1.5 mm in thickness, can be inserted between brake cam and end face of the brake shoes.
For this purpose, unhook the brake shoe spring, place intermediate layers of the same thickness on the end faces of the upper and lower brake shoes, hook the brake shoe spring in place.

T o o l : flat-nosed pliers.

Fig. 148

Adjusting the stop light switch

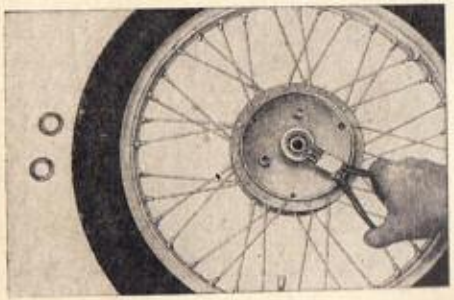
The stop light is adjusted with the help of an open-ended spanner without loosening the check nut. The shaft is turned by means of an open-ended spaner, width over flats 8, until the stop light flashes up. If necessary, the contact must be readjusted in the interior. Checking is effected by actuating the pedal brake while the engine is running.

T o o l : spanner, width over flats 8 mm,
screw-driver 4 mm.

Fig. 149

11. Work at the Wheel Hub

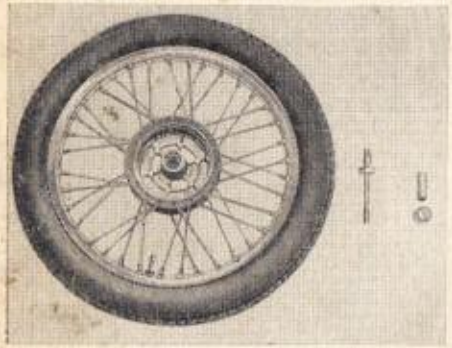
11.1. Demounting the Wheel Bearings



The rear wheel has already been removed from the vehicle.
Remove the packing rings and the snap ring.

T o o l : screw-driver 9 mm,
taper-nose pliers.

Fig. 150

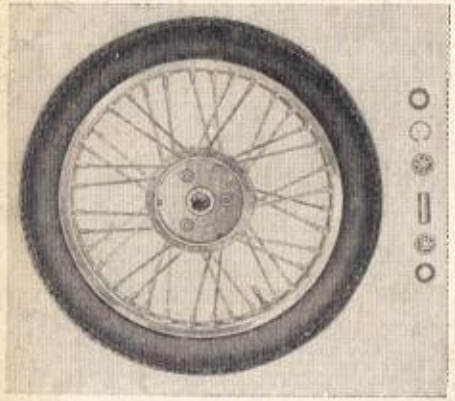


Insert the pulling device for wheel bearings into the wheel hub, tighten the expanding mandrel and then remove the wheel bearings one after the other, remove the spacer tube.

T o o l : spanner, width over flats 14 mm,
spanner, width over flats 9 mm,
rubber mallet,
pulling mandrel for wheel bearings DV 6.

Fig. 151

11.2. Fitting the Wheel Bearings



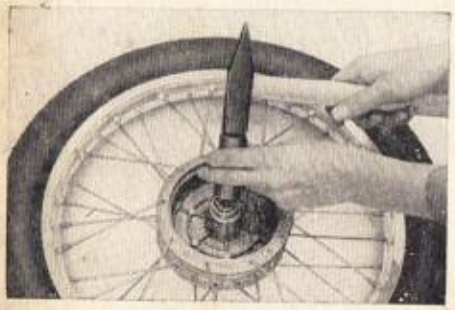
Wheel hub and individual parts are perfectly clean.
Fit the left hand wheel bearing 6201 together with an amount of 2 cm^3 of antifriction bearing grease.

T o o l : mandrel press (hollow mandrel, locksmith's hammer).

Note!

The length of the spacer tube must be $48.7_{-0.2}$ mm.

Fig. 152



Fit the spacer tube and the right-hand wheel bearing 6201 also with an amount of 2 cm^3 of antifriction bearing grease. Provide the two packing rings with graphite paste (about 1 cm^3) for sealing lips and press them in place.

T o o l : mandrel press (hollow mandrel, locksmith's hammer).

Fig. 153

12. Repair of the Telescopic Fork

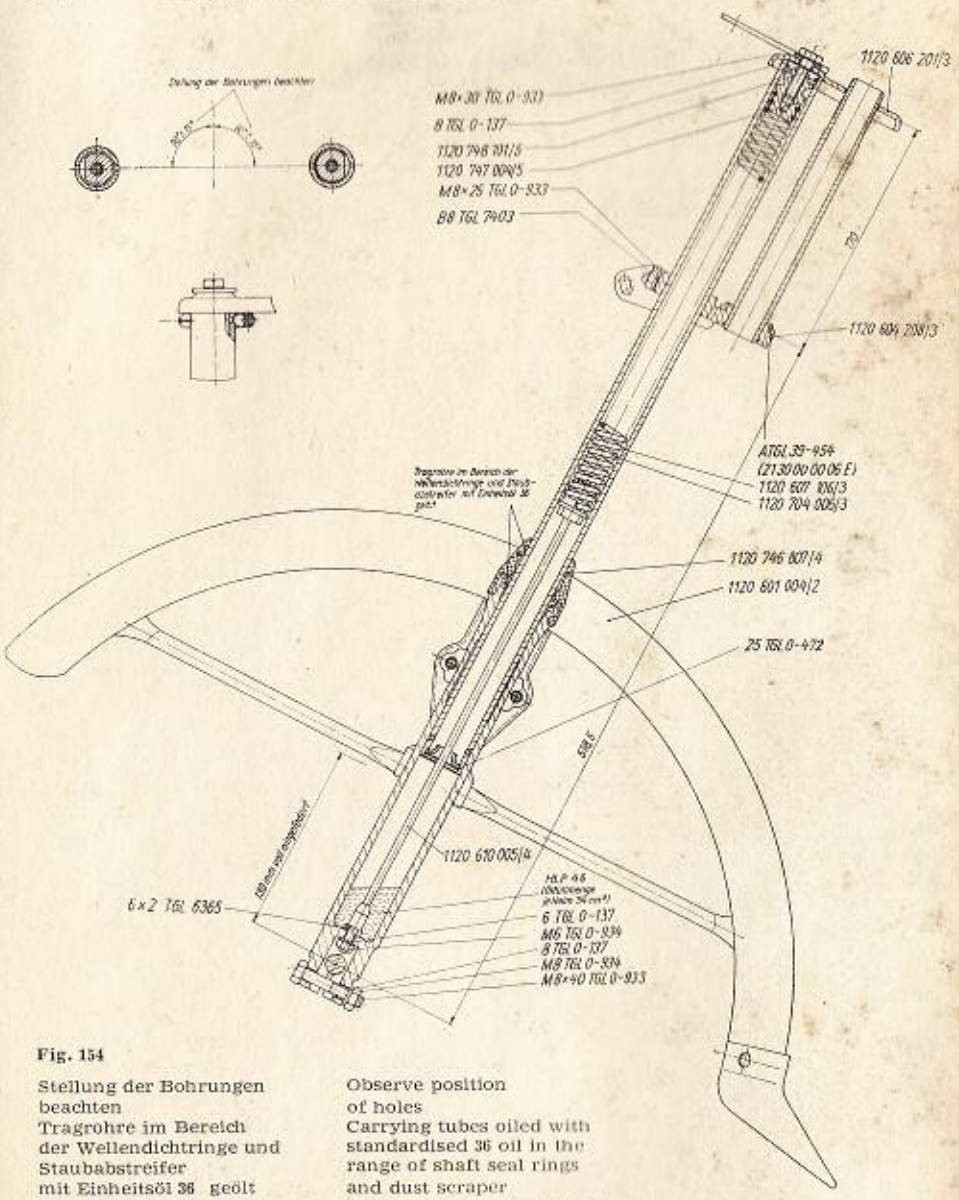
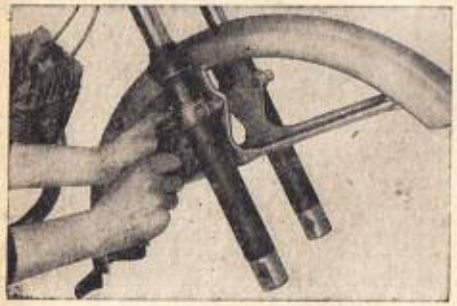


Fig. 154

Stellung der Bohrungen beachten	Observe position of holes
Tragrohre im Bereich der Wellendichtringe und Staubabstreifer mit Einheitsöl 36 geölt	Carrying tubes oiled with standardised 36 oil in the range of shaft seal rings and dust scraper
130 mm voll eingefedert	130 mm spring fully loaded
HLP 46 (Ölfüllmenge je Holm 34 cm^3)	HLP 46 (oil capacity 34 cm^3 per fork member)

The telescopic fork of the S 51 light motor-cycle is an undamped springing element with a hydraulic limit stop. Its sliding tubes consist of a hammered aluminium alloy, the surface of the carrying tubes are provided with hard chromium plating. Demounting and mounting the complete fork will be facilitated considerably when the load on the carrying springs is retained by a suitable means (wire hook between mudguard and lower fork guide).

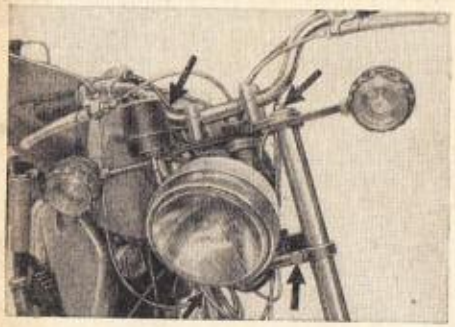
12.1. Removing the Fork Bars and Bellows



Remove the front mudguard. For this purpose, remove the two fastening screws M 6 × 35 with washer 6.4, spring ring B 6 and nut M 6 from the clamps at the sliding tubes.

T o o l : spanner, width over flats 10 mm.

Fig. 155



Remove the fastening screws M 8 × 30 from the top fork guide and loosen the clamping screws M 8 × 25 from the lower fork guide.
Pull the fork bars, while turning them slightly, from the fork guides (if necessary, loosen them from the seat in the upper fork guide by applying a slight blow, prior to the pulling action).
Remove the bellows from the fork bars.

T o o l : spanner, width over flats 13.

Fig. 156

Instructions for subsequently mounting the bellows:

The complete fork bars are removed from the fork guides.
Remove the dust wiper.
Press the plastic cap into the annular groove of the bellows. With this, the vent hole in the bellows is covered and a tight fit on the carrying tube ensured.
Slightly oil the carrying tube.

Push the bellows in their place and press them into the annular groove of the slide tube.
Mount the complete fork bars.
Shift the bellows upwards until they contact the lower fork guides.

12.2. Dismantling the Fork Bars

The structure of the two fork bars is practically the same. Only the left-hand bar is provided at its foot with a clamping screw M 8 × 45, a spring washer 8 and a hexagon nut M 8 for the knockout wheel axle to prevent it from turning.

Remove the dust wiper from the slide tube, clamp the foot of the bar carefully and vertically in a vice. Pull the carrying tube upwards to its final position and remove the snap ring 25 from the lower end of the carrying tube.
Pull off the carrying tube upwards.

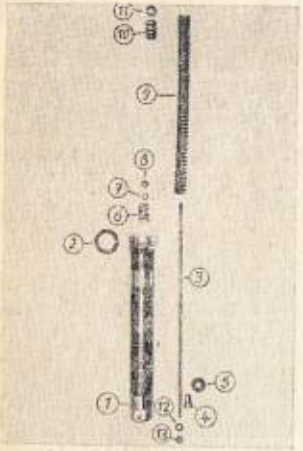
T o o l : taper-nose pliers, spanner, width over flats 13.

Fig. 157

Pour out the oil filling and clamp the slide tube horizontally in a vice. Loosen the M 6 nut from the slide tube foot and remove the lower spring holder with supporting spring from the slide tube.
Turn the supporting spring from the lower clamping member.

T o o l : L-handled socket wrench, width over flats 10 mm.

Fig. 158

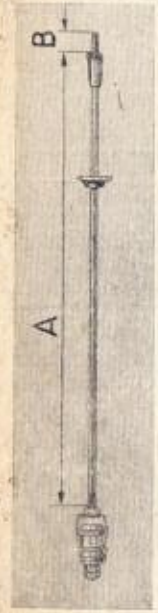


Individual parts of the slide tube and the spring element:

Fig. 159

(1) Slide tube
(2) Shaft seal ring D 30 × 40 × 7, TGL 16454
(3) Rod for spring holder
(4) Cone
(5) Stop plate
(6) Lower spring holder
(7) Washer 6
(8) Hexagon nut M 6
(9) Supporting spring (304 ± 5 mm long)
(10) Upper spring holder
(11) Sealing washer
(12) Annular ring 6 × 2
(13) Hexagon nut

12.3. Assembling the Fork Bars and the Fork



Complete the lower spring holder.
All screwed connections must be tightened with a torque of 4.9 Nm (0.5 kpm).
The cone is sealed by means of an annular ring 6 × 2.

$A = 331 \pm 1$ mm
$B = 13$ mm

Tool: spanner, width over flats 10 mm,
spanner, width over flats 13 mm.

Fig. 160

Fit the annular ring and insert it together with the spring holder into the carefully cleaned slide tube which, prior to this, has been provided with the sealing ring D 30 × 40 × 7 (TGL 16454 special design of the internal diameter).
Put the rod of the spring holder with its lower screw thread through the hole in the slide tube foot, fit the spring washer 6 and screw on the nut M 6 (the assembly must be oil-tight).

Note:

The lower spring holder is sealed by means of an annular ring 6 × 2 which is mounted under the cone and must not be forgotten.

Tool: L-handled socket wrench, width over flats 10 mm

Fig. 161

Provide the supporting spring with the upper spring holder and screw it into the lower spring holder. The sealing washer must be placed on the upper spring holder and then the carrying tube mounted. Move the limit stop into its upper position and insert it into the carrying tube.

Tool: taper-nose pliers (bent)

Fig. 162

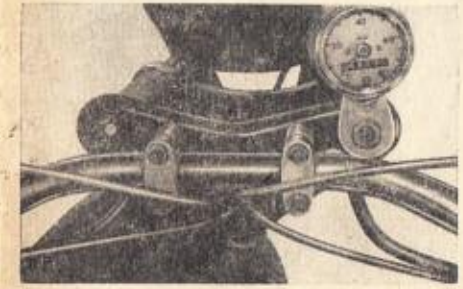
Push the cover plate over the slide tube opening and mount the snap ring 25.

T o o l : cover plate,
taper-nose pliers (bent).

Fig. 163

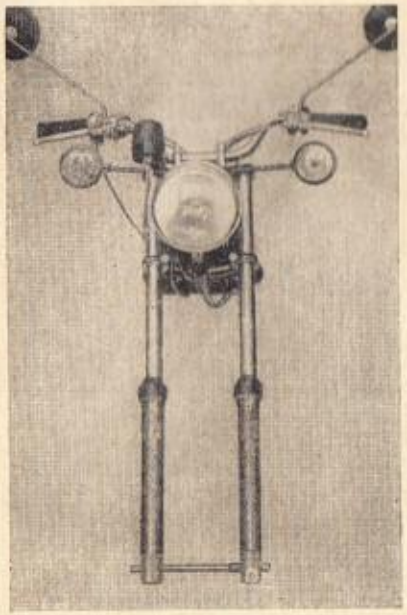
Pour an amount of 34 cm^3 of hydraulic oil, 46 mm^2/s (46 cSt) at 50 °C, into each fork bar and insert the bars into the fork guides.

Fig. 164



Provide the fastening screws M 8 × 25 with washers, put them into the upper fork guide and tighten them.
Insert the holder for the speedometer 1120 715 503 into the right-hand fork bar.
When mounting, take care that the upper spring holder is properly seated in the hexagonal recess in the upper fork guide.

Fig. 165

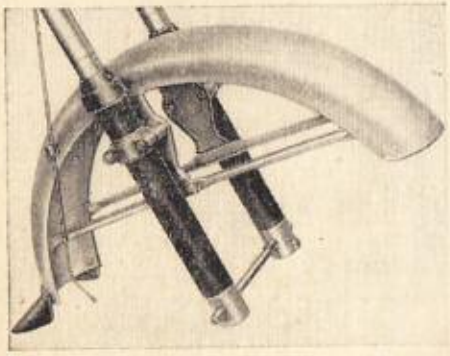


By turning the slide tubes clockwise with respect to the travel direction, the carrying tubes have to be subjected to a slight pre-tension.
Adjust the fork bars together with the knockout wheel axle and then tighten the clamping screws in the lower fork guide.

T o o l : spanner, width over flats 13 mm

Fig. 166

Mount the front mudguard.
For this purpose, put the halves of the clamps into the recesses provided for them in the slide tubes and insert the bolts M 6 × 55 together with the washers 6.4 put on them into the holes of the clamps. Fit the mudguard, fit the spring rings B 6 and properly tighten the M 6 nuts.
Check the assembly for proper functioning.
Mount the front wheel.



T o o l : spanner, width over flats 10 mm,
spanner, width over flats 13 mm,
spanner, width over flats 19 mm.

Fig. 167

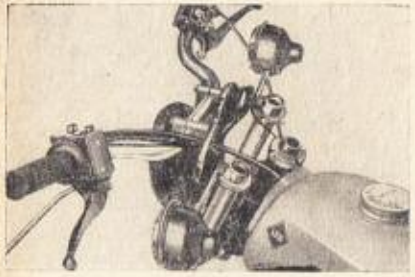
13. Demounting and Mounting the Steering Bearings

For demounting and mounting the steering bearings, neither the front fork nor the handlebars have to be removed. The only thing to do is to disconnect the cable controls passing through the guide tube of the front fork from the operating elements at the handlebars.

Remove the cable control bushing from the slotted nut at the guide tube and loosen the slotted nut.

T o o l : pin spanner

Fig. 168



Remove the two fastening screws M 8 × 30 from the top fork guide and remove the fork guide together with the handlebars.

T o o l : spanner, width over flats 13 mm.

Fig. 169

Loosen the top fork track ring and remove the complete front fork from the front tube of the frame.

T o o l : pin spanner

Fig. 170

14. Repair of the Suspension Units

14.1. Hydraulically Damped Suspension Units without Adjusting Device

Design

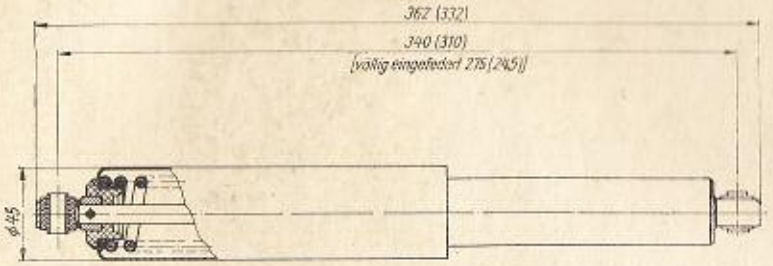


Fig. 171

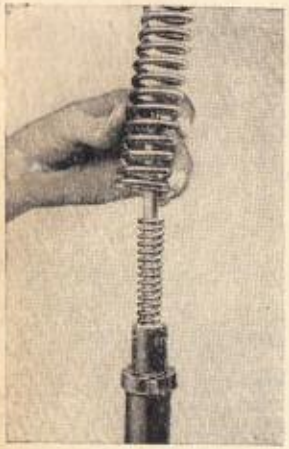
völlig eingefedert completely retracted

The values in ( ) apply to the front suspension units of the KR 51/2 types E and L

Replacement of the internal supporting spring

Press down the upper protective sleeve for some distance and remove the semicups.

Fig. 172



Remove the protective sleeve and remove the supporting spring from the piston rod.

Fig. 173

Check the shock-absorber for tightness and signs of wear.
Grease the supporting spring and put it on the shock-absorber.

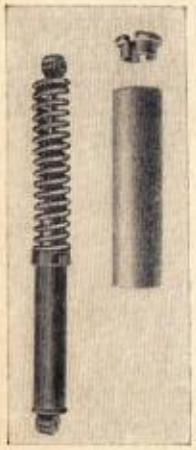
Fig. 174

Characteristics of the supporting spring of the rear suspension units:

Overall length 163 mm
Power increase per mm of spring deflection
c = 19.5 N/mm (2.0 kp/mm)
[26.0 N/mm (2.6 kp/mm)]
Number of springing turns
cf = 14.5, in addition one turn bent and ground on each end.
[] applies to the supporting spring of the suspension units with exposed supporting spring.

Fig. 175

Characteristics of the supporting spring of the front suspension units (KR 51/2 E and L):



Overall length 165 mm
Power increase per mm of spring deflection
c = 5.98 N/mm (0.6 kp/mm)
Number of springing turns
cf = 13.5, in addition one turn bent and ground on each end.

Push the protective tube over the supporting spring, press it down and insert the semi-cups.

Fig. 176

Replacement of the externally arranged supporting spring

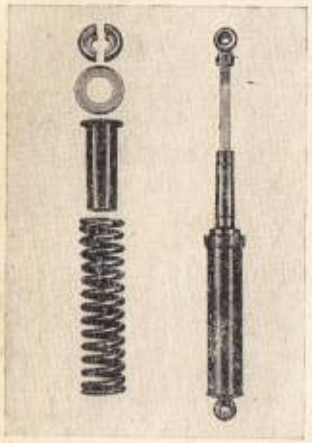


Fig. 177

The same operations have to be carried out as those which are also required for the replacement of the internally arranged supporting spring while the demounting of the protective sleeve is omitted.

14.1.1. Repair of the Hydraulic Shock Absorbers

The telescopic shock absorbers used by us operate on the principle of double-acting two-tube shock absorbers (system "Hartha").

Mode of action in the direction of pressure:

The piston provided with passages and a valve plate moves down through the damping cylinder which is filled with oil. In this action, the damping fluid must overcome the drag offered by the flow caused by the configuration of the piston. The energy entering the damper as a cause of a bump in the road is consumed in this way. The oil volume displaced by the piston rod is pressed through the bottom valve of the damping cylinder into the scape between protecting tube and damping cylinder. In this connection, energy is also consumed. The damping force can be varied by means of the valve screw provided in the bottom valve.

Mode of action in the direction of tension:

The piston moves upward in the direction of tension. The oil present in the working compartment (this is above the piston) passes through the openings provided for this purpose between piston rod and piston and is compelled to lift a parcel of spring disks closing these openings. The pre-load on this spring disk parcel can also be changed to ensure the desired damping force be means of an adjusting nut (on the piston rod)! The displacement of oil caused by the compression of the spring and

effected by the piston rod is compensated by the bottom valve from the reserve compartment (between protective tube and cylinder).

Functional troubles are due to:

an oil filling contrary to specifications

[52 ± 3 cm^3 of shock-absorber fluid having a viscosity of
30 to 38 mm^2/s (cSt) at 20 °C or
8 to 12 mm^2/s (cSt) at 50 °C];

contaminated or incorrectly adjusted valves,

in case of leaks,
in case of damage due to the action of undue force,
in case of wear or
due to errors in assembling.

Care, maintenance, functional test

No maintenance is required for the telescopic shock absorber. The rubber elements for fastening the shock absorber must not get into contact with grease. After every 3,000 km of road operation, the component must be checked for proper fastening to the vehicle and the protective tube for traces of oil as a sign of leaks. For testing the adjusted damping forces, special testing equipment is required which permits reproducable recording (diagrams) of the damping process. Curve and magnitude of the damping force are of decisive importance to the roadability of the vehicle. Checking by hand is not permissible because in this way it is not possible to find out whether or not damping action is given over the full working stroke. The test must be made with the shock-absorber in vertical position.
Due to transport or storage it may occur that an "idle stroke" is felt when expanding the telescopic shock absorber. This can be corrected by "pumping" the shock absorber in its mounted position so that the oil collected in the reserve compartment is again fed into the cylinder.

Characteristics of the shock absorber, rear:

Type of telescopic shock absorber	C 22-70 F-25/5
Damping force	
direction of tension	275 ± 49 N (28 ± 5 kp)
direction of pressure	49 ± 29 N (5 ± 3 kp)
Length	338 mm
Oil capacity	52 ± 3 cm^3
Test speed	100 rpm
Test stroke	40 mm

Characteristics of the shock absorber, front:

(KR 51/2 E and L)

Type of telescopic shock absorber	C 22-70 G-13/5
Damping force	
direction of tension	137 ± 49 N (14 ± 5 kp)
direction of pressure	49 ± 29 N (5 ± 3 kp)
Length	310 mm
Oil capacity	52 ±3 cm^3
Test speed	100 rpm
Test stroke	40 mm

Functional troubles and their causes:

1. Pressure stage fails to work:

   Sealing disk or bottom valve vails to seal (sealing disk distorted, sealing areas at the bottom valve body not even). Dirt particles between sealing disk and bottom valve body.

2. Tension stage fails to work:

   Dirt between sealing disk and sealing surfaces at the piston as well as between valve plate and contact area. Sealing disk at the piston does not seal (sealing disk distorted, piston sealing area not perfectly even).

3. Damping force starts acting later after every stroke in both tension and compression stages:

   Bottom valve fails to seal properly at the faces of the cylinder. Bottom valve in oblique position in the protective tube.

4. Damper shows oil loss:

   Piston rod seal (lip-type of packing) defective.
   Piston rod defective.
   Protective tube seal defectiv
   Protective tube leaky (abrasion, crack).

5. Damping action starts not smooth but jerkily:

   Damping liquid missing.
   Bottom valve leaky.

6. Damper fails to produce any effect without visible loss of oil:

   Foreign particle between membrane of the piston valve.

14.2. Hydraulically Damped Suspension Units with Adjusting Device

General remarks

The increased demand on the cycle parts is met by the incorporation of twice adjustable suspension units which have already stood the test. The pre-load on the suspension spring can be adjusted in tow steps by means of an adjusting sleeve and thus adapted to the given state of load. The two ways of adjustment are marked as follows:

solo operation – normal spring tension:	points in travel direction lever of the adjusting sleeve
operation with pillionist – increased spring tension:	lever of the adjusting sleeve points opposite to the travel direction

We should like to point out that the piston rod of the shock absorbers is provided with a spacing rubber element having a length of 16 mm (Fig. 5) which prevents any contact of the rear wheel with the rear mudguard when the suspension units are retracted as far as this is possible. Therefore, shock absorbers without this spacer rubber element must not be built in the vehicle.
The suspension units are classified in two groups according to their damping force. To identify the suspension units, one of these groups is provided with a green dot. When replacing suspension units, dampers of the same group must be used.

Characteristics of the supporting spring

Overall length: 260^{18} mm
Power increase per mm of spring de-flection
$c = 15.20$ N/mm (1.60 kp/mm)
Number of springing turns
$if = 14.5$

Characteristics of the shock absorber

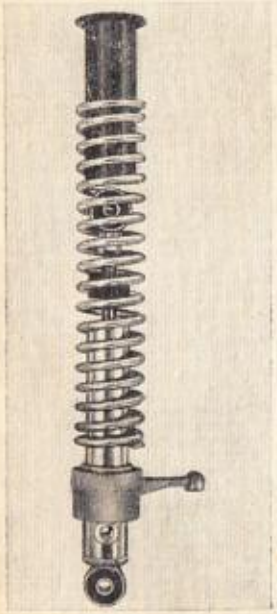
Damping force		
direction of tension	940 ± 60 N (96 ± 6 kp)	group without green dot
	820 ± 60 N (84 ± 6 kp)	group with green dot
direction of pressure	80 ± 30 N (8 ± 3 kp)	
Length	355 mm	
compressed	277_{-5} mm	
Oil capacity	67 ± 3 cm^3	
Test speed	200 rpm	
Test stroke	42 mm	

14.2.1. **Repair Work**

Dismantling operations

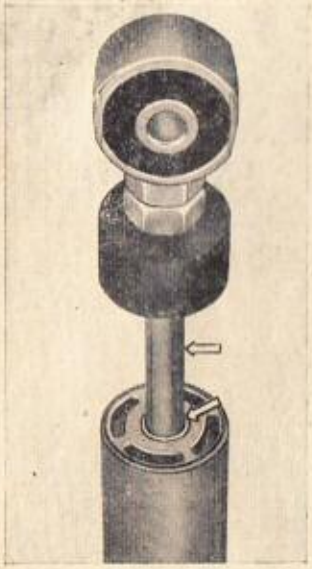
Clamp the suspension unit in a vice.
Set the adjusting sleeve to solo operation.
Slightly press down the supporting spring and remove the semi-cups.

Fig. 178



Remove the protective sleeve, the supporting spring and the adjusting sleeve from the shock absorber.

Fig. 179

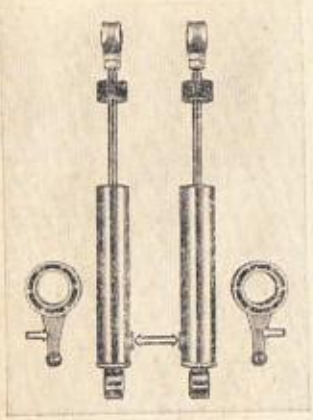


Check the shock absorber for leaks and signs of wear.

The suspension unit is assembled in the inverse order of the dismantling operations.

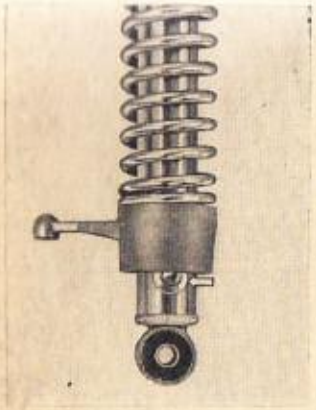
Fig. 180

14.2.2. **Information about Mounting into the Cycle Parts**



Before inserting the semi-cups, set the adjusting sleeve to solo operation. The levers of the adjusting sleeves are marked by *R* or *L*.
Adjusting sleeves marked by *R*, have to be mounted on the left-hand suspension unit (in travel direction); the adjusting sleeves marked by *L* on the right-hand suspension unit. The adjusting cams of the shock absorbers of the two suspension units in the mounted state must face each other.

Fig. 181



In the complete suspension unit, the adjusting cam becomes visible after turning the adjusting sleeve to position operation with pillionist. The illustration shows the left-hand suspension unit.

Fig. 182

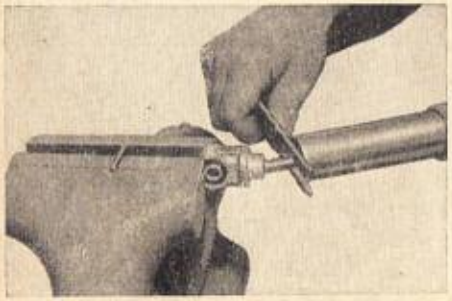
14.3. Repair of the Friction-damped Suspension Units (KR 51/2 N)

Dismantling the suspension units

Clamp the suspension unit in a vice. Compress the supporting spring with the lower protective sleeve and insert the retaining fork EV 8 into the respective recess.

T o o l : retaining fork EV 8

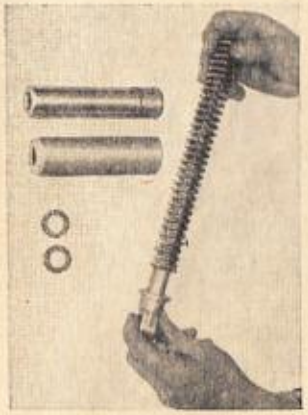
Fig. 183



Remove the notched cylindrical pin 4 × 28 from the lower holding piece and pull the holding piece from the piston rod.

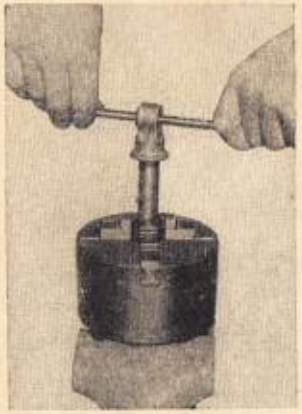
T o o l : drift 3.8 mm in diameter, locksmith's hammer.

Fig. 184



Remove the retaining fork.
Remove the lower protective sleeve, supporting spring and upper protective sleeve.

Fig. 185



Remove the rubber buffer from the piston rod and clamp the slide tube at its lower end.

T o o l : Three-jaw chuck.

Fig. 186

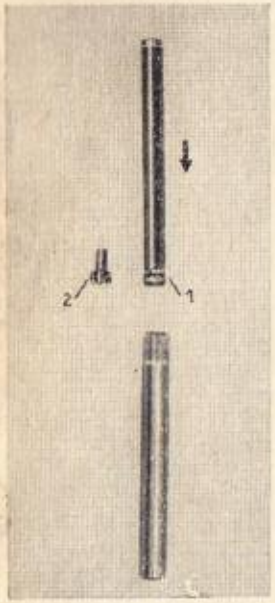
Unscrew the upper holding piece from the slide tube and push out the piston rod with the frictional segments.

T o o l : mandrel

Fig. 187

Assembling the suspension unit

Mounting the friction shock absorber



Check the state of wear of the frictional segments and of the slide tube. After about 3,000 to 5,000 km of road operation, the slide tube must be re-calibrated with the help of a pressure mandrel (ball diameter 15.1 [1] and 15.15 mm [2]).
(This work is done by regenerating enterprises.)

T o o l : pressure mandrel,
locksmith's hammer,
mandrel press.

Fig. 188

Insert the piston rod with the frictional segments into the fitting sleeve EV 7.

T o o l : fitting sleeve EV 7,
mandrel press.

Fig. 189

Press the piston rod into the slide tube.

T o o l : fitting sleeve EV 7,
mandrel press.

Fig. 190

Screw on the upper holding piece. **Slightly** grease the piston rod and carry out a functional test.

T o o l : three-jaw chuck,
mandrel.

Fig. 191

Completing the suspension unit

Slip the rubber buffer on the piston rod, mount the upper protective tube and a washer.

Fig. 192

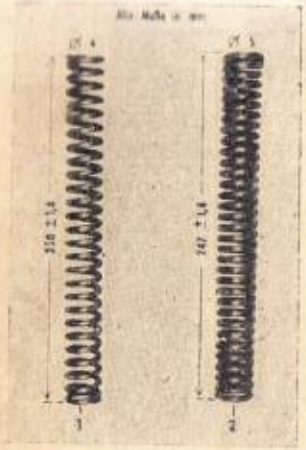


Fig. 193. Characteristics of the supporting springs:

(1) supporting spring, front
(2) supporting spring, rear

Alle Maße in mm — All dimensions in mm

Provide the supporting spring with viscous grease (lubricating grease must not get into the interior of the friction shock absorber!). Mount the supporting washer and the lower protective tube.

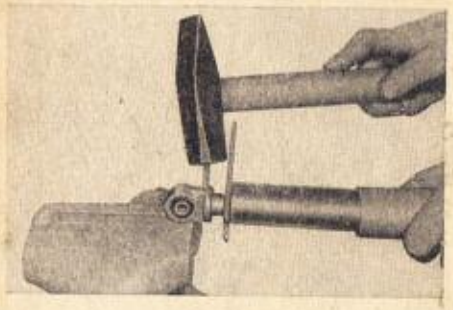


Fig. 194

Compress the supporting spring, insert the retaining fork, put on the lower holding piece and insert the notched cylindrical pin 4 × 28.

T o o l : retaining fork EV 8,
locksmith's hammer.

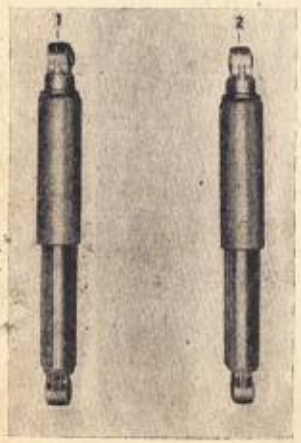


Fig. 195

(1) suspension units, front
(2) suspension units, rear

Remove the retaining fork and mount the suspension unit according to its marking on the vehicle.

15. Work at the Cycle Parts

The cycle parts have the form of a tubular construction consisting of sub-assemblies screwed together. Consequently, many components can be replaced conveniently.

15.1. Replacement of the Dual Seat, the Fuel Tank and the Luggage Carrier

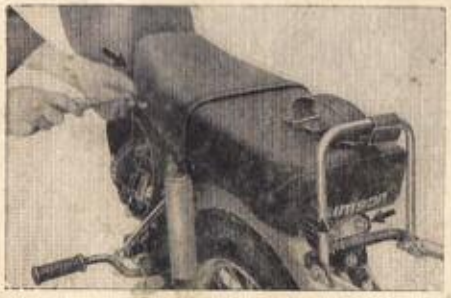


Fig. 196

Loosen the front and rear dual-seat fasteners (at the front, a fillister head screw M 6 × 16, at the rear two hexagon-head screws M 6 × 14) and remove the dual seat.

T o o l : spanner, width over flats 10 mm,
screw-driver 6 mm.

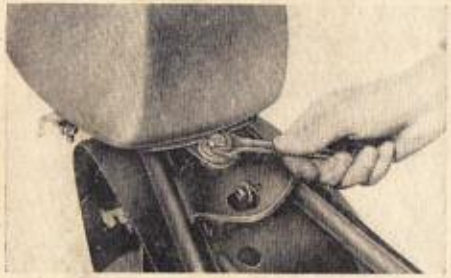


Fig. 197

Remove the fastening screw M 8 × 20 and withdraw the fuel tank backwards.

T o o l : spanner, width over flats 13 mm.

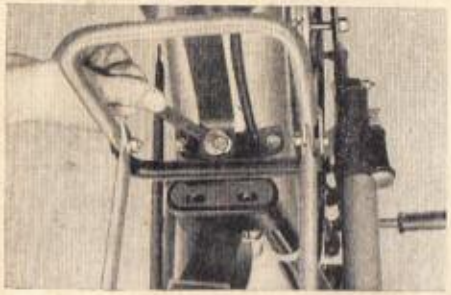


Fig. 198

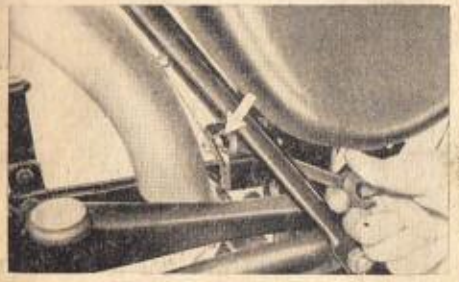
Remove the M 6 × 14 fastening screw for the tail-lamp holder and the two M 6 × 12 fastening screws for the luggage carrier and remove the luggage carrier.

T o o l : spanner, width over flats 10 mm.

The assembling operations are to be performed in the inverse order; pay particular attention to the properly tight fit of the screwed connections and the correct insertion of the locking elements (washers, spring washers, spring rings) and sectional rubber parts (fuel tank).

15.2. Demounting and Mounting the Rear Mudguard and the Casing Central Part

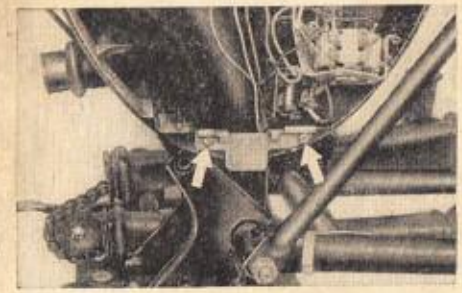
Open the container for accessories, remove the accessories and remove the battery, open the intake muffler (unhook the cover), disconnect the cable connections from the frame.



Loosen the lower M 6 × 12 fastening screw in the spring strip for fastening the mudguard and remove the mudguard backwards.

T o o l : spanner, width over flats 10 mm.

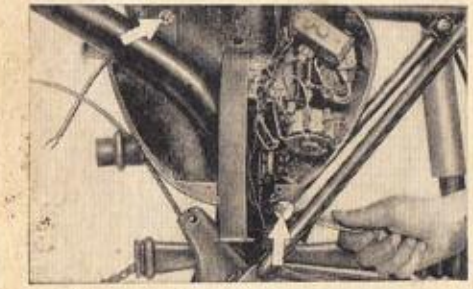
Fig. 199



Loosen the holder for the battery strap (two fillister-head sheet-metal screws 4.8 × 13) and remove the two hole covers from the openings for the frame tube in the central part of the casing.

T o o l : screw-driver 6 mm

Fig. 200



Loosen the internal fastening screw, size M 6 × 25, which also serves as earth point, (together with washer 6.4, toothed lock washer A 8, second washer 6.4, hexagon nut M 6, spring washer 6 and second hexagon nut M 6) and external fastening screw M 6 × 22 (together with washer 6.4, spring ring B 6 and hexagon nut M 6) and remove the casing central part towards the right.

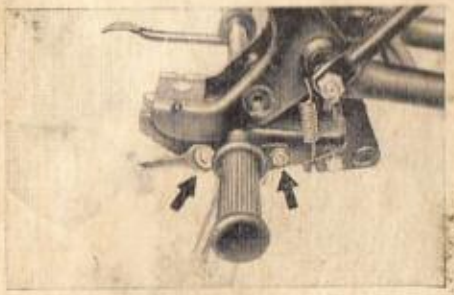
T o o l : L-handled socket wrench, width over flats 10 mm,
spanner, width over flats 10 mm.

Fig. 201

The mounting operations have to be performed in the inverse order. In this procedure pay particular attention to proper, non-damaged cable terminals and correct installation of the electrical lines!

15.3. Replacement of the Foot-rest Carrier

This operation can also be done with the vehicle completely assembled.



Remove the front fastening screws M 8 × 14 (together with spring ring B 8 and hexagon nut M 8), loosen the bearing screw for the prop stand M 8 × 90. Remove the foot-rest carrier in foward direction.

T o o l : spanner, width over flats 13 mm

Fig. 202

Mounting is to be performed in the inverse order.

15.4. Replacement of the Prop Stand

This operation can also be done with the vehicle completely assembled.

Unhook the prop stand spring. Remove the bearing bolt M 8 × 90 (together with washer 8.4, spring ring B 8 and hexagon nut M 8). Remove the prop stand.

T o o l : spanner, width over flats 13 mm,
combination pliers.

Fig. 203

Mounting is to be performed in the inverse order.
The prop stand bearing must be provided with an amount of about 2 g of antifriction bearing grease.

15.5. Replacement of the Brake Pedal Lever

This operation can also be done with the vehicle completely assembled.

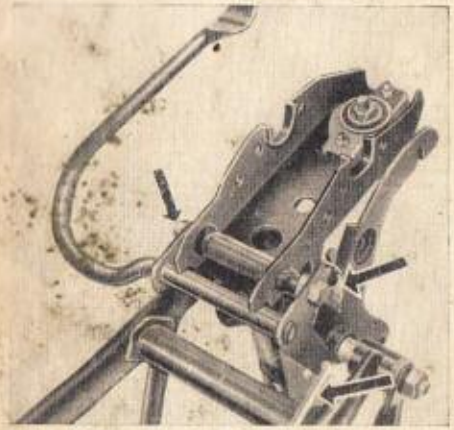


Fig. 204

Unhook the brake linkage and the return spring.
Remove the bearing bolt M 8 × 110 (together with spring ring B 8 and hexagon nut M 8), remove the brake pedal lever, remove the protective caps and spacer tube.

T o o l : spanner, width over flats 13 mm.

Mounting is to be performed in the inverse order.
Provide the bearing bolt with about 2 g of antifriction bearing grease before fitting.

15.6. Replacement of the Rear Swing Arms

Prior to this work, the rear wheel and the rear wheel drive must be demounted, the spring for the prop stand and the spring for the brake pedal must be unhooked.

Fig. 205

Loosen the lower fastening of the suspension units (hexagon bolt M 8 × 45, washer 1126 126 503, spring ring B 8 and hexagon nut M 8).
Remove the left-hand hexagon nut M 12 × 1.5 (together with spring ring B 8) of the swing-arms bearing bolt. Press out the bearing bolt by means of a suitable mandrel which may be used to arrest the engine mounting, if required.
(Avoid damage to the screw threads!)
Remove the swing arms backwards.

T o o l : spanner, width over flats 13 mm,
spanner, width over flats 10 mm,
mandrel 10 mm in diameter,
locksmith's hammer.

Mounting is to be performed in the inverse order.

Advice regarding the sequence of assembling for vehicle types with frame-trussing braces:

From the left-hand (in travel direction) outside, the components have to be mounted as follows:

bolt with hexagon nut M 12 × 1.5
upper chord brace, left-hand
frame-trussing brace, left-hand
swing-arms bearing
engine bearing, left-hand
thrust bush

From the right-hand (in travel direction) outside, the components have to be mounted as follows:

hexagon nut M 12 × 1.5
spring washer 12
frame-trussing brace, right-hand
spring ring B 12
upper chord brace, right-hand
swing-arms bearing
engine bearing, right-hand
thrust bush

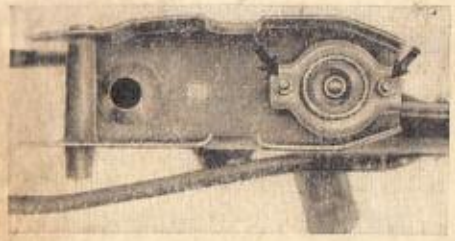
15.7. Replacement of the Engine Bearing

Prior to this operation, the engine must be removed and the swing-arms bearing bolt also.

Fig. 206

Remove the M 8 nut (together with spring ring B 8 and lower pressure member) of the carriage bolt M 8 × 45 and draw out the carriage bolt.
Remove the left-hand and right-hand engine bearings and the upper pressure member.

T o o l : L-handled socket wrench, width over flats 13 mm,



Remove the tray for the engine bearing. For this purpose, remove the two fastening bolts M 6 × 25 (together with spring ring B 6 and hexagon nut M 6).
Remove the tray and the bearing rubber.

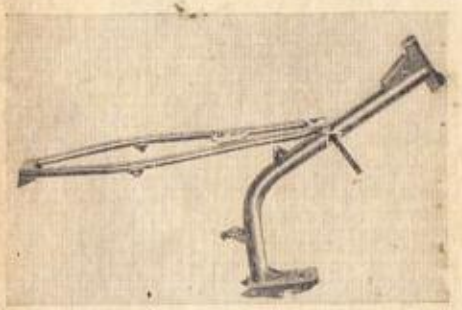
Tool: L-handled socket wrench, width over flats 10 mm,
spanner, width over flats 10 mm.

Fig. 207

Mounting is performed in the inverse order.
To facilitate assebling, tighten the hexagon nut of the carriage bolt at the engine bearing as the last operation.

15.8. Replacement of the Frame Upper Chord

This operation can be done with the vehicle completely assembled. Prior to this, the fuel tank and the dual seat must be removed.



Remove the front fastening bolt M 8 × 75 (together with spring ring B 8 and hexagon nut M 8) and loosen the upper fastening of the suspension unit (i.e. at each unit one hexagon bolt M 8 × 65 with washer 11 26126 503, spring ring B 8 and hexagon nut M 8).

Remove the frame upper chord.

Fig. 208

Mounting is to be performed in the inverse order.

15.9. Replacement of the Frame-trussing Braces

From the gusset plate, loosen the hexagon nut M 8, the hexagon-head bolt M 8 × 22 and the spring ring B 8. The swing-arms bearing bolt is removed according to Section 15.6.; the instructions given in this Section must be observed in any case. Mounting is to be performed in the inverse order.

16. Table of Conversion for the Introduction of the "International System of Units" (SI)

Comparison of the most important old units and the new SI units:

	old unit	new unit
quantity	conversion factor	
force	pond p kilopond kp	Newton N
	1 kp = 9.807 N (10 N) 1 N = 0.102 kp (0.1 kp)	
pressure; stress	kp/cm² at atm mm column of water bar	Pascal Pa or Newton N per square metre N/m² 1 Pa = 1 N/m²
	1 at = 1 kp/cm² = 98,070 Pa = 98.07 kPa = 0.09807 MPa 1 at = 1 kp/cm² ≈ 100,000 Pa ≈ 100 kPa ≈ 0.1 MPa 1 kp/mm² ≈ 10 MPa ≈ 10,000 kPa 1 Pa = 0.0000102 kp/cm² = 0.102 · 10^{-6} kp/mm² 1 kPa ≈ 0.01 kp/cm² ≈ 0.0001 kp/mm² 1 MPa ≈ 10 kp/cm² ≈ 0.1 kp/mm² 1 MPa ≈ 10 at	
work; energy; quantity of heat	kilopondmetre kpm kilocalorie kcal hp-hour hph	newtonmetre Nm or joule J or watt second Ws 1 J = 1 Nm = 1 Ws
	1 kpm = 9.807 J = 9.807 Nm = 9.807 Ws 1 kpm ≈ 10 J ≈ 10 Nm ≈ 10 Ws 1 kcal = 4,187 J 1 hph = 2.648 · 10^6 J	
	1 J 1 Ws 1 Nm } = 0.102 kpm = 0.000239 kcal = 3.777 · 10^{-7} hph	

	old unit	new unit
power	kilopond metre per second kpm/s kilocalorie per second kcal/s horsepower hp	netwon metre per second Nm/s or joule per second J/s or watt W 1 Nm/s = 1 J/s = 1 W
	1 kpm/s = 9.807 Nm/s = 9.807 J/s = 9.807 W 1 kcal/s = 4,187 Nm/s = 4,187 J/s = 4,187 kW 1 hp = 736 Nm/s = 736 J/s = 0.736 kW 1 Nm/s, 1 J/s, 1 W = 0.12 kpm/s = $2.388 \cdot 10^{-4}$ kcal/s = $1.36 \cdot 10^{-3}$ hp	
plane angle[1])	degree°	radiant rad
	1 degree = 0.017453 rad 1 rad = 57.296°	
temperature[1])	degree Celsius °C degree centigrade	Kelvin K
	°C = T (K) — 273.15 K T (K) = °C + 273.15 K	

[1]) The statement of the plane angle in degree and of the temperature in degree Celsius is permissible also after 1980.

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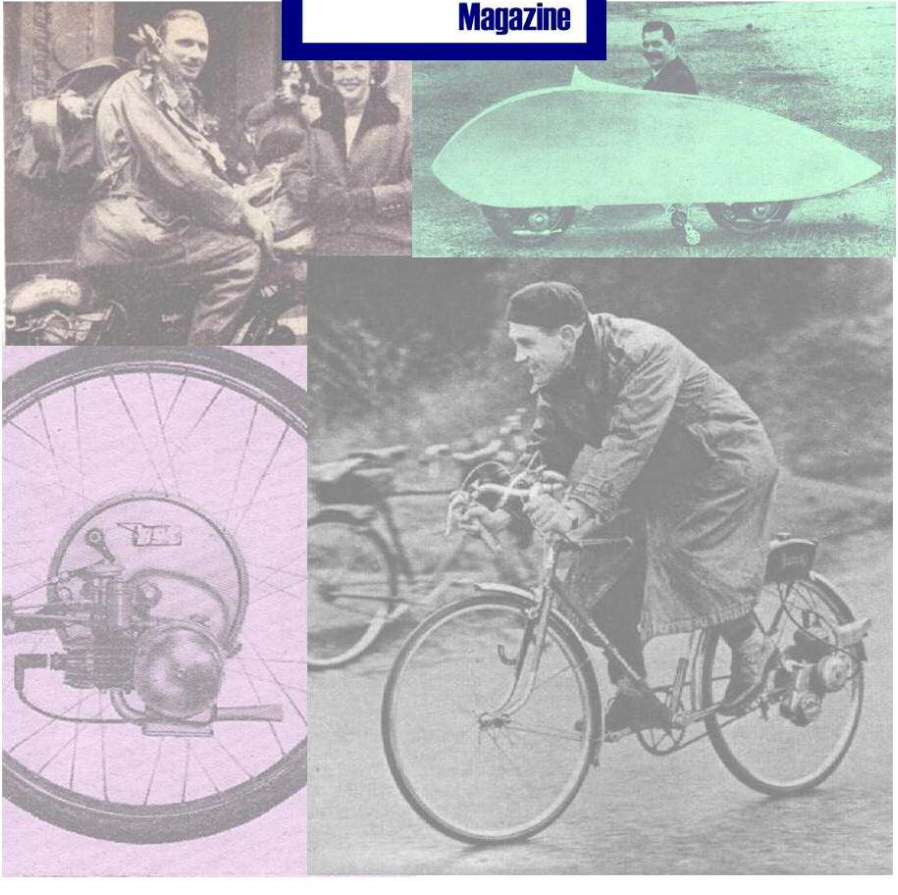

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