Repair Manual

for the

MZ MOTOR-CYCLES

ES 125 and ES 150

Edition 1966

VEB MOTORRADWERK ZSCHOPAU

Repair Manual

for the

MZ MOTOR-CYCLES

ES 125 and ES 150

With 155 illustrations

and 25 drawings of special tools

VEB MOTORRADWERK ZSCHOPAU

The motor-cycles types ES 125 and ES 150 are manufactured by VEB Motorradwerk Zschopau

This Repair Manual has been compiled by a group of authors in the employ of VEB Motorradwerk Zschopau

Translated from the German by Herbert Liebscher

VEB FACHBUCHVERLAG LEIPZIG

Dead line: 15. 3. 1966

Composition and print: (87) BBS Rudi Arndt, Berlin 1 6830

KG 3/54/67

RH/ES 125/150, engl.

PREFACE

We hold lengthy comments on MZ motor-cycles to be unnecessary. In the high latitudes of Finland, in the parching heat of Africa, under the most different operating conditions these motor-cycles run to the satisfaction of their owners.

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

Repair work is a matter of confidence in several respects:

Reliability and workmanship of the mechanics; the safety of the driver depends on them.

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

From these items result: no retouching work, short times of inoperation and low repair costs.

To ensure this, we describe not only the work of the fitter or mechanic, but also the symptoms of various faults and their possible causes.

A good workmanship in repairs largely depends on the use of the special tools and means recommended by MZ. They are available from the MZ Spare Sales Department; however, they can also be made by the experts of the repair shop, using the sketches given in the Appendix.

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

We hope this Reference Book offers the required information to the staffs of the workshops contracted for servicing our products at home and abroad, and to the friends of MZ motor-cycles throughout the world; and we wish good success to each and all.

VEB MOTORRADWERK ZSCHOPAU

Service Dept.

Contents

Fig. 1. ES 125/150, 1964/65 model

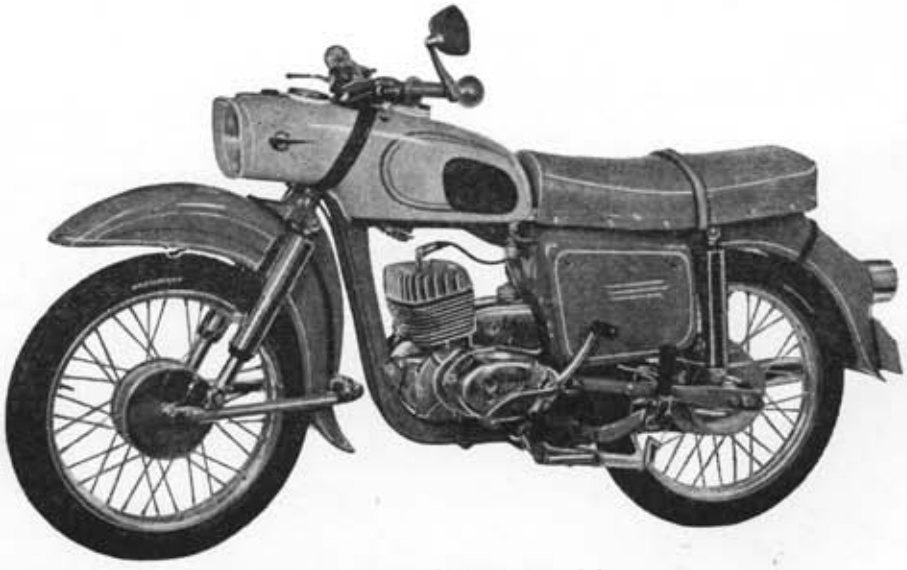


Fig. 2. ES 125/150, 1966 model

1. Technical Data

1.1. Engine

	ES 125	ES 150
Cycle	two-stroke reverse scavenging	two-stroke reverse scavenging
Cooling system	air-cooled	air-cooled
Number of cylinders	1	1
Stroke/bore	58/52	58/56
Swept volume	123 c.c.	143 c.c.
Ratio of compression	9 : 1	9 : 1
Compression volume with the sparking-plug inserted	15.4 c.c.	18.0 c.c.
Output at 5,500 to 5,800 r.p.m.	6.9 kW = 8.5 DIN h.p. or 9.5 SAE h.p.	7.35 kW = 10 DIN h.p. or 11 SAE h.p.
Maximum torque	1.10 kg-m	1.35 kg-m
Lubrication	petroil lubrication 33 : 1, special two-stroke motor oil	
Big-end bearing	cage-type needle bearing	
Crankshaft main bearing	3 ball-bearings type 6303 c 003 f (silent, 17 × 47 × 14)	
Lubrication of main bearings	by gear lubricant	
Piston	provided with 2 rings (2 mm in width) (Only use those marked "A", and for wide-fin cylinders those marked "B". Note explanation regarding Fig. 74.)	
Weight of piston complete with rings, gudgeon-pin and locking devices	160 ± 5 g	200 ± 5 g
Cylinder	light-alloy, liner of special grey cast-iron onto which the light metal is cast	
Timing in terms of crank angles (also holds for wide-fin cylinder):		
Inlet, port with point	142°	142.5°
Inlet, port without point	126°	126°
Transfer	110°	110°
Exhaust	152°	150°

1.2. Carburetter

1.2.1. Carburetters 22 KNB and 24 KN

	BVF 22 KNB 1–3	BVF 24 KN 1–2
Type	(two-lever barrel throttle valve with multi-hole atomiser)	
Carburetter characteristics:		
Transfer port diameter	22	24
Main jet	110	115
Needle jet	70	70
Partial-load needle No.	1 with 5 notches	3 with 7 notches
Needle position, adjustment from top	2nd to 4th notch (4th for running-in period)	3rd to 6th notch (6th for running-in period)
Pilot jet	35	45
Throttle opening	3.5 mm	4 mm
Pilot air screw	opened by 1.5 to 2.5 turns	opened by 1.5 to 2.5 turns
Fuel level in mm	21 + 1	28 + 1

	ES 125	ES 150
1.2.2. Carburetters 22 N and 24 N		
Type	BVF 22 N 1–1 (starting carburetter)	BVF 24 N 1–1 (starting carburetter)
Carburetter characteristics:		
Transfer port in mm	22	24
Main jet	90	92
Needle jet	65	65
Partial-load needle No.	c 1	c 3
Needle position, adjustment from top	3rd notch*) (4th for running-in)	3rd notch*) (4th for running-in)
Starter jet	70	75
Pilot air screw	opened by 2 to 3 turns	opened by 2.5 turns
Throttle opening	4 mm	3 mm
Air filter		
1962/63 model	wet-type filter with intake muffler;	
from 1964	dry air filter (paper filter cartridge) with intake muffler	

1.3. Electrical Equipment

Ignition	battery ignition	battery ignition
Ignition timing	4.5 mm before T.D.C. fixed setting	4.0 mm before T.D.C. fixed setting
Contact breaker		
points gap	0.4 mm	0.4 mm
Sparking plug	Isolator M 14/240	Isolator M 14/240
Electrode gap	0.6 mm	0.6 mm
Dynamo	direct current, 6 V, 60 W, short-time operation 90 W	
Charging control light (red)	in speedometer	
Regulator	RSC 60/6	
Battery	6 V, 12 Ah (lead storage battery, flat type)	
Ignition coil	6 V, below left-hand side panelling	
Headlamp	fixed – lamp opening 136 mm	
Tail lamp	lamp opening 95 mm	
combined with stop light	contact at rear brake spanner	
Flashing-light indicators	at the two handle-bar ends (switch at right-hand handle bar)	
Flasher unit	in headlamp shell	
Horn	below fuel tank	
By-pass light signal	actuated by push-button arranged below dimmer switch	
Electric bulbs		
Twin-filament bulb	6 V, 45/40 W, asymmetric passing beam	
Parking light	6 V, 2 W, cap BA 9 s	
Stop light	6 V, 18 W, cap S 8.5	
Tail light	6 V, 5 W, cap S 8	
Flashing light	6 V, 18 W, cap S 8.5	
Charging control light	6 V, 1.2 W	
Idling indicating light	6 V, 1.2 W	
Speedometer illumination	6 V, 1.2 W	

1.4. Transmission

Clutch	multiple disk clutch in oil-bath
Gear-shift system	foot-operated, left-hand side
Number of speeds	4

*) Range of adjustment within needle positions from 2nd to 4th notch; always take the appearance of the plug into consideration

	ES 125	ES 150
Gear ratios		
1st speed	3.05 : 1	
2nd speed	1.805 : 1	
3rd speed	1.285 : 1	
4th speed	1 : 1	
Bearing on clutch shaft	6202 (15 × 35 × 11)	
Bearing on countershaft	6201 (12 × 32 × 10)	
Bearing on shaft wheel	6004 (20 × 42 × 12)	
Idling indicating light	electric indicating light (green) in speedometer	

1.5. Power Train

Transmission		
engine/gear	2.31 : 1 = 16 : 37 teeth	
Silent chain	A 9.5 × 7.5 ($^3/_8 \times ^5/_{16}$ in.) 48 links	
Transmission gear/rear wheel	3.2 : 1 = 15 : 48 sprockets	
	3.0 : 1 = 16 : 48 sprockets	
Roller chain	12.7 × 6.4 × 8.51 ($^1/_2 \times ^1/_4$ in.) 120 rollers	

1.6. Basic Structure

Frame	continuous pressed-steel frame, folded	
Steering angle	61°	
Castor	95 mm	
Suspension system	front swing fork leading type, rear trailing type	
front	suspension units with hydraulic shock absorber, 150 mm	
rear	suspension units with hydraulic shock absorber, 100 mm, adjustable	
Wheels	spoke type	
Rime size, front and rear	1.85 B × 18	1.85 B × 18
Tyres, front and rear	3.00 – 18	3.00 – 18
Dynamic radius of rear-wheel tyre	292 mm	
Tyre inflation pressure (in atm. excess pressure over atmosphere)		
front	1.4 (19.91 p.s.i.)	1.4 (19.91 p.s.i.)
rear	1.8 (25.60 p.s.i.) without pillion rider	2.0 (28.45 p.s.i.) with pillion rider
rear	1.8 (25.60 p.s.i.) without pillion rider	2.0 (28.45 p.s.i.) with pillion rider
Brakes	central brakes, diameter 150 mm, shoe width 30 mm	
Brake actuation	mechanically, by means of cable controls for both brakes	

1.7. Dimensions and Weights

Wheel base	1,270 mm	1,270 mm
Length	1,990 mm	1,990 mm
Width (with flashing lights)	about 750 mm	about 750 mm
Height (with mirror), unloaded	about 1,150 mm	about 1,150 mm
Ground clearance, loaded	about 100 mm	about 100 mm
Weight unloaded (formerly weight empty)	112 kg	112 kg
Carrying capacity	158 kg	158 kg
Maximum total weight	270 kg	270 kg

1.8. Capacities

(Capacities in gallons [Brit.] in brackets)

Gear	0.45 litres (0.099 gal.) of motor oil (viscosity to be selected in accordance with the season, summer or winter oil)	
Fuel tank	12 litres (2.64 gal.) of fuel, mixing ratio 33 : 1	
including reserve of	about 1.5 (0.33 gal.) litres	

	ES 125	ES 150
Suspension units		
front	80 cubic cm of shock absorber oil "Globo" for each suspension unit	
rear	70 cubic cm of shock absorber oil "Globo" for each suspension unit	
	Viscosity between 1.65 and 1.92 °E at 50 °C = between 8 and 11 cSt at 50 °C	
	In foreign countries use branded shock absorber fluid of the same viscosity!	
Maximum speed	about 90 km/h	about 95 km/h

1.9. Deceleration

7.1 metres per second on a skid-proof concrete road (autobahn). With practically new tyres and careful actuation of both brakes, the following braking distances are ensured:

at 30 km/h . . . . . 4.9 m
at 60 km/h . . . . . 19.4 m
at 90 km/h . . . . . 44.0 m

These values do not include the rider's reaction time.

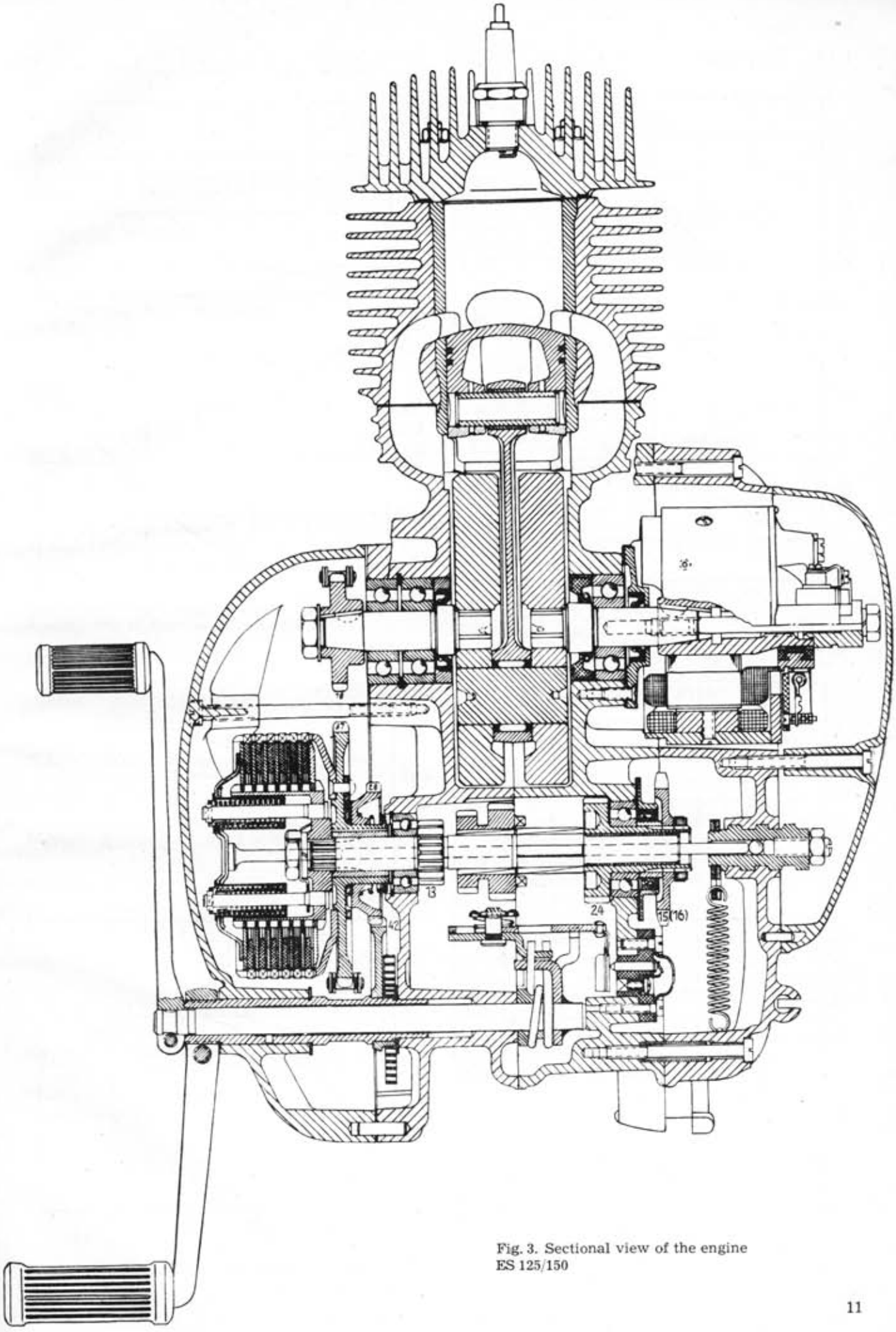


Fig. 3. Sectional view of the engine ES 125/150

1.10. Diagrams

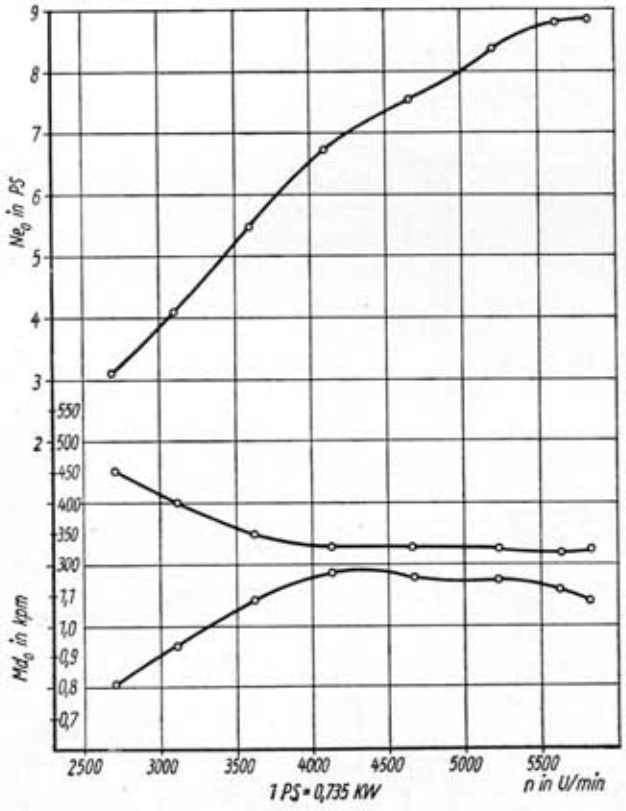


Fig. 4. Horsepower, specific fuel consumption and torque of the ES 125

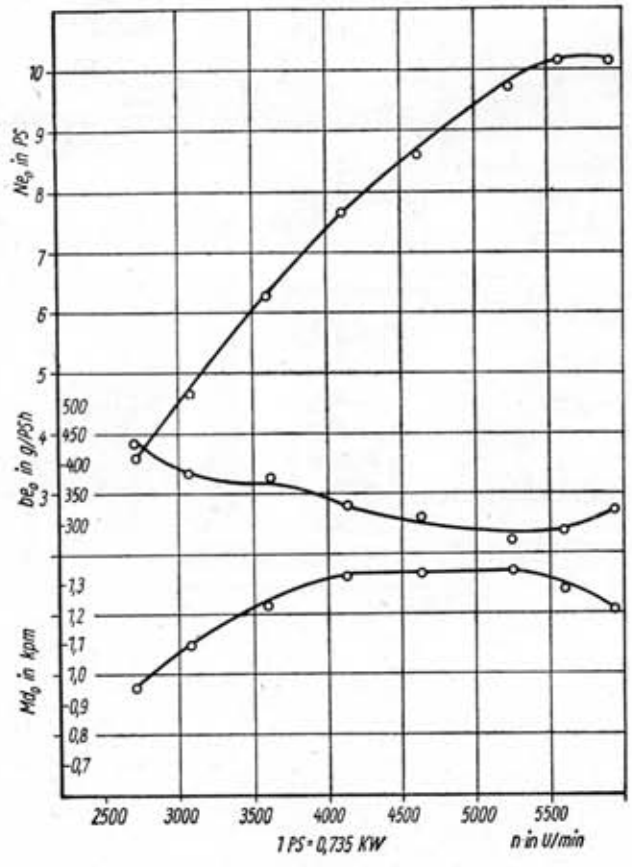


Fig. 5. Horsepower, specific fuel consumption and torque of the ES 150

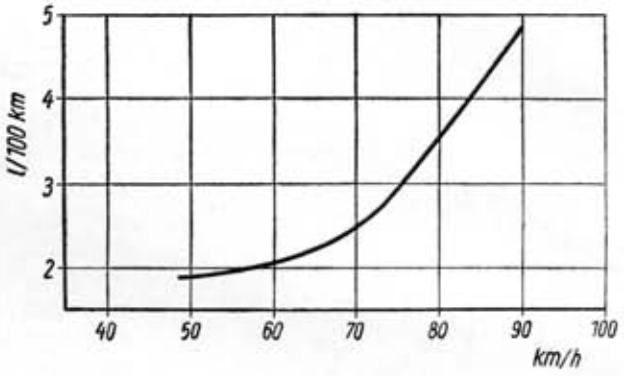


Fig. 6. Traffic fuel consumption of the ES 125 at 4th speed

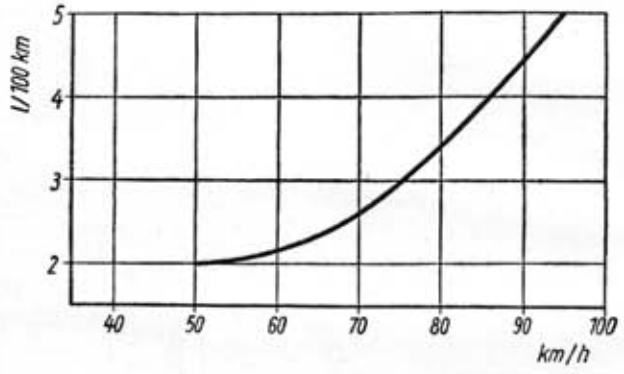


Fig. 7. Traffic fuel consumption of the ES 150 at 4th speed

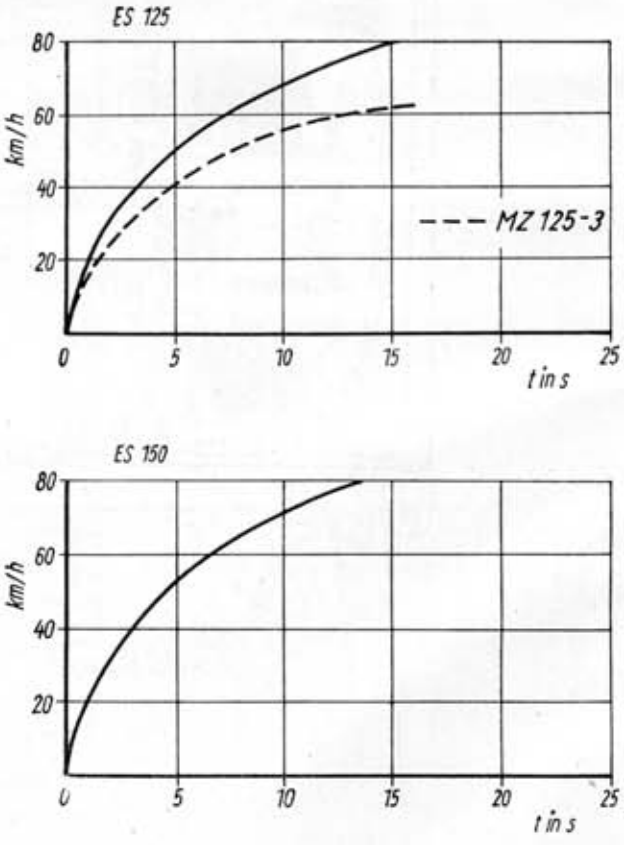


Fig. 8. Diagram of Acceleration of ES 125/150

2. Fuel, Lubricants and Fluids

2.1. Fuel

According to the ration of compression of 9 : 1, a petrol of 78 octane, namely "VK Extra" (yellow), should be used for both ES types.

In foreign countries the use of "Super" 85 to 95 octane is recommended.

If petrol with an octane rating below 75 is only available, it is advisable to have a cylinder cover with a reduced ratio of compression of about 7.5 : 1 supplied by your importer from our spare stocks.

2.2. Motor Oil

Connecting rod, cylinder liner and piston are lubricated by the simple and reliable petroil lubrication. Tests conducted by us over a period of many years have shown that it is recommendable to use exclusively.

Hyzet two-stroke motor oil
at home. This additive-type oil reduces the rate of mechanical wear and the deposition of products of combustion.

Guarantee claims regarding any compensation for damage due to the use of non-additive type motor oils are rejected by MZ.

Customers of MZ abroad are recommended to use exclusively special additive-type two-stroke motor oils (Shell X 100, Zwo-Ta-Mix or similar brands).

2.3. Mixing Ratio

The mixing ratio is 33 : 1 in any case, that is to say, during and after the running-in period. In any case, 10 litres of petrol are mixed with 0.3 litres of Hyzet oil.

In foreign countries: 1 Imperial gallon (4.54 litres) of petrol is mixed with 0.23 Imperial pints of two-stroke oil
1 U.S. gallon (3.78 litres) of gasoline is mixed with 0.23 U.S. pints of two-stroke oil

If non-additive type of motor oil is only available, a mixture in the ratio of 25 : 1 must be prepared.
This is equal to 10 litres of petrol and 0.4 litres of oil.

2.4. Lubricants for Transmission System

For the transmission system with primary drive, 450 cm^3 of motor oil are required as lubricant. Graphited or additive-type motor oils should on no account be used because this would cause the clutch to slip.

Summer or winter oil must be used in accordance with the given season.

Summer: SAE 40
Winter: SAE 20

2.5. Lubricants for Chassis

All lubricating nipples of the chassis must be lubricated with motor oil by means of a grease gun. Only the speedometer drive in the chain cover and the twist-grip throttle are lubricated with automotive grease.

At home: F-8 gear grease
Abroad: Shell-Abroleum or similar brands

2.6. Shock Absorber Fluid

The front shock absorbers are filled with 80 cm^3 of "Globo" shock-absorber fluid each, the rear ones with 70 cm^3 each of the same fluid.

Viscosity: between 1.65 and 1.92 °E/50 °C which is equal to anything between 8 and 11 cSt/ 50 °C

If this shock-absorber fluid is not available in foreign countries, a different branded grade my be used provided it has the same viscosity.

If the viscosity value is higher than specified, the compression spring returns too slowly into its final position. As a consequence, only half the shock course may be available for the next shocks and, thus, the system will become hard and harder and poor roadholding will be the consequence.

If the viscosity is lower, the "return power" of the compression spring in the suspension unit is not fully taken up and, consequently, the vehicle will "float".

3. Disassembly of the Engine

NOTE: SW = width over flats; for example "SW 17" means width over flats 17 mm.

Remove the protective and dynamo covers, and disconnect the cables form the dynamo. Use the special socket wrench SW 5.5.
If the identification colours of the various cables are not clearly discernible, it is advisable, especially for armature constructors, to attach paper slips with markings (D+, DF and frame) to the cables to save the work of measuring them for reassembling.

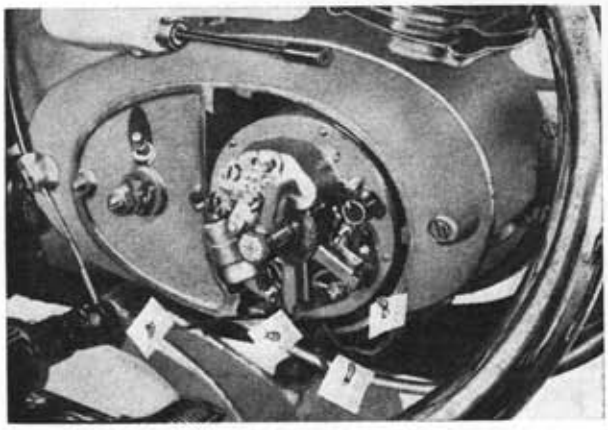


Fig. 9

Assembling device 11-MV 55-1 (with 6-mm receiving bolt for MZ 125/2, with 8-mm bolt for MZ 125/3 and ES 125/150).
Loosen the two fixing screws (arrows) of the pole casing and remove it (it is mounted on centering and retaining pin).
Loosen the armature fastening screw (1) and withdraw the contact-breaker cam. Take care not to damage the centering device at the face of the collector in order that the cam can properly operate. The armature must only be removed by means of puller 02-MW 39-4. Other means, e.g. a jaw-type extractor, damage the winding or squeeze the segments.

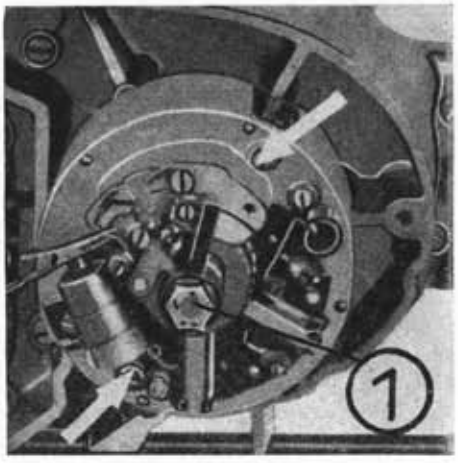


Fig. 10

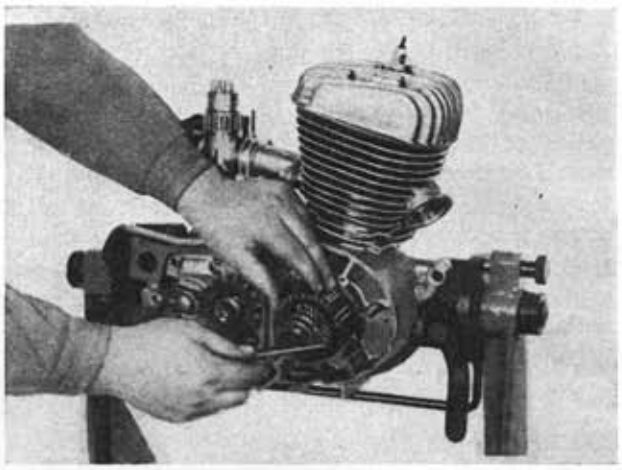


Fig. 11

Keep the key carefully so that it cannot be lost.
To loosen the nut from the gearbox sprocket fold up the lock plate and retain the sprocket by means of holder-up 05-MW 45-3.
Note: Left-handed thread
Remove the cover plate (1) and the sealing cap (2).

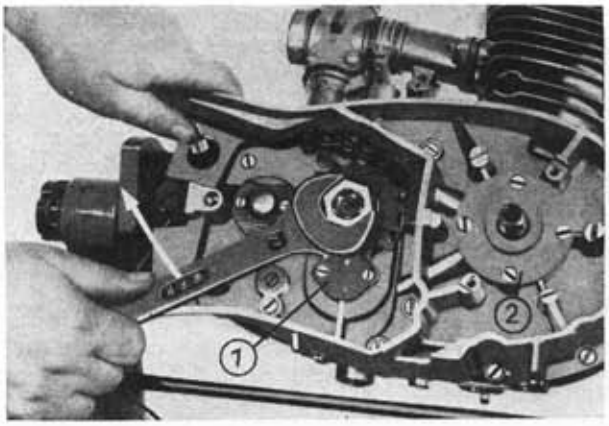


Fig. 12

Remove the clutch.
Unscrew the clamping screw of the foot control lever because it is in a groove (A).
Slacken back the clamping screw of the kick-starter and remove both levers. Loosen the clutch cover by slightly striking against it by means of a plastic mallet close to the setpins (B) and remove the cover. Do not use a screw-driver to lift the cover because the cover will only fit tightly after comprehensive touching up.
Press down the spring plate by means of auxiliary tool 11-MW 15-4 and push out the pins.
Loosen the nut from the chlutch shaft (SW 19), note, this is a l e f t - h a n d t h r e a d. Use the holder-up 01-MW 22-4 (1) and 12-MW 5-3 (2). Then unscrew the nut (SW 19) from the driving gear (right-hand thread).
The amateur constructor may use an old clutch disk of steel and rivet or weld a round bar stock of

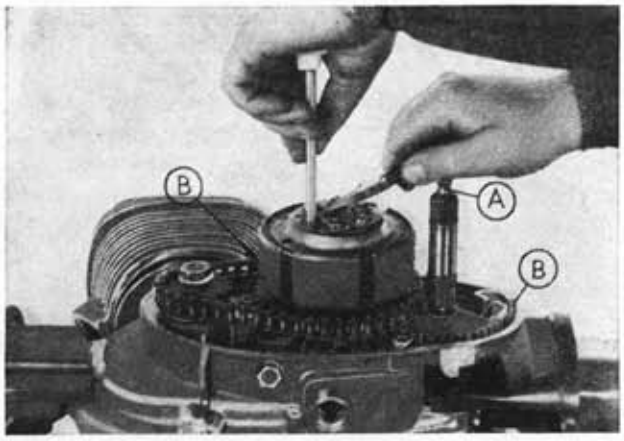


Fig. 13

10 mm in diameter and 200 mm length on it. This holder (which resembles a direction indicator disk) can be used in the place of the two holder-ups. The internal gearing holds the clutch dog, the round bar-iron the clutch drum.

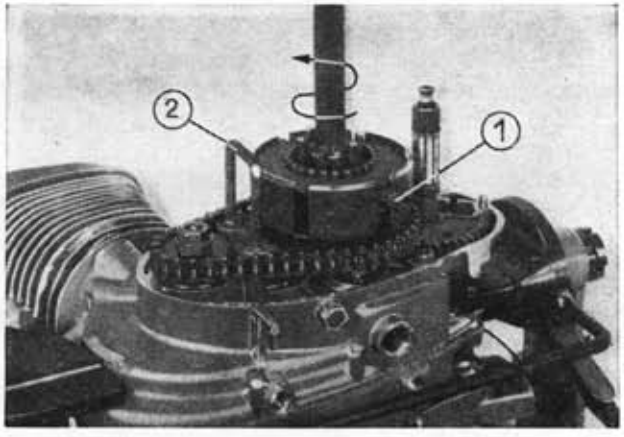


Fig. 14

Loosen the driving sprocket by means of puller 01-Mv 72-4. Remove gear with chain und clutch basket.

Remove the kick-starter shaft with spring and check plate.

Keep the key from the tail shaft carefully.

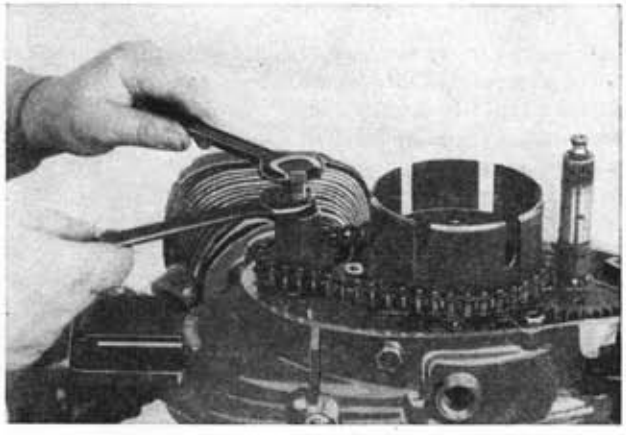


Fig. 15

Dismantle the cylinder with cover and piston. Remove the gudgeon-pin circlip by means of a pair of pointed pliers.

Remove all the 14 casing screws, starting from the right-hand side.

Drive the fitting sleeves at the front and rear engine suspension out of their seats by means of the offset drift 11-MW 3-4.

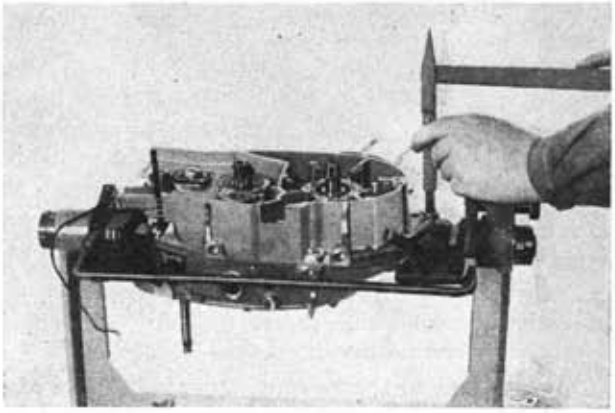


Fig. 16

Engage the fourth speed. Remove the right-hand half of the casing by means of dismantling screw 05-MV 71-2.

The removal is facilitated by slight blows with the plastics mallet (mind the arrow).

Then, apply a copper pin (thread!) from the lower end and beat out both clutch shaft and countershaft upwards.

For this purpose, turn the gear-shift wheels so that the splined section passes smoothly through the gear-shift wheels, otherwise the shift dog will be displaced.

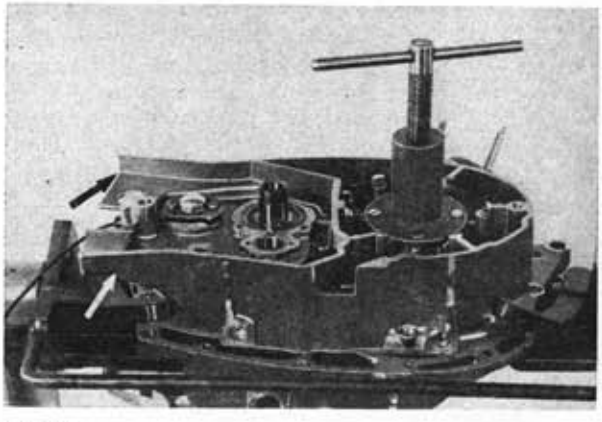


Fig. 17

After folding up the lock plate and unscrewing the nut, unscrew the gear detention shaft (1).

Fold up the lock plates of the screws (2) and (3) of the retaining plate with gear-shifting quadrant and loosen the screws.

Now the complete gear-shift mechanism can be removed.

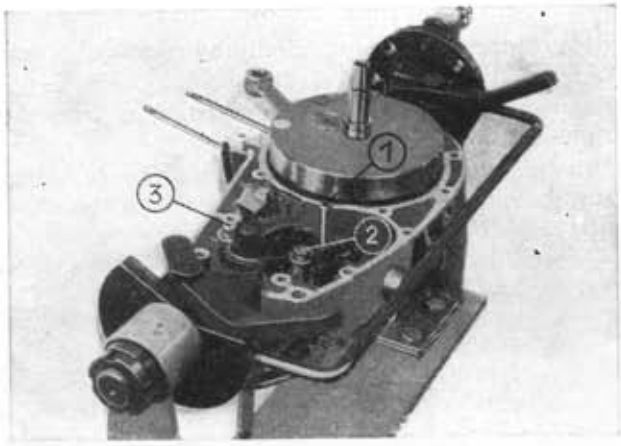


Fig. 18

Drive out the crankshaft by means of pusher 11-MV 21-3.

Do not beat out the crankshaft because with severely damaged tail shafts they are no longer accepted by reconditioning shops.

If the bearings of the two gearbox shafts have also to be replaced, remove the circlips (indicated by arrows) by means of pointed pliers.

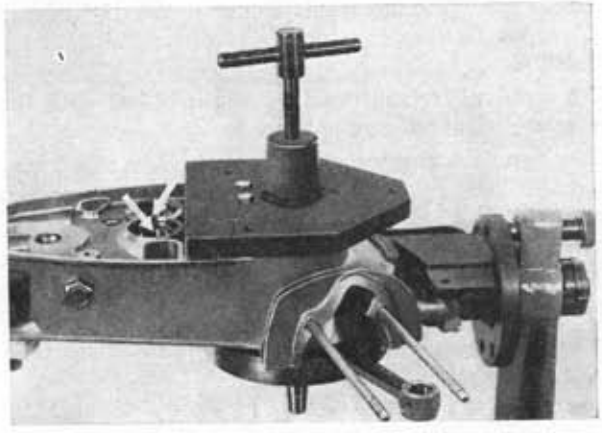


Fig. 19

To remove the ball bearings, heat the appropriate half of the casing to a temperature of about 100 °C.

This facilitates the removal without damaging the bearings seats.

Drive out the bear rings of both the clutch shaft and the countershaft towards the outside.

As to the crankshaft main bearings 6303, bear in mind that a circlip is fitted between the two bearings (see Fig. 3).

At first drive out, from the inside of the casing, the outer bearing by means of a pin. Then remove the circlip by means of pointed pliers and drive the inner bearing together with the packing ring out of its seat towards the inside by means of drift 11-MW 7-4.

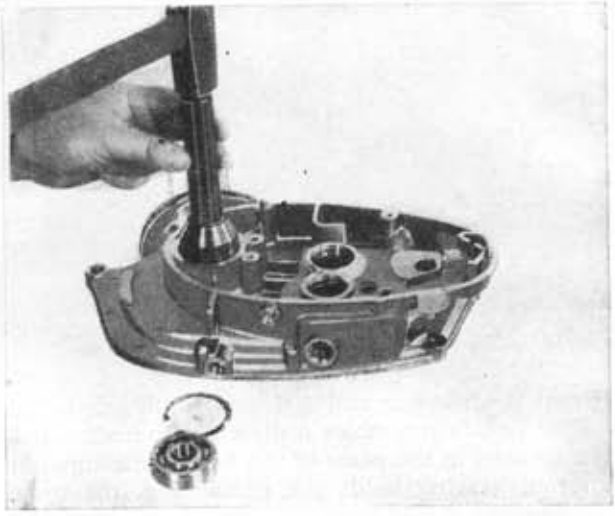


Fig. 20

Drive the crankshaft main bearing 6303 at the right hand half of the casing, which must be heated, out of its seat from the outside towards the inside.

The feed and return holes for lubricating the crankshaft bearings at the side of the dynamo have to be cleaned from remains of lubricants and then air must be blown through.

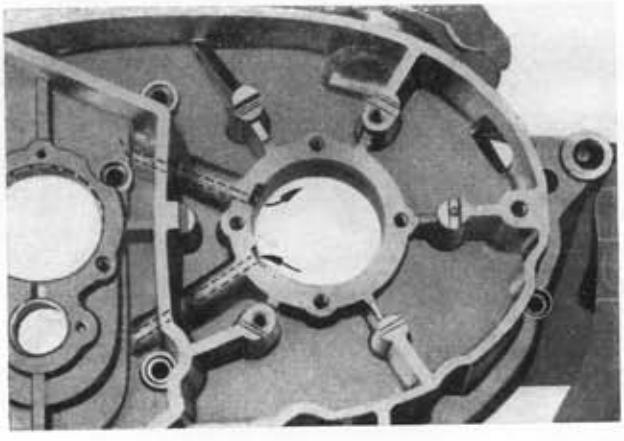


Fig. 21

All engine parts must be cleaned carefully to ensure a successful trouble shooting. Note that not only those parts which may cause any operational trouble should be checked but all parts subject to wear should be checked and measured. This is the only way to save the costs of a second repair after a short operating time.

4. Assembling the Engine

N o t e : SW = width over flats; e.g. "SW 14" means width over flats 14 mm.

After having cleaned the engine parts carefully, the first thing to do is to treat the two halves of the casing and the clutch cover.

All sealing surfaces are checked on a surface plate and touched up, if necessary (emery paste), until all scratches or sealing material remains are removed. Then, and only then, the engine will become perfectly tight.

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

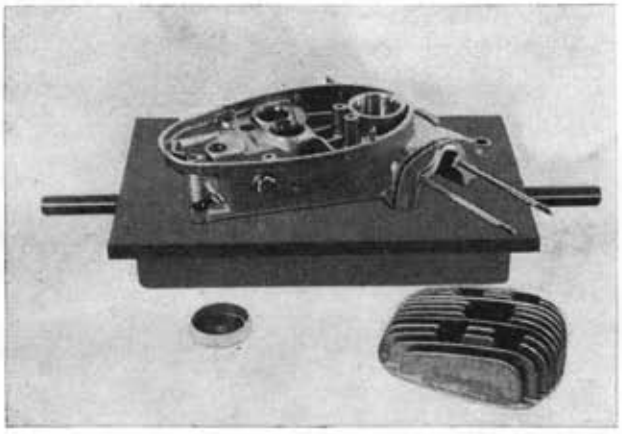


Fig. 22

The next thing to do is to insert the circlips for the crankshaft main bearing and the clutch shaft and countershaft by means of pointed tongs into the left-hand half of the casing. Then, this casing half is heated to a temperature of about 100 °C on an electric or gas cooker.

This is necessary to facilitate the insertion of all ball-bearings, especially to prevent them from being tilted and the casing boreholes (bearing location) from being damaged.

On no account use a welding torch for heating; due to local overheating the casing might get distorted.

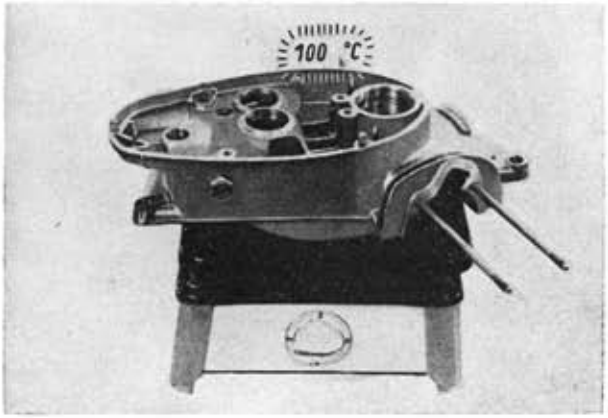


Fig. 23

NOTE:

Bearing for clutch shaft = c l o s e d s i d e of the cage points to the gearbox.

Bearing for countershaft = o p e n s i d e of the cage points to the gearbox.

To insert the bearings use a piece of tube (inside must be clean) or a bolt having a diameter of 35 or 32 mm.

Width of the circlips according to the DIN specifications = 1.75 mm (old design).

Width of the circlips according to the TGL specifications = 1.60 (new design).

When inserting circlips of the latest design into an old casing, compensate for the difference of two times 0.15 mm by inserting 0.3-mm shims.

(A) Gearbox vent

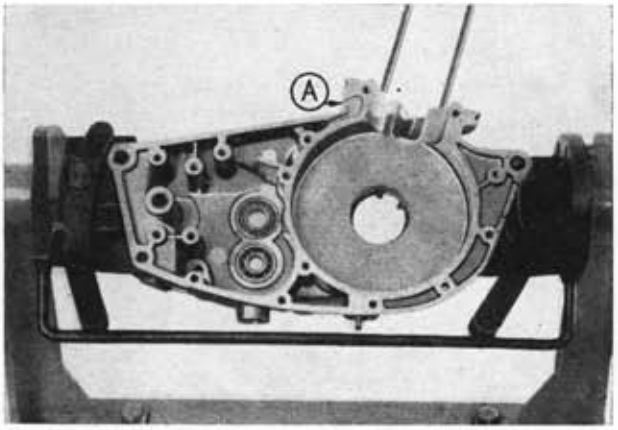


Fig. 24

For fitting the crankshaft bearing 6303 and subsequently the packing ring, use drift 12-MW 19-4, sealing lip points towards the outside – see Fig. 3. Only use the s i l e n t s p e c i a l b e a r i n g s 6303 c 003 f as crankshaft bearings.

For sealing the crankcase only use the g r e e n o r i g i n a l p a c k i n g r i n g s.

Check that all three bearings contact the circlips.

Once more heat the casing half for a short time until the cold ball bearings have been heated from

Fig. 25

the cold casing to such a degree that the cold tail shaft is allowed to slide in the heated inner race of the bearing in the same way as previously the cold outer race of the bearing in the cold casing.

All operations regarding the assembly of the crankshaft and the gearbox must be finished before the casing temperature falls below 70 °C.

Therefore, check all parts to be assembled for proper condition (replace parts if required) and place them on a clean sheet of suitable material together with the required tools (this resembles the preparations for a surgical operation).

Each crankshaft, no matter whether it is new or reconditioned, must be checked that it is not out of true before it is assembled. It may have been distorted during transportation or even by falling on the ground. When it is fitted in this condition, the crankshaft bearings wear out prematurely, the engine output drops, because the contact-breaker cam lifts twice or at a wrong instant.

If there is no test arrangement for true running tests available, tests can be made between the centres of a lathe.

Maximum amount the crankshaft is allowed to be out of true at all measuring points 0.02 mm.

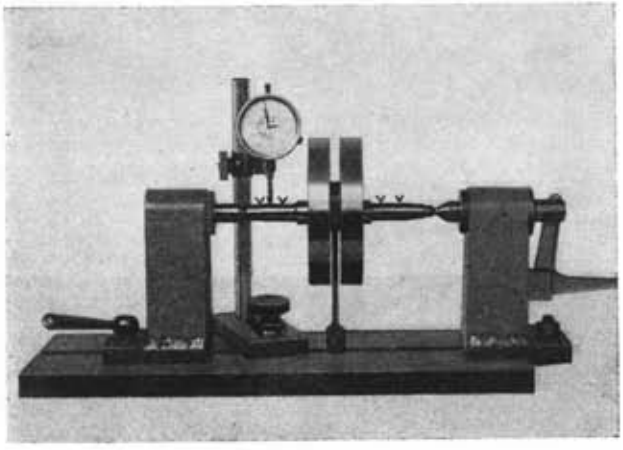


Fig. 26

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

Permissible wear
maximum 0.05 mm

Running clearance of the small-end bush, in new condition
0.020 to 0.030 mm

Permissible wear
0.045 mm

It should be borne in mind that the small-end bush becomes oval due to wear.

Worn small-end bushes are exchanged by means of the H 8-594 V 3 (consecutive No. 2) device. The new small-end bush having finished size is slipped on the device and presses the old bush out of its seat when the nut is tightened.

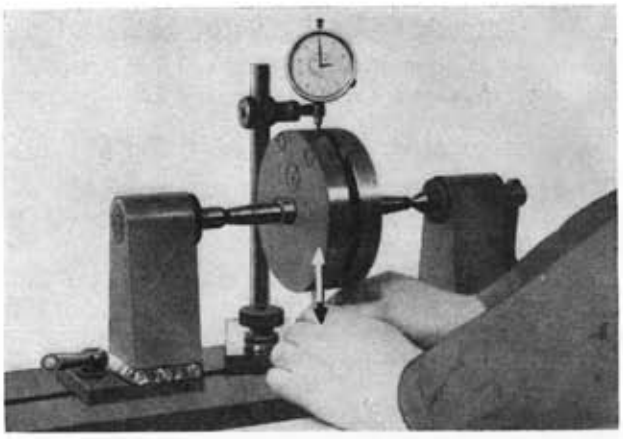


Fig. 27

Take care to see to it that the oil holes to be drilled end in the oil pockets.

Carefully deburr the holes.

The fit should not be too tight because the plain bearing requires a continuous lubricant film.

Check the angular position by means of pin and ruler.

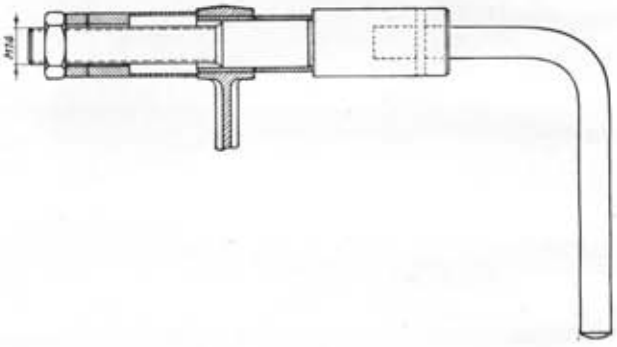


Fig. 28

Axial clearance:
in new condition from 0.25 to 0.40

Permissible wear
0.55 mm

The motor-cyles ES 125, ES 150 and the motor-scooter "Troll" have the same crankshaft.

Oil the tail shaft.

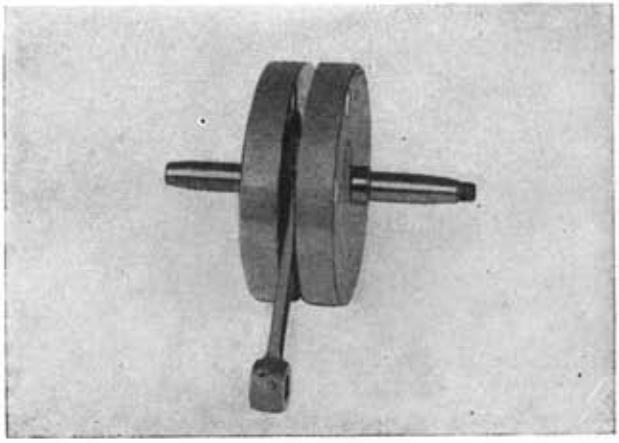


Fig. 29

The inner race of the crankshaft bearing at the reheated casing half is, by means of a hot mandrel, heated to such a temperature that the crankshaft passes through up to the offset by virtue of its own weight.

A second possibility of fitting the crankshaft is by preheating the inner bearing race by means of a heating mushroom (1) before fitting. An asbestos plate prevents the transfer of heat to the outer race.

Never force or beat the crankshaft through a cold bearing because it will become useless before it has started operating (out of true). In this case, the contact-breaker cam lifts at any point but not at the highest point of the cam. Or, at any revolution, the primary chain becomes alternately loose and tight.

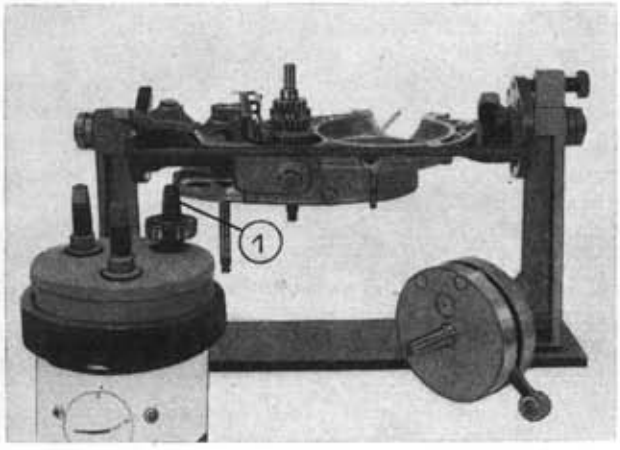


Fig. 30

Limits of wear on gear-shift mechanism – causes of shift faults:

(1) Bolt at retaining plate has a clearance of more than 0.3 mm
(2) Recess in retaining plate is worn off more than 0.4 mm
(3) Windows in quadrant lever and the dogs of the gear-shift member are severely worn down (round)
(4) Return spring has become weak
(5) Gear-shift pin has worked loose
(6) Spring or ball (6.35 mm) jams in the gear-shift fork
(7) Shift dog worn down more than 0.3 mm or its colour has turned blue

Screw the retaining plate with gear-shifting quadrant in place and fit the lock plates.

Insert gear-shifting shaft with gear-shift member; before, slightly oil the part of the shaft which is supported by a bearing.

Screw the gear detent pin in place and adjust it by means of setting gauge 11-ML 8-4.

The check nut (with the lock plate inserted) must be tightened before measuring, because the tightening of the nut changes the setting.

If the gauge is not available, then use the block gauge and adjust the pin according to the schematic representation in Figure 36.

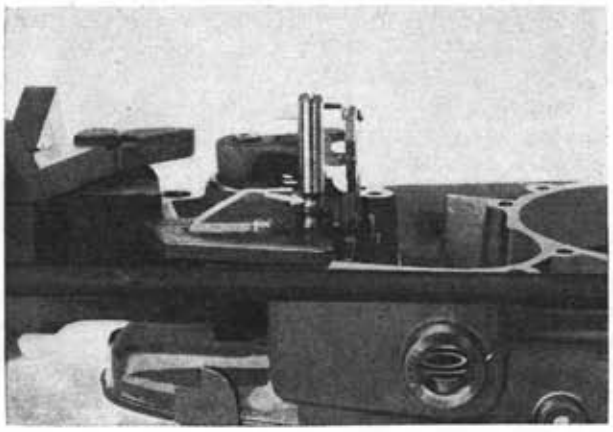


Fig. 32

Slip the shift dog with compression spring and ball on the gear detent pin. For this purpose press the ball into the bore-hole by means of a screw driver.

Fit the gear-shift lever in place and operate the mechanism. Check that the dogs of the gear-shift member engage properly and the spring-mounted lever of the quadrant does not obstruct the gear-shift member on return motion.

Check all dogs of the gear-shifting wheels for wear. The 5° undercut must bear for $^3/_4$, otherwise this part and the pertaining gear must be replaced which is in engagement with the worn dogs.

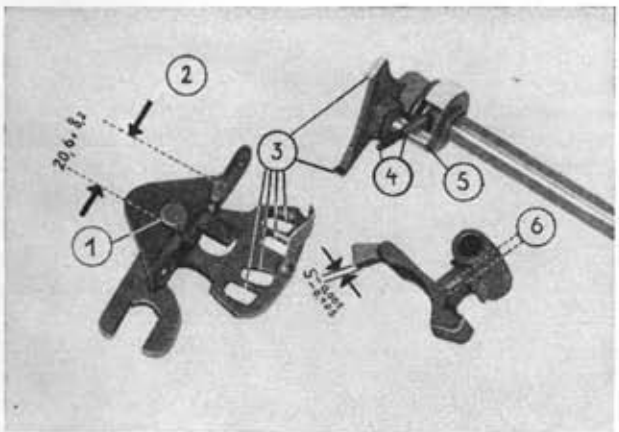


Fig. 31

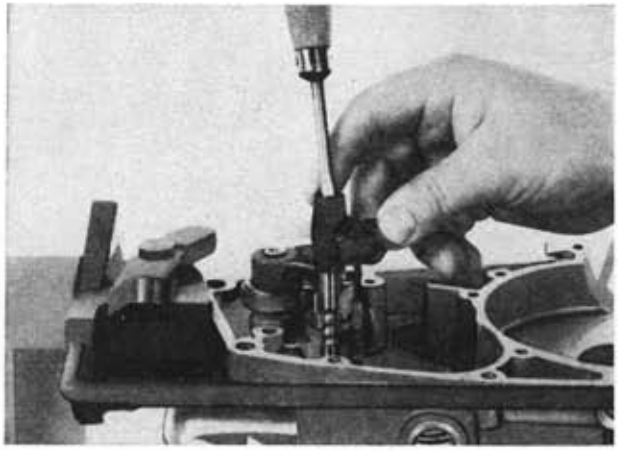


Fig. 33

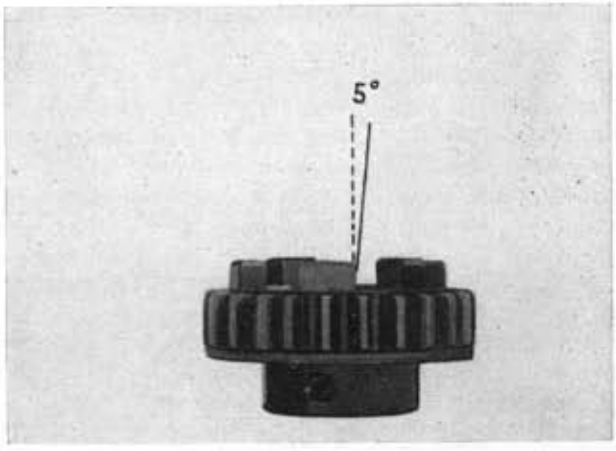


Fig. 34

Under load, the undercut retains the gears in mesh but not the gear detent.

If the edges of the splines of the clutch shaft (1) and countershaft (2) and their gear-shifting wheels are rounded due to wear or broken, they have to be replaced. If the gear-shifting wheel for the 2nd and 4th speeds (3) is still provided with cylindrical dogs instead of those with the 5° undercut, they have to be exchanged even if they are still in working order.

Check the working surface of the bearing collar at the pair of gear-shifting wheels for 1st and 3rd speeds (4) for wear marks.

When fitting new parts, take care to see to it that they are well matched, i.e. black point must coincide with black point and white point with the corresponding white point.

Check the gear of the 1st speed (5) for proper edges at the window and cracks.

Check the bush of the shaft weehl (6) for wear marks.

The amount the clutch shaft may be out of true is

0.05 mm.

Aligning must only be done by pressing but not by striking. It is recommendable to check the shaft between the centres of a lathe and straighten it, if necessary.

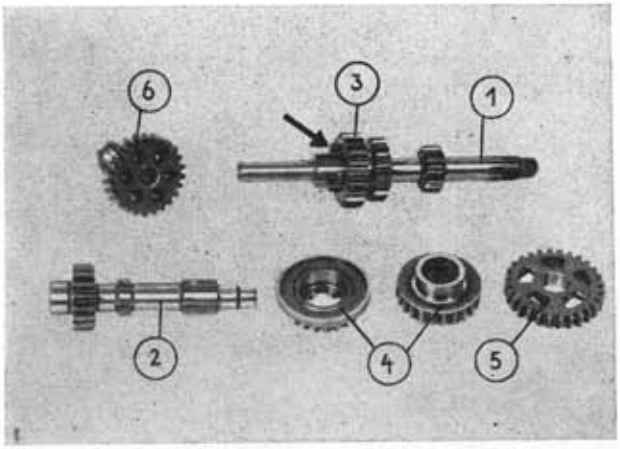


Fig. 35

Arrangement of gears and power train of all four speeds.

If the setting gauge shown in Fig. 32 is not available, make a "block gauge" having a height of 16.1 mm. With the third speed engaged, the gauge must be allowed to enter; the resistance offered must be just felt. If this is not the case, adjust the gear dentent pin until the clearance is correct.

With the 4th speed engaged, a clearance between 0.1 to 0.2 mm is required between the gear-shifting wheel of the 4th speed and the shaft wheel. The shaft wheel bearing 6004 must not be exposed to axial thrust.

Mount the gear-shift mechanism.

Oil all journals and shafts. Slip the gear-shifting wheels for the 2nd to 4th speeds on the clutch shaft and insert the latter into the ball bearing. At the same time insert the finger of the shift dog into the guide groove of the gear-shifting wheel. Use a plastic mallet to drive the shaft in place up to the stop. The shift dog is engaged with the 4th speed.

As to the countershaft, at first fit the gear (perforated body) of the 1st speed (smooth side on top). Then insert the pair of gear-shifting wheels for the 1st to 3rd speeds in such a way that their guide collar is in engagement with the mating wheel and put the countershaft through this assembly. Turn the shaft until the splined section slides through the gear-shifting wheels.

Use a mallet of plastics to drive the countershaft in place up to the stop.

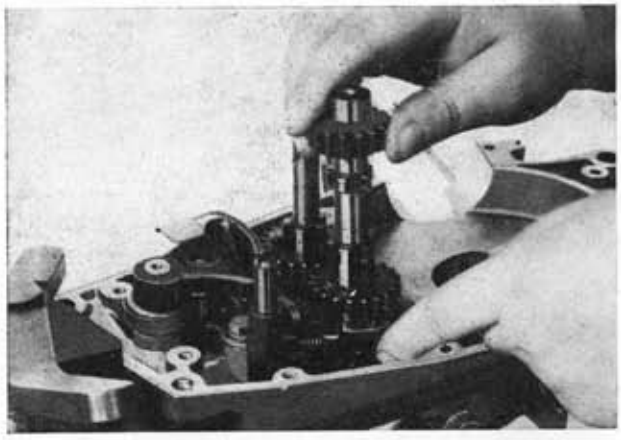


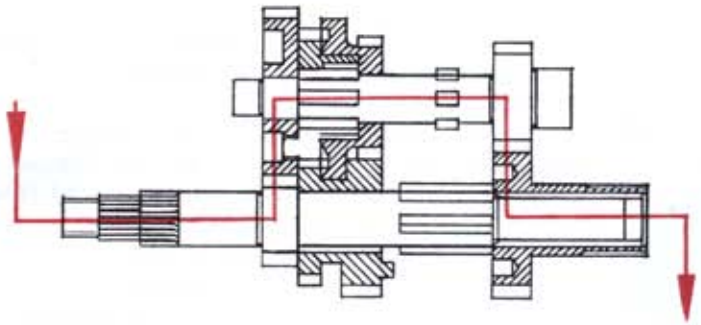
Fig. 37

Left-hand half of the casing readily assembled.

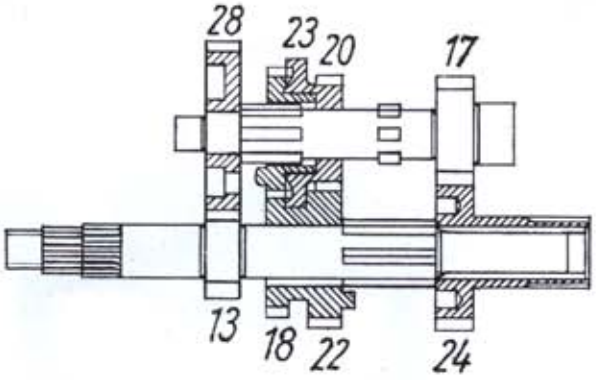
Slip on the shaft wheel (1), check the contact strip of the idling control light (2) and adjust it, if necessary.

Meanwhile, the right-hand half of the casing has been heated to about 100 °C and then the crankshaft seal ring driven in place (from the interior) so that it is flush with the inner edge of the casing and the sealing lip points outwards. See Fig. 3.

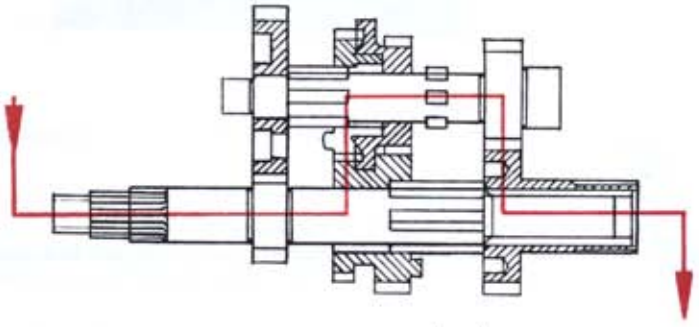
Heat the inner race of the bearing 6004 by means of a mandrel and fit it into the casing by means of drift 01-MW 44-4.



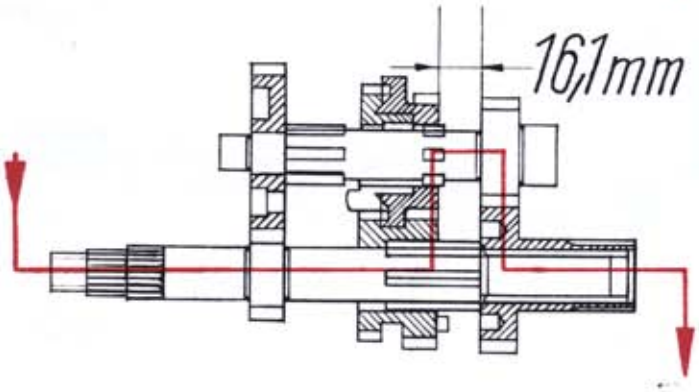
1.GANG



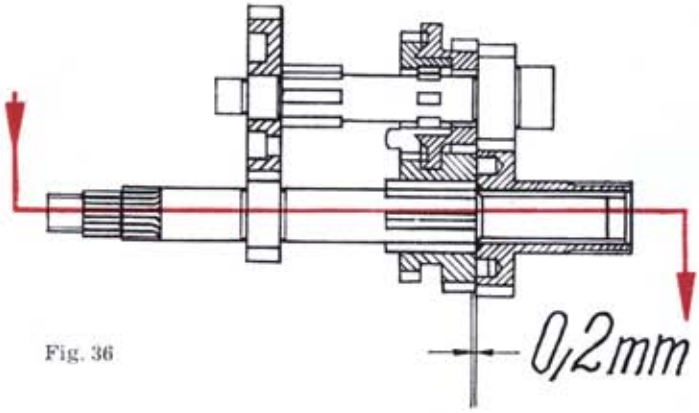
LEERLAUF



2.GANG



3.GANG



4.GANG

Fig. 36

1. Gang — 1st speed
2. Gang — 2nd speed
3. Gang — 3rd speed
4. Gang — 4th speed
Leerlauf — Idling

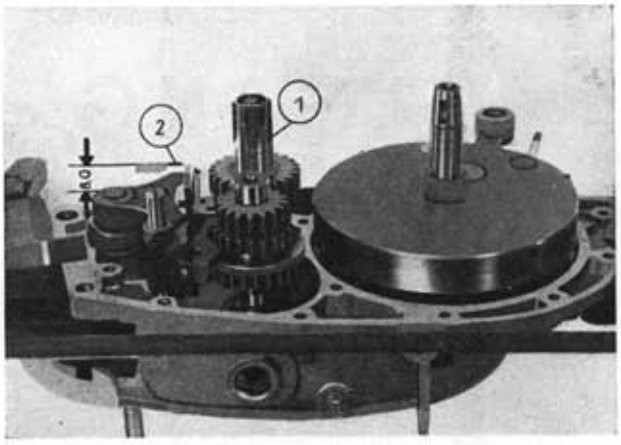


Fig. 38

Apply a thin film of sealing compound to the sealing surface (note that most of the sealing compounds can be diluted with nitro solution). Take care not to clog the threaded holes or the breather (Fig. 24). Put the casing half in place, fit it properly by applying slight blows by means of a mallet of plastics.

Beat down the bearing 6004 at the shaft wheel by means of drift 01-MW 44-4.

Drive the two fitting sleeves (arrows) in place, using mandrel 11-MW 3-4.

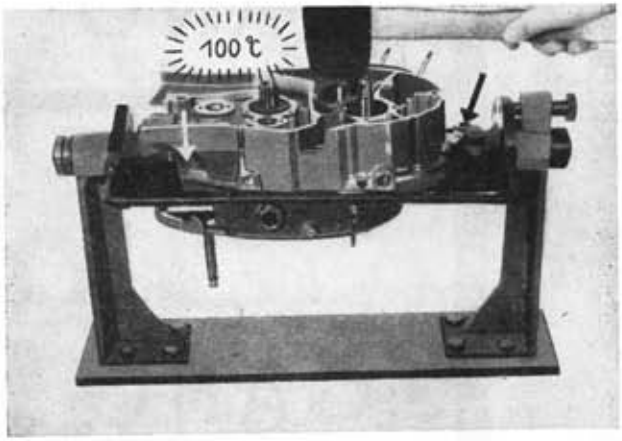


Fig. 39

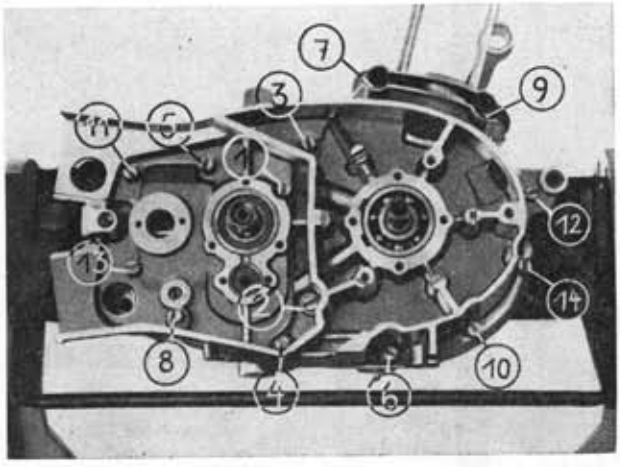


Fig. 40

Properly tighten all 14 casing fastening screws by means of a well fitting screw-driver (use a brace, if available).

Observe the correct sequence, namely:
start from the centre of the casing, alternately tighten right-hand and left-hand screws and crosswise.

This job must be done quickly so that the casing is still hot enough for the next operations.

Heat the inner race of the 6303 bearing by means of a hot mandrel to about 80 °C and fit it by means of drift 11-MW 7-4. This is done by applying slight blows until it contacts the collar of the tail shaft.

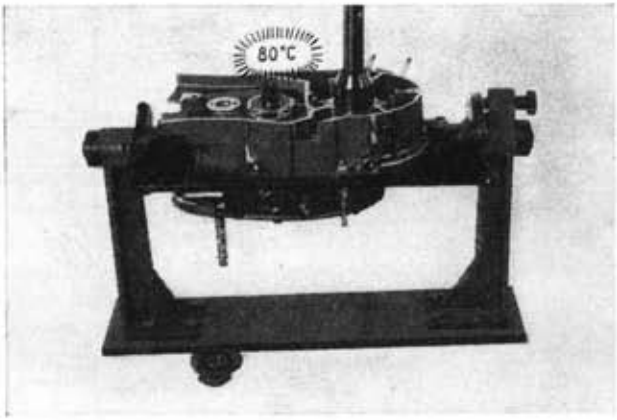


Fig. 41

Especially at the right-hand crankshaft bearing everything depends on the fact that the cold outer race slides in the hot casing and the hot inner race on the cold tail shaft when but slight hammer blows are applied. Otherwise you cannot feel if the bearing already contacts the collar (Fig. 3) or not. A heavy blow more than necessary may cause the following:

Fig. 42
Axially the crankshaft is exposed to pressure because the bearing has been driven in too far. The inner race forces the crankshaft which is slightly floating back. With this, the bearing clearance of the left-hand bearing has also been removed (the lubricating film is interrupted). The balls fail to bear radially but run against the side and produce a hissing sound until their premature wear.

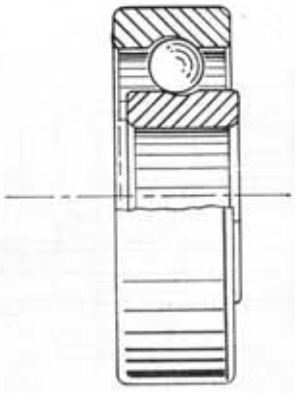


Fig. 42

Fig. 43

If the driving-in pressure has been higher, the crankshaft will be compressed laterally. Thus, it is out of true and useless for the following reasons:

1. The contact breaker fails to lift at the specified point or the adjusting range of the contact-breaker base plate becomes insufficient.
2. The out-of-true crankshaft causes the engine to vibrate heavily; as a consequence the declared engine output cannot be reached.

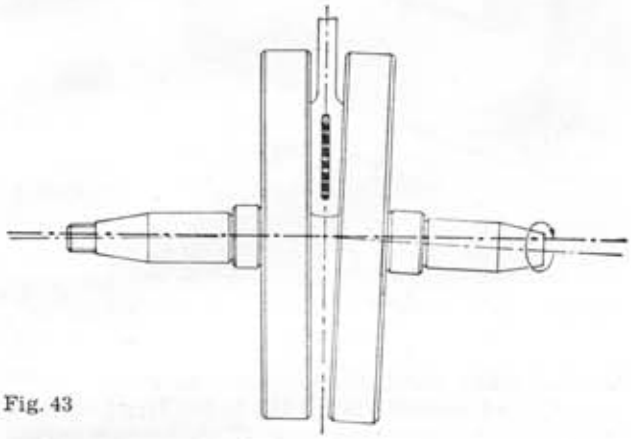


Fig. 43

Fig. 44

If the bearing is driven with undue force into a cold casing and with the inner race not heated, there is the risk of the outer race to be tilted, that is to say, it fails to run parallel with the shaft axis.

In addition to the state described above and shown in Fig. 42, the casing has become useless. A correctly fitted bearing would again be tilted because of the damaged bearing seat.

(For reasons of clearness the sketches have been slightly exaggerated.)

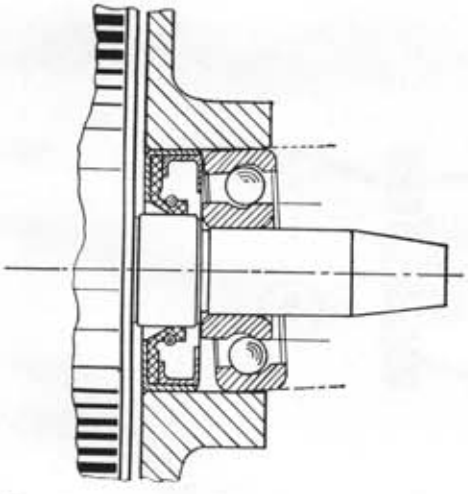


Fig. 44

Meanwhile the inner race of the third crankcase bearing has also been heated to about 80 °C.

Turn the casing in the assembling device through 180 °C and drive the bearing in until it contacts the circlip, using drift 11-MW 7-4.

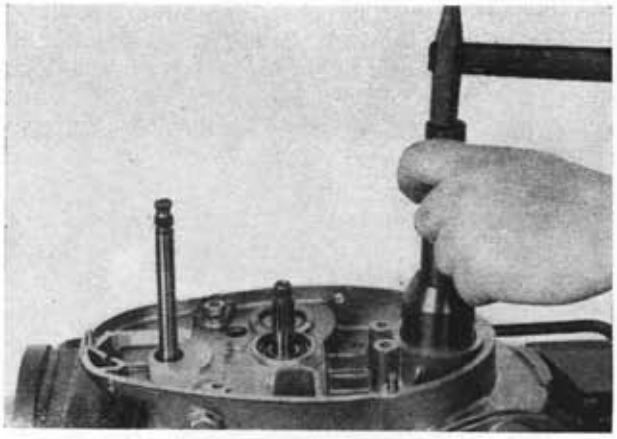


Fig. 45

Bring the engine in upright position and, provided there is not fault in the assembly (Figs. 42 to 44), it must be easy to turn the crankshaft.

Operate the gear-shift mechanism to test it, at the same time turn the clutch shaft.

The clutch shaft must move with ease. If this is not the case, use a mallet of plastics and beat the shaft (1) 0.2 mm towards the front and, using a copper mandrel (through the shaft wheel), beat it back. Then the end clearance between end face of the splined section of the clutch shaft and the shaft wheel must be given as shown in Fig. 38.

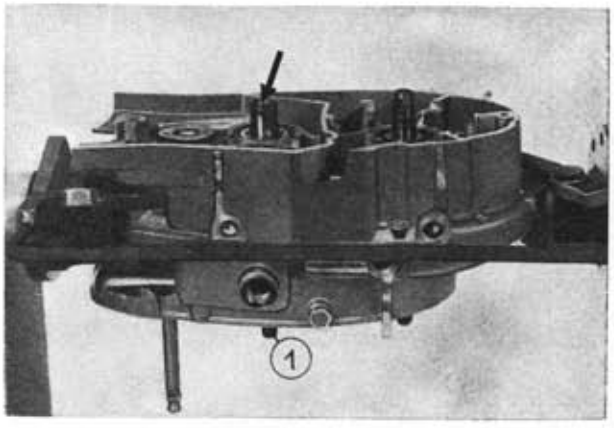


Fig. 46

Measure the distance from the outer edge of the casing to the bearing outer race and, if necessary, correct it by means of shims.

A distance of 0.2 mm must remain. Take the thickness of the original packing (0.1 mm) and the height of the collar of the cover plate into consideration.

Check whether the spacer sleeve (1) is severely worn by the sealing lip and whether the sealing ring itself is in perfect working order.

Carefully clean the sealing surface of the cover plate, place the paper packing (leakproofing material) on the cover plate and fasten it by means of the bolts which should be tightened crosswise. Slightly grease the lip of the sealing ring, slip on the spacer sleeve.

Slip on the gearbox sprocket (recess must point to the engine) and the lock plate, tighten nut SW 27 (left-hand thread) and fold back the lock plate.

Arrest the sprocket by means of holder-on 0.5-MW 45-3 or an old chain.

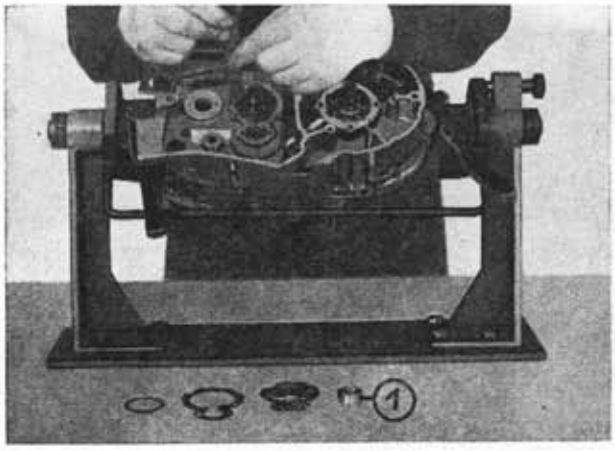


Fig. 47

After checking the 17 × 30 × 7 packing ring in the sealing cap, measure the distance (1) between sealing cap and ball bearing by means of a slide rule and establish an end clearance of 0.4 mm by inserting shims. The thickness of the original paper packing (2) of 0.1 mm must be taken into account.

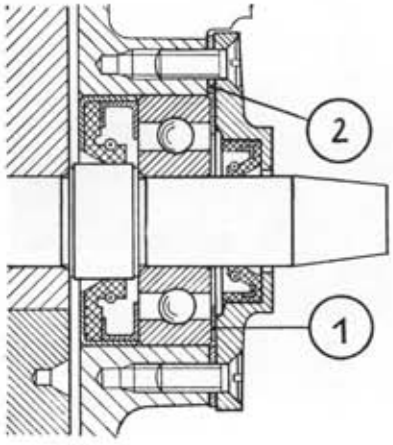


Fig. 48

Adjusting the idling indicating light.

If the green indicating light fails to flash up (with the engine installed), loosen the terminal of the supply cable and connect the cable from the indicating light to the frame. If the green lamp fails to light, either the supply cable of the bulb is defective. If it lights up, the fault is in the contact switch: the contact plate distance is smaller than specified (Fig. 38).

The distance between outer edge of the casing and upper edge of the contact plate must be 12.5 mm. If necessary, use a spoke of a bicycle or motorcyle which is bent at right agles and draw the contact plate to the required distance (for this purpose, the gearbox must be in the idling position).

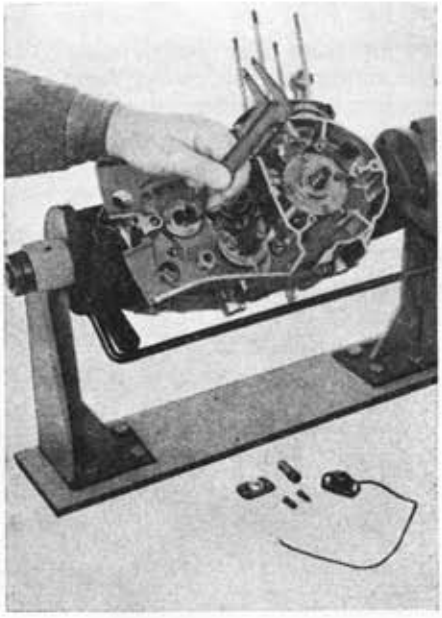


Fig. 49

On the other hand, the distance between contact pin (A) and contact spring (B) is too large because the latter has been bent back. If the contact spring is oxidised or soiled, there is no ground connection, too.

When replacing the contact switch take care to see to it that a switch of type MZ 125/2 (or older) is not used. They generally are similar to the new design except that the contact pin is 1.5 mm longer. As a consequence it may be possible that it gets behind the contact plate, blocking the gear-shift mechanism, that is, the foot control lever can be moved without shifting the gears.

Apply a thin film of leakproofing material to the plane surface of the switch and bolt it to the casing.

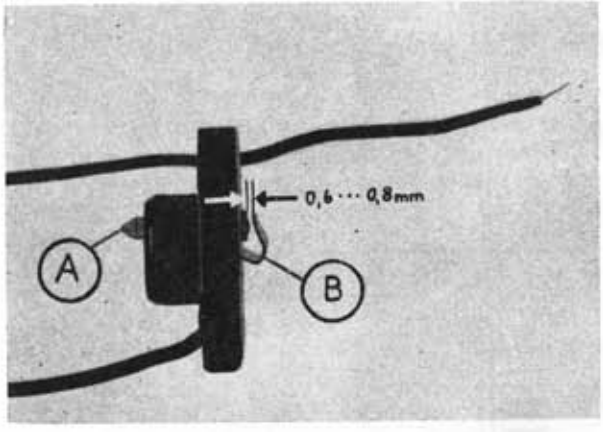


Fig. 50

Shift all four speeds in succession for a trial. At the same time check that the gears engage properly by turning clutch shaft and gearbox sprocket against each other.

Fit the lock plate (1) on the nut of the gear detent shaft.

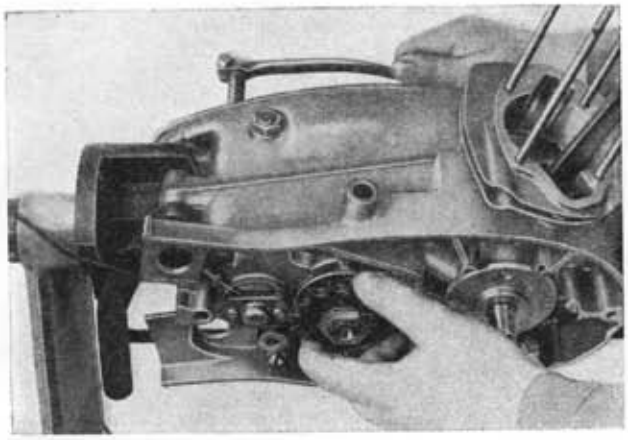


Fig. 51

Check the teeth of the starter segment at the working side (2) for wear.

Insert the folded over end of the kick-starter spring into the slot of the starter segment; in order that the spring end fits tightly, readjust it, if required.

Guide (or check) plate 30 × 17 × 1 must then be slipped on and the starter shaft with spring be mounted.

Slip on the kick-starter lever and turn the starter spring clockwise to prestress it. For this purpose withdraw the starter shaft far enough to allow the segment to pass the stop (3) closely. Press the rolled up spring end into the holder.

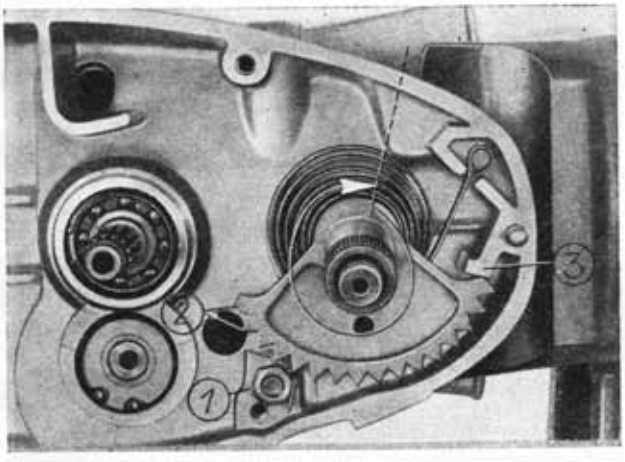


Fig. 52

Check the complete clutch drum for the following items:

(A) if the drivers of the frictional clutch facing have produced wear marks in the clutch drum. – Small recesses are removed by means of a smooth file. In the case of deeper indentations, the damaged part must be replaced because in this condition the clutch fails to disengage properly.

(B) if the edges of the window in the driver and the dog of the kick-starter wheel to be engaded with this window are severely worn (rounded). If this is the case, replace the assembly, otherwise the kick-starter will slip.

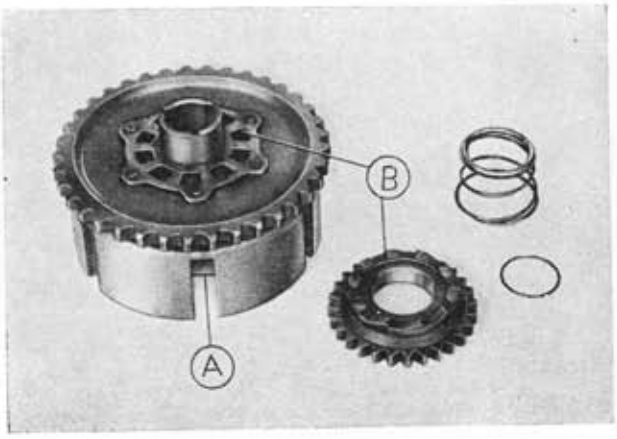


Fig. 53

Check the sprocket wheel on the crankshaft, the silent chain and the clutch sprocket for wear. For this purpose provisionally assemble these parts.

With the engine in upright position and with one strand of the chain tight, the other strand must not show a sag exceeding 8 to 10 mm. If the sag is too large, the chain will whip, climbs on the teeth and may break.

When selecting a new chain, observe the colour marking or the stamp on the packing:

green	=	normal, for new sprockets,
yellow	=	0.1 mm, to be used in case
white	=	0.2 mm, to be used in case of of slight wear,
blue	=	0.3 mm. severe wear,

Silent chains for the tolerance range "white" and "blue" are available in small quantities only.

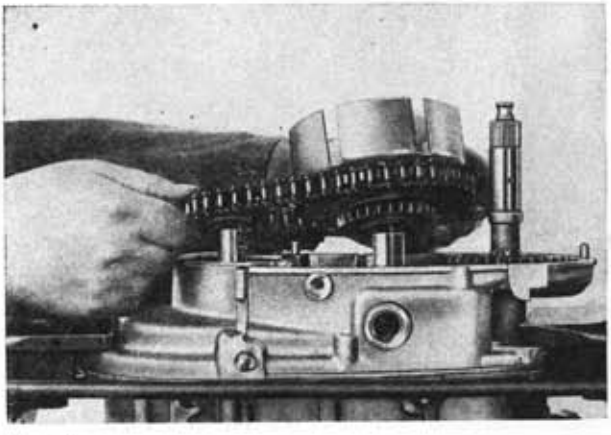


Fig. 54

First slip the check plate 25 × 15 × 0.5 on the clutch shaft, then the clutch drum with bush; finally the sprocket an the tail shaft.

Check that the two chain wheels are in line by means of a ruler or a slide caliper rule. Necessary corrections are made by inserting shims between bush and check plate.

Sprockets which fail to be in line cause chain and sprockets to wear prematurely.

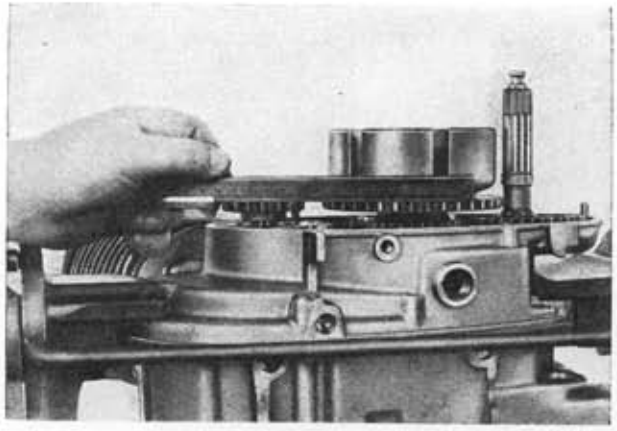


Fig. 55

Check the inner driver for proper seat of the internal gearing on the side of the clutch shaft. The seat must be non-chattering.

Just visible indentures or such that can just be felt in the spline section of the driver due to the clutch (steel) disks can be neglected.

In case of indentures deeper than 0.1 mm, the inner driver must be replaced by a new one.

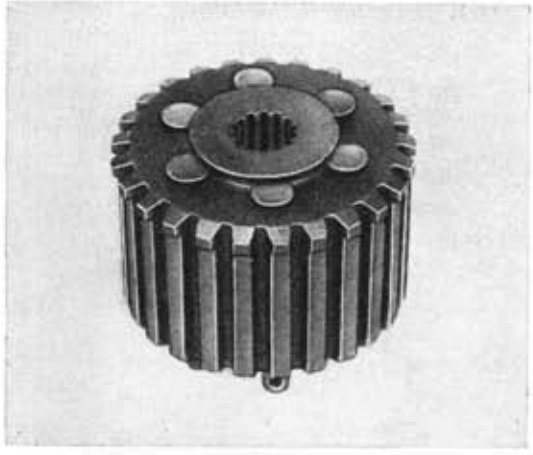


Fig. 56

Insert holder-on 12-MW 5-3 (1), slip on the inner driver (2) and retain by means of holder-on 01-MW 22-4 (3).

Slip first the left-hand spring ring and than the lock plate on the clutch shaft; put the eyelet with the offset downwards on one of the spring bolts. Tighten the nut (SW 19) by means of a socket wrench – left-hand thread.

Put on the lock plate.

Slip the right-hand spring ring on the tail shaft and tighten the nut (SW 19 – right-hand thread).

Steel disks:

By placing a ruler or a slide caliper rule on the disk, check that the surfaces are still plane; if necessary, check on a straightening plate.

Frictional facing disks:

Thickness, new	3.4 ± 0.1 mm
max. permissible wear	– 0.2 mm

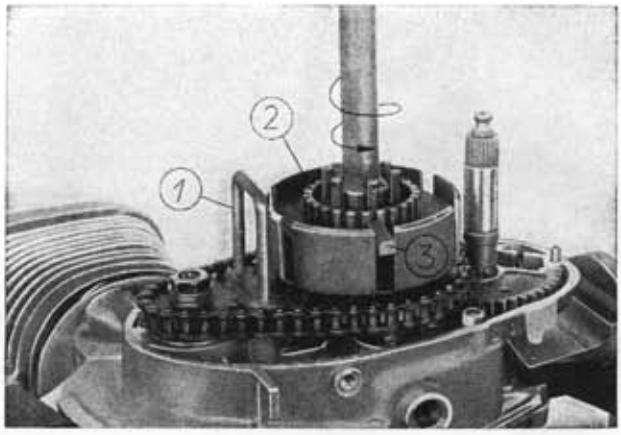


Fig. 57

Pressure springs:

Length, slack	49 mm
Pressure (P) normal	16 kg at a
Building-in length of	31.5 mm

(1) Retaining disk, (2) spring collar, (3) pressure pin

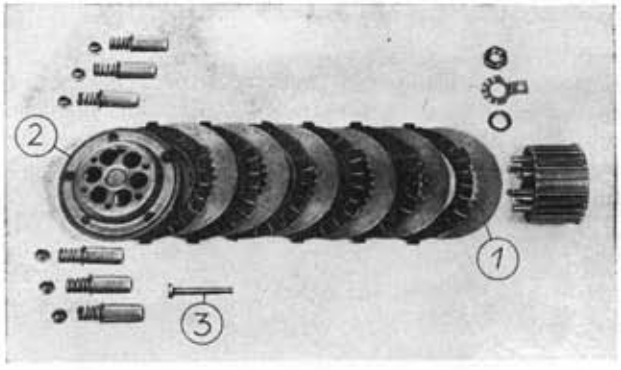


Fig. 58

At first insert the slightly thicker retaining disk and then, in the correct sequence, the other clutch disks. Apply grease to the pressure pin on either side and put it into the clutch shaft.

Mount the spring collar (1) in such a way that the spring bolts (2) are exactly in the centre of the circular opening. The spring caps and the pressure springs itself must not jam or rub.

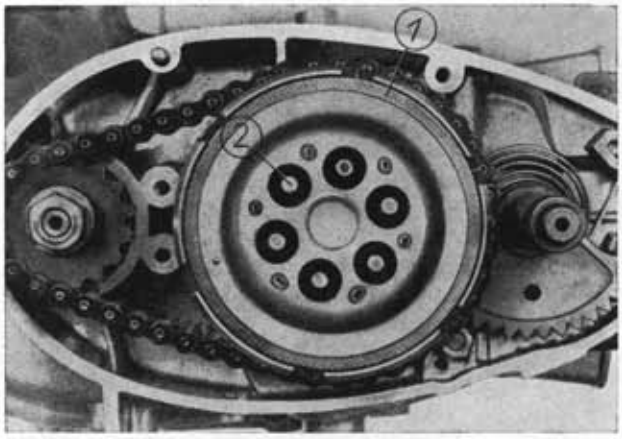


Fig. 59

Use the "set bolt for clutch pins" 11-MW 15-4 to press down the nipples and pressure springs and insert the taper pins.

Place the 20 × 30 × 1 washer on the kick-starter shaft.

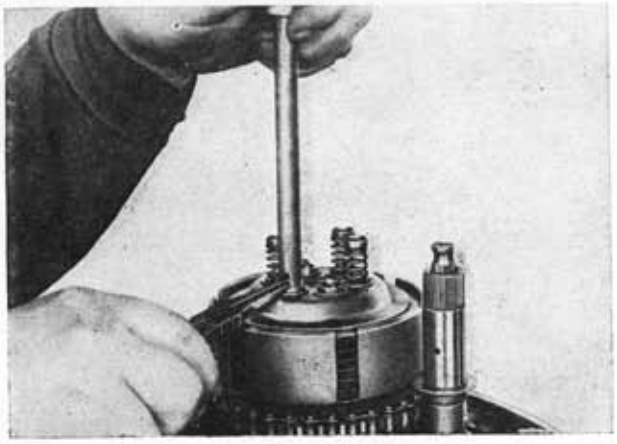


Fig. 60

Fit the paper packing (without leakproofing material) and the touched-up clutch cover in place, tighten the bolts uniformly.

Slip on the kick-starter lever and control lever and tighten the clamping screws. After the trial run retighten the two screws.

Screw the oil drain plug M 18 × 1.5 (with magnetic stopper to retain metallic grit) into the crankcase and the oil-level inspection screw into the clutch cover. See to it that the packing rings are in proper condition.

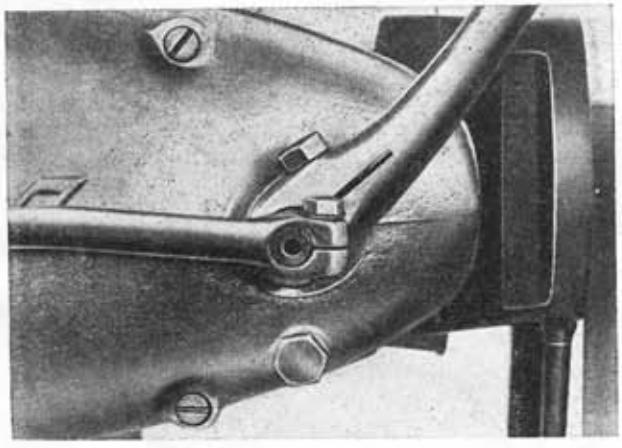


Fig. 61

It may happen that, due to improper handling during transportation or improper storing, the connecting-rod of the new crankshaft has been distorted. Since a twisted connecting-rod or a rod which is not at right angles with the crankshaft will wear out the small-end bush before long, the connecting-rod must be checked and straightened, if necessary.

The gap between mandrel and ruler shows whether the axes of crankshaft and gudgeon pin run parallel to each other (or whether there is a distortion).

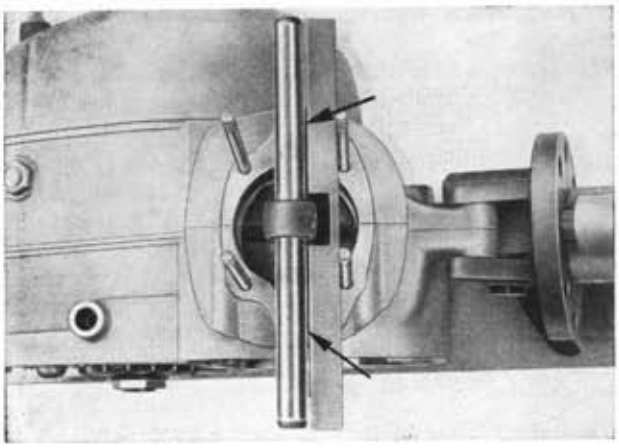


Fig. 62

The catalogue No. of mandrel and ruler are H 8-626-3.

This shows how the connecting-rod should be checked for correct angular position (or whether it is oblique).

If the engine has been operated for some time, the wear pattern of the piston will show whether the small-end boss is out of the perpendicular or not.

Always support the connecting-rod when straightening. Do not try to press the whole connecting-rod into the proper position, it will return to its initial position.

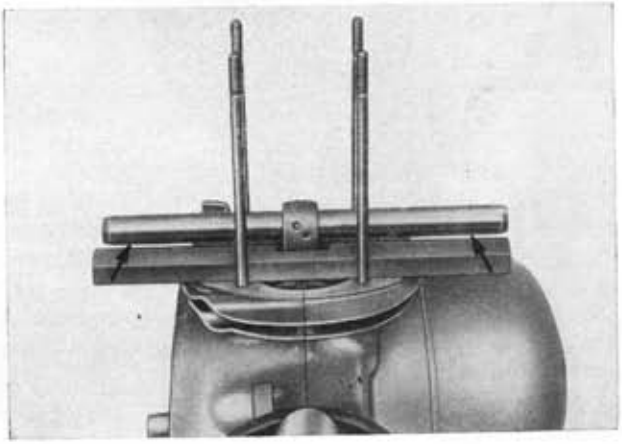


Fig. 63

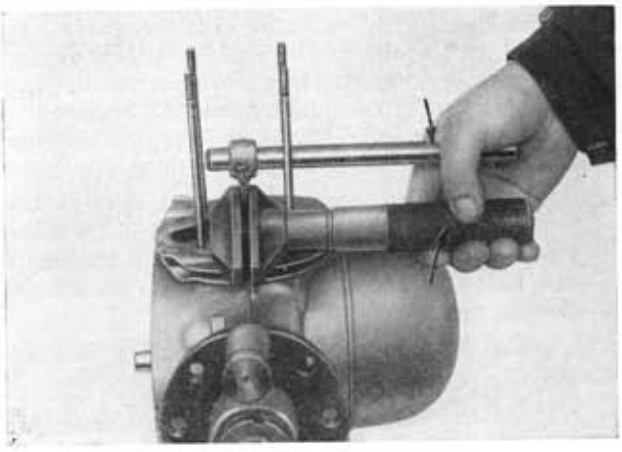


Fig. 64

The markings on the piston head have the following meanings:

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

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

The finished size for the cylinder bore (honed) and the piston diameter (ground) are given with tolerances, e.g. + 4 mm – 6 mm; this also applies to all other parts.

To avoid that upper tolerance limits of the piston are brought together with lower tolerance limits of the cylinder (or vice versa), both parts must be measured and be matched according to the specified clearance in the assembly.

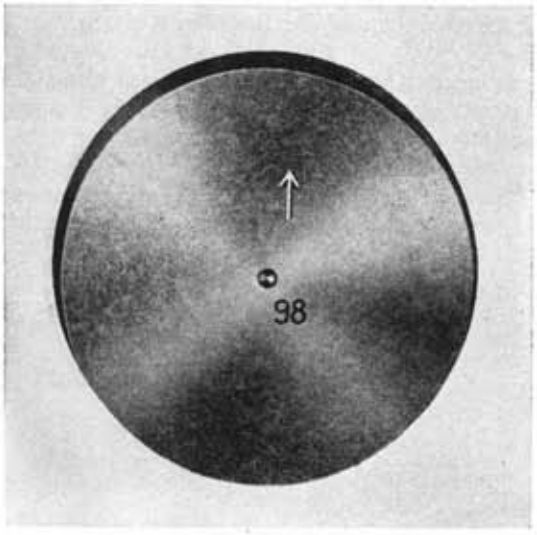


Fig. 65

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

Assembly examples
piston/cylinder

		wear value
ES 125	0.03 mm	0.25 mm
ES 150	0.04 mm	0.30 mm

Oversizes of pistons for each type:

8 oversizes, each by 0.25 mm thicker than the previous one. More than 2 mm must not be removed in reboring the cylinder, otherwise the cylinder liner is liable to the risk of deformations.

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

The arrow shows the marking of the nominal size on the cylinder:

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

Fig. 66

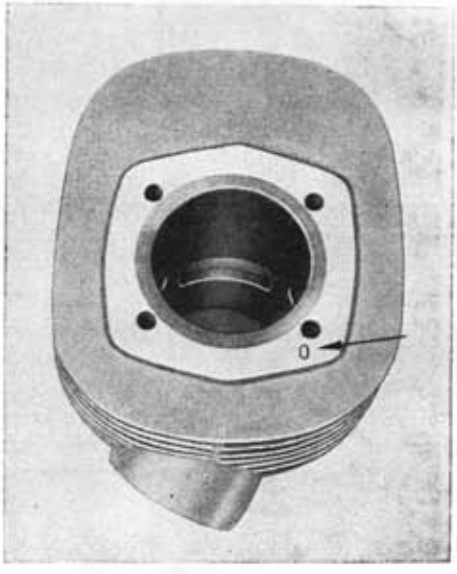


Fig. 67

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

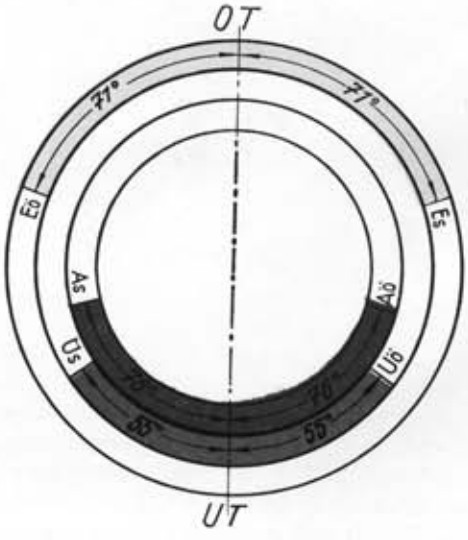


Fig. 68

All MZ standard motor-cycles have a "symmetric" timing diagram. Related to the transfer angle of 110°, that is to say, the transfer ports open 55° before bottom dead centre and close 55° after B.D.C.

Exhaust and transfer are measured from B.D.C., inlet from T.D.C.

Timing

	ES 125	ES 150
Inlet port with point at	142°	142.5°
Inlet port without point at	126°	126°
Transfer	110°	110°
Exhaust	152°	150°

Fig. 69

To check the timing, a graduated disk can be used as a makeshift; it is available from any stationer's shop (teaching aid). This disk can be reinforced for workshop use by riveting a sheet metal disk on it.

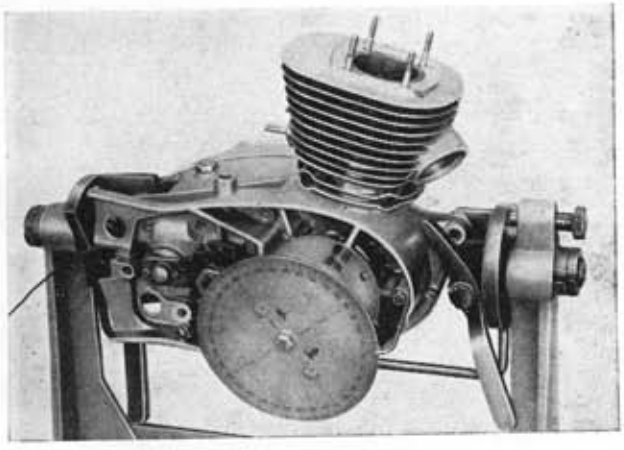


Fig. 70

If an old piston is reused, the piston rings must be checked that they are free to move in the piston ring grooves. Special attention should be paid to the top ring because it is exposed to the highest temperature. In the case of abnormally high operating temperatures due to wrong carburetter tuning or ignition timing, it may be distorted; this is indicated by a corrugated contact surface.

Each ring must be fitted into the same groove in which it has already been and run in (but not overturned).

Width of piston ring groove	wear value
$2^{+0.04}_{+0.06}$ mm	2.10 mm

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

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

Fig. 71

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

The same applies to deposits on the ring section and the piston skirt.

Piston-ring gap

in new condition:	0.2 mm
Wear value:	1.5 mm

Fig. 72

If the piston ring gap is too small, the rings will stick; as a consequence of the increased friction, the wear rate will increase, too.

The view that by fitting a new set of piston rings the performance of an engine that has run for a long period will be improved is wrong. In accordance with the engine performance, the cylinder bore has become more or less oval, whereas the new rings are perfectly cylindrical. As a consequence, exhaust gases escape, the rings are heated, become distorted and may evetually seize. This may lead to the sizing of the piston.

If, during assembling, a piston ring should be broken, the fitting of a new ring can be considered to ensure a proper performance only up to a maximum distance covered of 3,000 km. Moreover, the cylinder must be rebored and a new piston fitted.

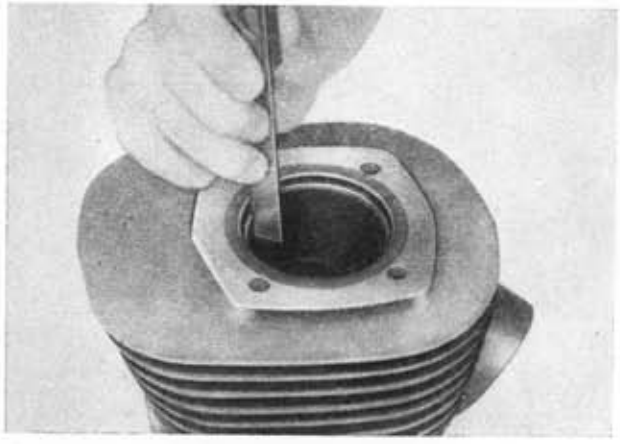


Fig. 73

Seizing traces should only be removed by means of a smooth-cut file or an oil-stone (emery stick) but not by means of emery-cloth or abrasive paper.

The piston shown in the accompanying illustration was seized because the gudgeon pin had too tight a fit in the gudgeon-pin boss.

N o t e : On no account use pistons of the MZ 125/3 or of the IWL motor-scooter "Berlin" for aluminium cylinders but only the pistons 52.505 A and 56.503 A.

Fig. 74

The reason is that the grinding curve of the piston has been adapted to an altered design.

For wide-fin cylinders, pistons with abaxial gudgeon-pin bore (reduces the noise) with the identification letter "C" – that is, 52.505 C or 56.503 C, should be used.

For fitting the gudgeon pin, the piston must not be too cold but "lukewarm" (about 35 to 40 °C).

After oiling the small-end bush and putting the piston on the support 01-MW 46-4, the g u d g e o n p i n c a n b e p r e s s e d i n p l a c e w i t h t h e t h u m b with the help of the guide pin 02-MW 33-4.

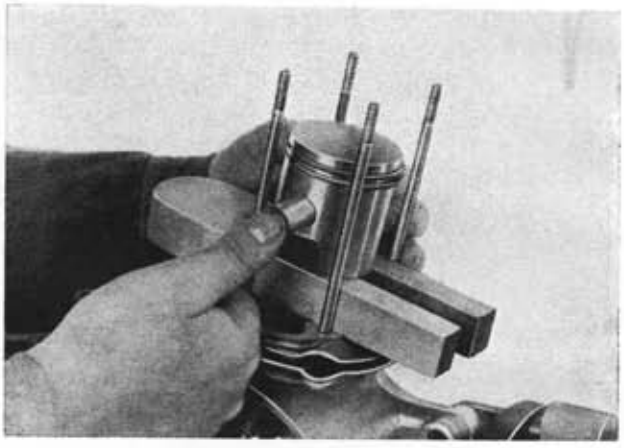


Fig. 75

The locking rings are inserted in such a way that the eyelets point upwards or downwards but not sidewards. See to it that the rings have a tight fit in the groove.

I n a n y c a s e o n l y u s e n e w l o c k i n g r i n g s. G u d g e o n p i n s are available in the following o v e r s i z e s :

0.01 mm
0.02 mm
0.03 mm

The piston-ring tightener (arrow)

01-MW 46-4 for ES 125 (52 mm)
11-MW 4-4 for ES 150 (56 mm)

is, with the rounded side, slipped over the ring section of the piston. Make sure the piston-ring gap

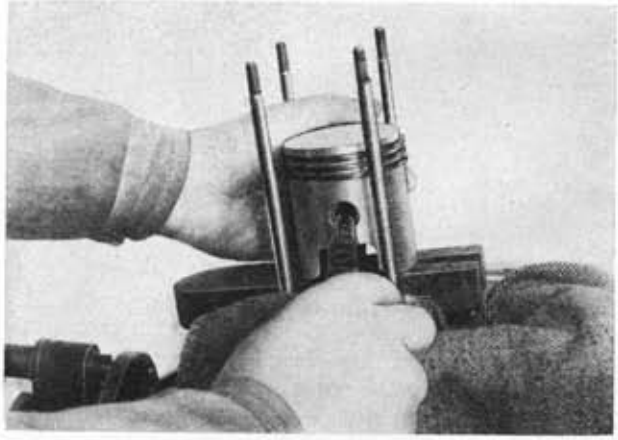


Fig. 76

is located at the locking pins, otherwise the ring will break.

To protect the cylinder-foot gasket from damage, stick it to the cylinder by means of two dots of grease. Then apply a film of motor oil to the working surface of the cylinder and slip the cylinder over the piston without the application of undue force.

Withdraw the piston support and shift the slot of the tightener over one of the four stay bolts. After rotation through 180° it becomes possible to pass the connecting-rod and the stay bolt through the slot and the tightener will be released.

When doing this, retain the cylinder with one hand to prevent it from sliding down.

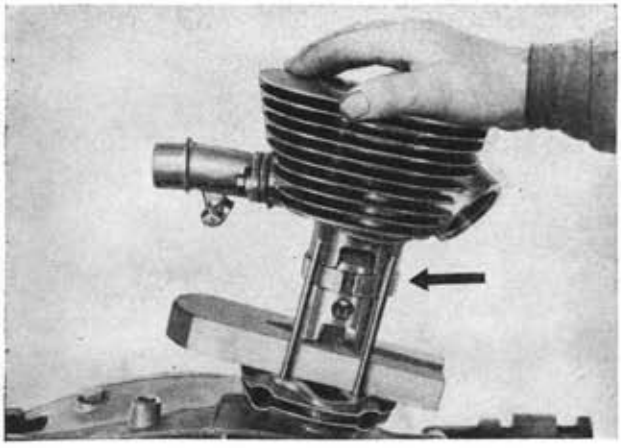


Fig. 77

There is no gasket between cylinder and cylinder head. Not for reason of economy but to ensure a better heat transfer.

The sealing surfaces of the cylinder head (in any case) and of the cylinder must be checked that they are perfectly plane, using a surface plate.

If the head is severely distorted, it can be re-turned by means of a turning mandrel with threaded pin M 14 × 1.25. It is screwed into the thread for the sparking-plug.

Not more than 0.3 mm of metal should be removed in re-turning, otherwise the ratio of compression will become excessive.

The four supporting corners must be recessed by no more than 0.1 to 0.15 mm.

Combustion chamber with the sparking-plug screwed in place:

ES 125 = 15.4 cm^3
ES 150 = 18.0 cm^3

To meter out the chamber use petroil mixture, pour it into the chamber by means of a graduated measuring glass.

Untight cylinder heads are almost exclusively due to the wrong tightening of the fastening screws. Tightening must always be done "crosswise", that is to say, in the sequence 1-2-3-4. At first tighten the screws only slightly; at the next stage in tightening use a torque of about 5 kg-m.

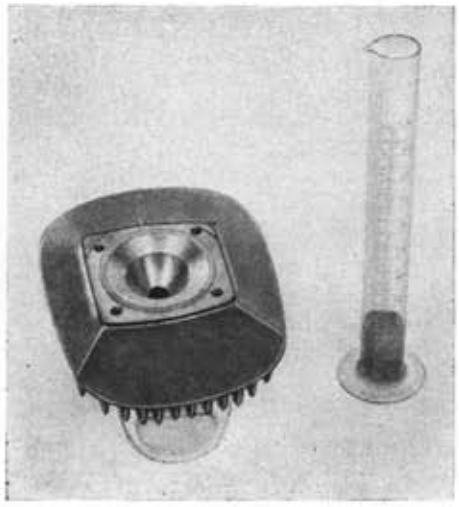


Fig. 78

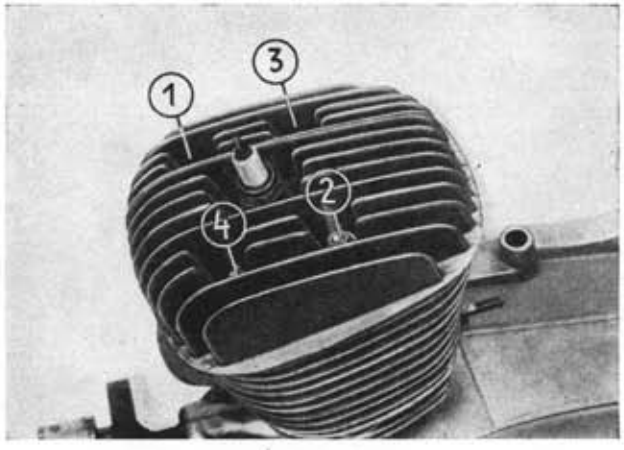


Fig. 79

Since the casing has cooled down, meanwhile, retighten all 14 casing fastening screws once more (observe Fig. 40).

A piece of binding wire must be pushed through the bore-hole for the gearbox breather to prevent it from being clogged by hardened leakproofing material.

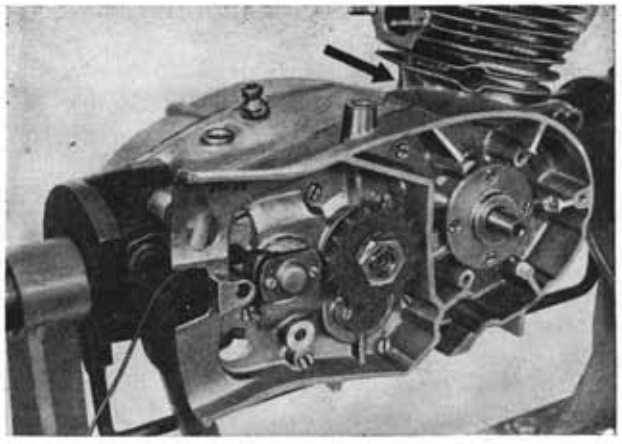


Fig. 80

5. Electrical Equipment

The purpose of checking the electrical equipment exclusively is to locate accurately the source of a trouble, the part which actually is defective. Repair work should exclusively be done by IKA Service Workshops.

5.1. Checking the Armature for Accidental Ground

The test voltage should be anything between 60 and 75 V; if the necessary care is taken, 220 V (mains voltage) are permissible. In any case use a properly insulated support.

Interconnect a test lamp and test one commutator segment after the other by means of the test point.

If the lamp fails to flash up, the insulation of armature and commutator are in order.

If the lamp shows a dark-red light, a slight ground leakage is given; if the lamp shines bright, a large ground leakage is given so that the armature must be replaced.

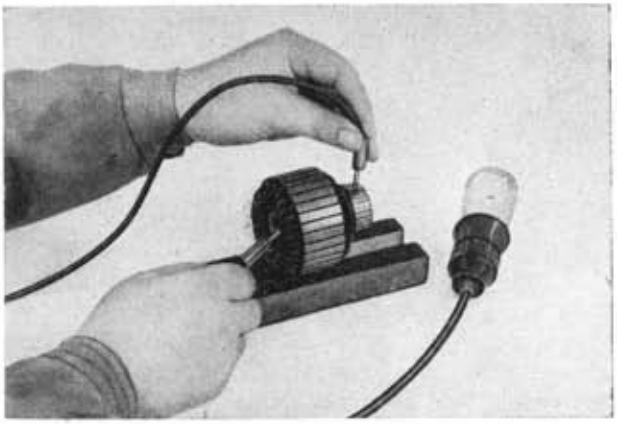


Fig. 81

A uniform brown to grey-black colour of the commutator surface is without any significance. If this surface shows tracks or scratches, have the commutator turned down on a mandrel in a lathe by an expert because the commutator must be not more than 0.03 mm out of round.

If the eccentricity of the commutator exceeds this value, the brushes will spark heavily (because the brushes "jump") and char the commutator surface; as a consequence, the dynamo cannot supply the full rated power. After turning the commutator, scrape out the slots between the commutator segments on a milling machine or a saw. This time-consuming work is necessary, otherwise the projecting mica sheet will rapidly wear down the carbon brushes.

In this connection it should be mentioned that the same condition is given if the radial play of the crankshaft main bearings is excessive. Oiled up and dirty commutator surfaces are cleaned by means of a non-fuzzy piece of cloth soaked in petrol.

5.2. Checking the Field Coil for Accidental Ground

Remove the adjustable resistor and neutralise the negative field connection (connected to the socket of the resistor). Also remove the positive connection to DF (dynamo – field) because the terminal DF may be shorted to earth in the old design.

Apply one test point to the frame and the second to the DF terminal. Further, apply the test point to the positive link of the field coil, the second test point to the frame.

If the test lamp does not flash up in both cases, there is no accidental ground.

Fig. 82

5.3. Checking the Field Coil for Shorted Turnes

Apply the test pins of an ohmmeter to the positive and negative sides of the field coil.

The ohmmeter must indicate any value between 2.7 and 3.1 ohm.

Fig. 83

Low value = shorted turn
No deflection = field coil interrupted

Have the defective field coils replaced by the Electric Service only.

5.4. Carbon brushes

After loosening the connections and with-drawing the brush springs, both brushes can be removed and cleaned by means of a piece of cloth soaked in petrol – but never by means of a file. Also clean the brush holders, the brushes must be free to move in their holders.

Before re-inserting the brushes, put the compression springs (only use non-deformed springs which are in perfect working order) on the brushes and take careful note that the brushes engage with the spring end, otherwise the springs my be displaced laterally.

Brushes worn down to about 9 mm must be replaced.

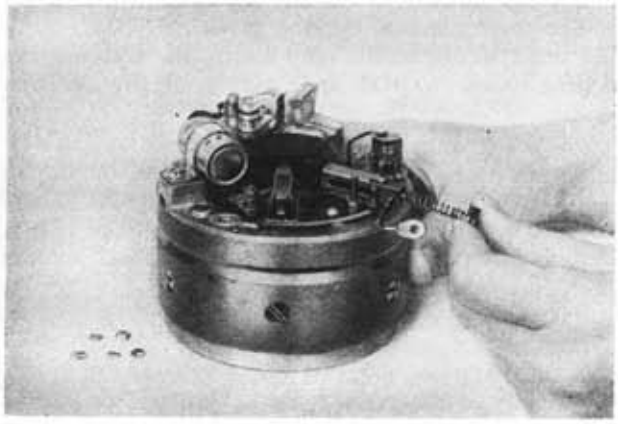


Fig. 84

5.5. Adjustable (Series) Resistor

An expert will know a blown adjustable resistor by the irregular firing order and, perhaps, by ignition failures at high speeds. A charred insulation varnish on the resistor coil will then be the proof.

Do not only replace the resistor but remove the cause of the trouble.

For example: wire D+ loose or disconnected from the regulator (short circuit).

The following connections have to be made
long cable (yellow-red) to D+ (positive brush)
short cable (black) to DF (field – positive)

5.6. Ignition Timing

Wipe the tail shaft (cone), insert the key and slip on the armature.

Mount the pole casing and fasten it. Take care of the locking pin and centring edge, they must not be displaced by force.

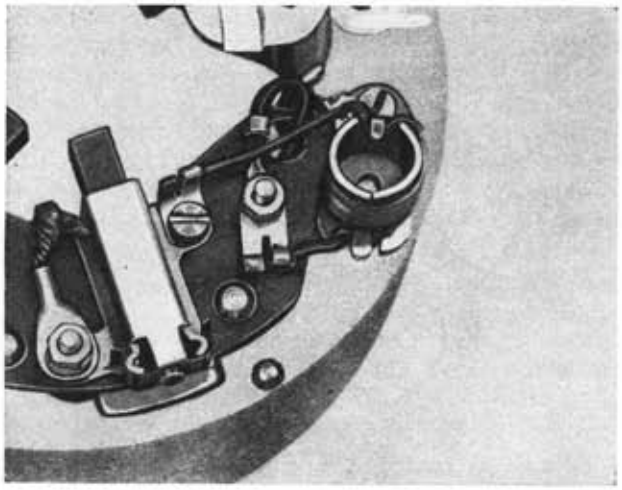


Fig. 85

The cam carrier is centred by its cylindrical projection in the armature. To ensure true running, the bore must not be jagged and must be clean.

Take care – the nose in the armature bore must engage with the groove in the cam carrier in undamaged state, otherwise the range of adjustment of the contact-breaker base plate will become insufficient.

Connect cam and armature by tightening the M 7 screw.

The washer but not the spring ring must contact the cam.

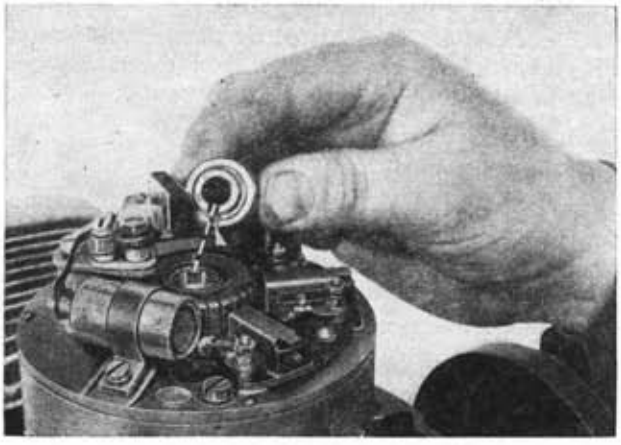


Fig. 86

Ignition timing starts with checking the contact breaker points: loosen the terminal screw (1) of the contact rail from the capacitor, remove the contact lever. Clean the breaker point faces by means of an emery stick. If they are seriously pitted, insert new parts.

The breaker points must make contact with their full face; adjustments of the contact angle are possible. Remove remains of lubricant from the pivot (2). Uniformly apply a drop of "Hypoid-oil" or "B 2"; refit the contact lever.

In foreign countries: Use E.P. gear oil having a pour point of – 15 °C (almost similar to SAE 90).

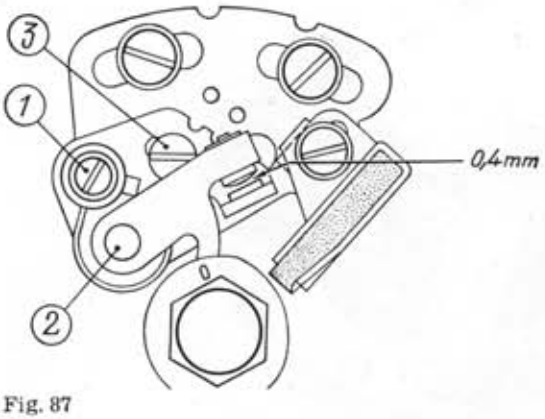


Fig. 87

Seriously burnt contact faces are indicative of a defective capacitor (initial stage). If several plies of the capacitor winding break down, the engine will be able to idle but will stall when it is accelerated (any effort to adjust the carburetter will in this case be in vain). Make sure the ground contact is in order.

To adjust the contact breaker points gap, which is 0.4 mm, the crankshaft must be turned until the high-level portion of the cam ("O") lifts the contact lever. The test gauge must slightly pass over both breaker points, in other words, it must not jam nor clatter.

After loosening the setscrew (3), adjust the points by applying a screw-driver between the lugs at the contact-breaker base plate and the two notches at the contact angle.

The specified gap is adjusted by turning sidewards. Properly tighten the setscrew and check the gap once more.

Contact breaker points gap:

ES 125	0.4 mm
ES 150	0.4 mm

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

Note:

If the contakt breaker points gap is increased, the advanced ignition is further advanced (the cam starts lifting the contact breaker already at the beginning of the "cam lobe").

If the contact breaker points gap is reduced (due to wrong adjustment or wear) the advanced ignition is retarded. (In this case the contact breaker only slightly contacts the high-level portion of the cam. The ignition coil is not in a position to built up the required high voltage – a weak spark will result. The engine causes the carburetter to "splash".)

Ignition timing gauge H 8-1408-3 (Special tool) or similar gauge of high accuracy (dial gauge) to be screwed in.

When timing the ignition alsways use a test lamp

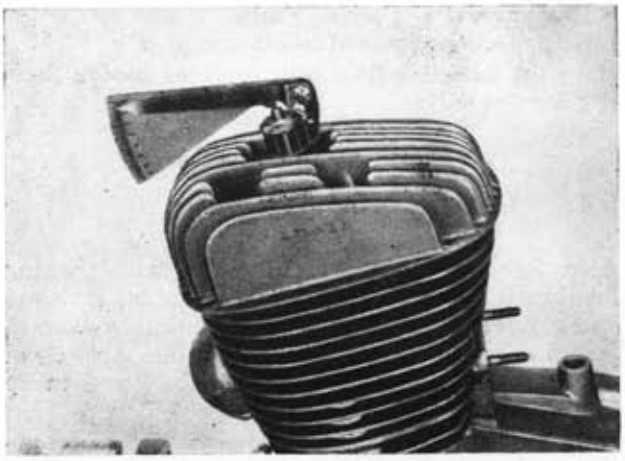


Fig. 88

Apply one terminal of the lamp to connection "1" at the capacitor (or contact rail) and the second terminal to the frame.

If the spark is timed with the equipment removed from the vehicle, then connect the positive terminal of the 6-V battery to "1" and the negative terminal to the earth contact. Set the piston to T.D.C. (with the flat spanner at the stay bolt), the slide of the setting gauge to "O" and switch in the ignition system.

Turn the crankshaft opposite to the normal sense of rotation (arrow in circle) until the specified value is indicated at the gauge. At this instant the test lamp must flash up. If not, loosen the two screws (1) and shift the contact breaker base plate laterally.

Advanced ignition:

ES 125	4.5 mm before T.D.C.
ES 150	4.0 mm before T.D.C.

Then a few drops (about 5 to 7 g) of Hypoid or B-2 oil are applied to the lubricating felt pad which is adjusted in such a way that it slightly contacts the high-level portion of the cam.

If the pad contacts the whole circumference of the cam, the lubricant will be pumped out before long; consequently the dry pad heats the cam and premature wear will be the result.

Hypoid is a gear oil with E.P. properties (compound type, similar to SAE 90).

"B 2" has been developed as special oil for lubricating contact breaker systems and is supplied by VEB Fahrzeugelektrik Karl-Marx-Stadt.

After mounting the engine in the chassis and connecting the leads to the dynamo, put the dynamo cover in place. Then the clutch is adjusted.

5.7. Sparking-plug

Sparking-plugs should not be treated in this way. Almost invisible hairline cracks in the ceramic body will render it useless. If the plug is removed from the engine, an intense spark will flash over between the electrodes, however, in the engine (under pressure) the ignition current will take a different way.

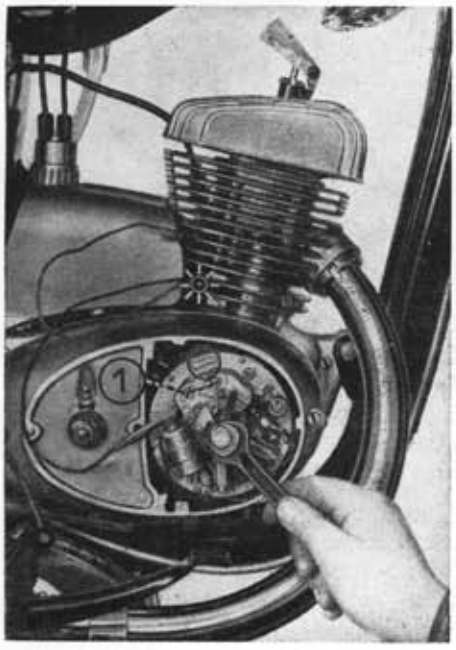


Fig. 89

The proper functioning of the sparking-plug also depends on the good condition of the plug sealing ring. It must provide a gas-tight seal, otherwise leaking gases of combustion will heat the plug to such an extent that incandescent surface ignition will occur, although the plug has the correct calorific value.

The fissured interior of the plug absorbs a larger amount of heat than the smooth chamber of combustion; however, a seriously deformed sealing ring obstructs the exchange of heat. At the firing instant more than 2,400 °C are involved.

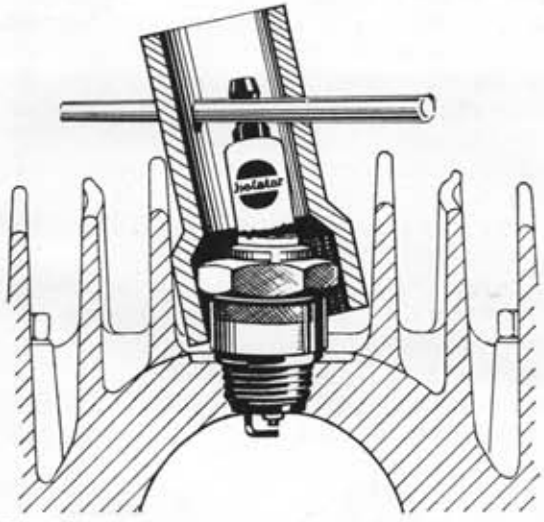


Fig. 90

The threaded part of the plug must be flush with the surface of the combustion chamber. Projecting threads of plug or cylinder head will lead to overheating.

Tetra ethyl lead is added to high-octane fuels which, especially in the case of over-aged fuels, may form deposits of lead oxide. Lead oxide is transparent (therefore, besides a slight "glaze" nothing else can be seen in the interior of the plug) and will become conductive at 300 to 400 °C, whereas it is non-conductive in the cold state. If the cold engine starts properly, whereas ignition failures occur when the engine is hot, the only remedy is a new sparking-plug.

Spark gap: 0.6 mm (to be measured by means of a feeler gauge)

The bridging of earth and central electrodes, also known as "plug bridge", is the result of increased electrode temperatures in connection with insufficiently filtered intake air. The electric field built up by the spark carries particles to the earth electrode where they are deposited until the plug is short-circuited.

For normal operation the Isolator sparking-plug M 14/240 should be used. Motorists who take part in racing events are recommended to use the Isolator plug RM 14/250 S.

The plug thread is M 14 × 1.25 mm pitch.

5.8. Plug Cable Connector

Frequently the partially shielded plug cable connector causes ignition lag (reduced engine output) or ignition failures; in these cases frequently the connector is replaced by a new one. However, in this way material is wasted because the old connector can quickly and simply be restored to perfect working order.

The sparks flashing over between the electrodes produce a high-frequency electric field which radiates through the supply line to the surrounding. The ignition cable (especially if it is wet and dirty) acts in this connection as an antenna.

An anti-interference resistance damps these oscillations. It produces the best effect when installed close to the electrodes. However, sparking-plugs with incorporated anti-interference resistance are not yet installed in the standard equipment.

Normal sparking-plugs are radio-shielded by a resistance (1) shielding the cable of the plug. The surface of the cable connector is provided with a metallic shielding coat (2) which diverts the electric field of the connector over the spring-loaded bottom

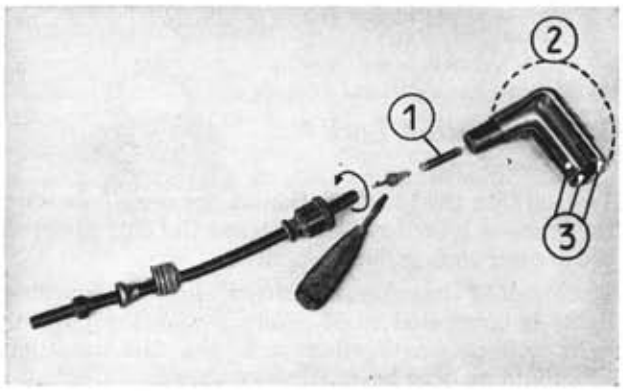


Fig. 91

part (3) to ground. If the care for this shielding is neglected, ignition failures will be inevitable:

The dust, water and oil particles contained in the air-stream are, attracted by the high-frequency electric field, diverted at high speed to the interior of the connector and the shielding (ground). In the course of time a conductive coating is formed in this way. As a consequence, the spark becomes weaker and weaker until it will fail completely.

Remove this coat by means of a brush and a washing agent or dry-cleaning spirit, blow out the connector and rub it until it is dry.

The contact springs (3) must contact the hexagon portion of the plug, otherwise the VHF and television reception will be interfered with to an impermissible degree.

The contact faces of the resistor (1) must be free from oxides. The contact area in the connector is cleaned by means of a small stick of wood. Resistors which have become loose or sooted are useless.

5.9. Horn

The contact breaker of the horn can be readjusted by means of the slotted screw (E), if required.

The screw need only be turned slowly through an eighth of a revolution, either clockwise or anticlockwise, which is to be found by trying, until the signal again has the correct sound level.

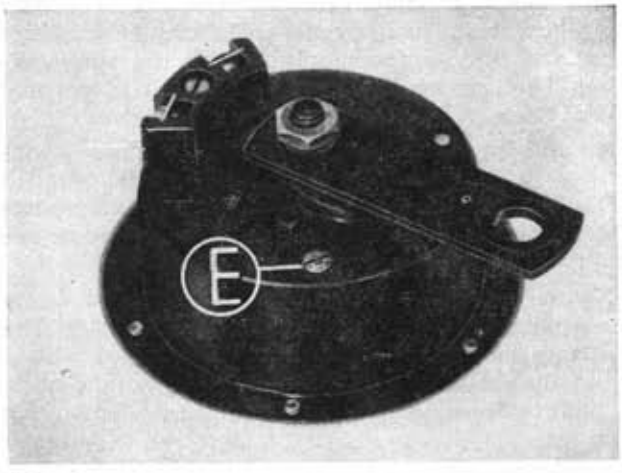


Fig. 92

5.10. Ignition Lock

To facilitate the identification of the terminals with the ignition lock installed, observe the clue given in the accompanying illustration.

Terminal 57 has been omitted, line 57 (parking light) is connected to 58. That is why the parking light will be on together with the full headlight beam and passing beam.

Take careful note of the wiring diagram.

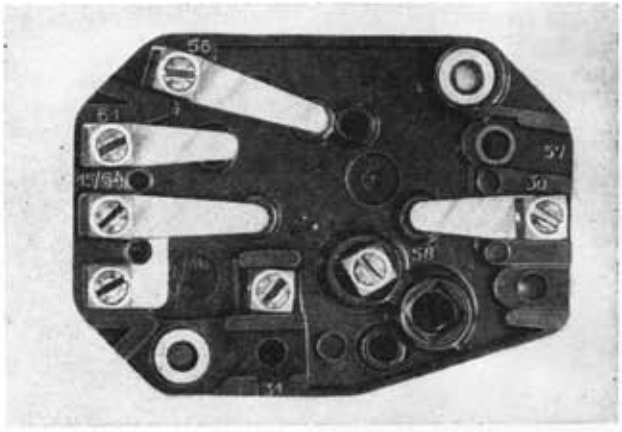


Fig. 93

5.11. Battery

The motor-cycles are provided with a 6V-12Ah-flat lead battery. A new battery must be filled with accumulator sulphuric acid (density 1.24, in the tropics 1.22) up to the mark. After about three hours, when the plates will be soaked completely, the battery is charged with 0.6 A. The battery is completely charged if all cells uniformly evolve gas, the charging voltage has reached a value between 7.5 and 7.8 V and remains constant within the next three consecutive hours and the density of the acid is 1.28.

After four weeks the storage battery has reached its full storage capacity; then the battery is charged with 1.2 A.

Take care to see to it that the acid level is kept within the marked limits, replenish with distilled water, and check the density of the acid by means of a hydrometer.

Protect the battery container from fuel, impacts, and excessive pressure.

The battery suspension strap must not close the central vent plug, otherwise this cell will boil over.

Fig. 94

Check the battery cable, loosen jamming terminal screws by slightly heating them.

Clean pole connections and pole terminal screws, apply a film of appropriate grease to the battery terminals (special grease for terminals).

5.12. Regulator, Terminal Strip and Ignition Coil

Terminals at the combined regulator and cutout.

Defective cable sockets must in any case be replaced. If, for example, the cable socket D+ breaks off, the adjustable resistor of the dynamo will blow.

If the retaining spring is distorted, make sure the end of the spring (arrow) does not contact the insulated rivet at the bottom. (In the latest design, this rivet is not live!)

The terminal strip (hatched area) is liable to oxidation due to the passage of intense current. This may lead to a voltage drop of up to 50 per cent.

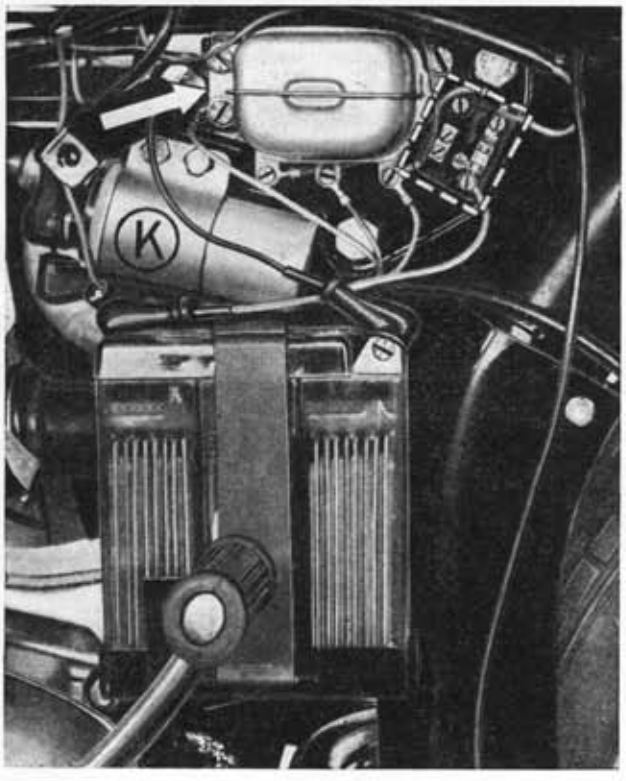


Fig. 95

Thoroughly clean positive and negative terminals, screws, retaining spring with fuse. The cable ends – which must be soldered especially in this case – must always be bright.

Protect all metal parts with special grease for battery terminals.

Latest terminal strip design provided with two fuses (see section "Slip-on type of connectors").

Tighten the clip (K) of the ignition coil with every care, otherwise the secondary winding (a parcel of wires as thin as hair) will be damaged so that its turns become shorted.

When connecting do not exchange the cables; that lead which is live when the ignition system is switched on is connected to terminal "15" (terminal 15 at ignition lock). The lead for terminal pin "1" is connected with the contact breaker.

The adjustment scheme (Fig. 96) for mechanical adjustments by means of a feeler gauge is here included only for emergency repairs, e.g. if a contact is charred.

For the final (electric) adjustment, only the Electric Service (with test bench) is competent.

Do not increase the regulator setting before thorough trouble shooting; especially in the case of older vehicles check that the line system allows the current to pass (free from oxid).

5.13. Focusing the Headlamp

If the road is insufficiently illuminated, the contacts in the lamp holder have, among other things, to be checked:

Unscrew the polyamide stop-ring of the lamp, withdraw the two clamps of the insert and hook them at the sides. Reflector and light-diffusing glass are stuck together – do not separate them.

Carefully withdraw the contact rail (1) – distorted contact reeds may no longer allow current to pass through. Thoroughly clean all contact points; if necessary, unfold or bent the reeds open.

In view of the high current of 45/40 W, take care to see to it that the ground connection is in order (2).

When taking out the retaining spring (3) of the lamp holder, retain the latter with your hand because there is a compression spring below it.

The fixed headlamp can be adjusted after loosening the locking screw.

For this purpose, the vehicle is loaded with the driver, the rear suspension units being set to "soft".

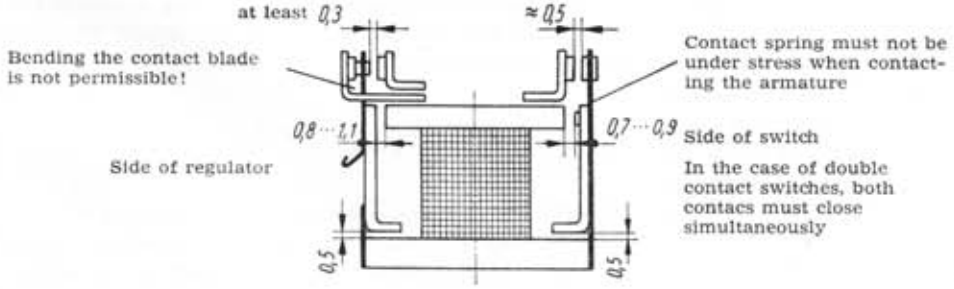


Fig. 96

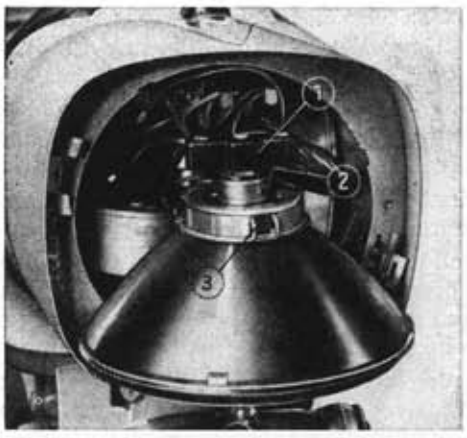


Fig. 97

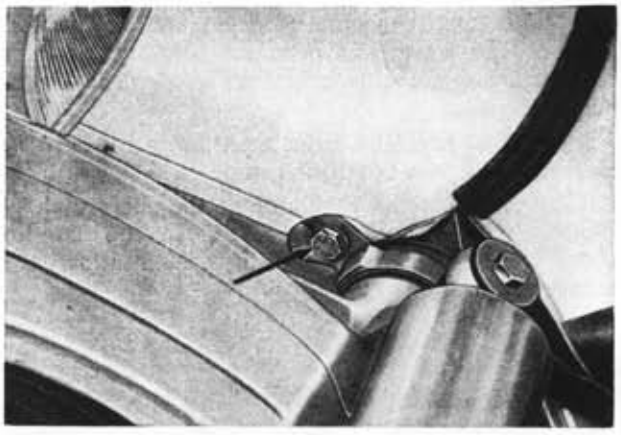


Fig. 98

Bear in mind that the tyres must show the specified inflation pressure.

For a check-test load the vehicle additionally with a pillion rider and set the suspension units to "hard".

Headlamp focusing cheme

The "light/dark boundary" of the asymmetric passing beam must be not higher than 5 cm below the centre of the headlamp (+) for both types of vehicle loads. The centre of the light area (hatched "Z"-line) is 15 cm below headlamp centre – the angle within the range "V-W".

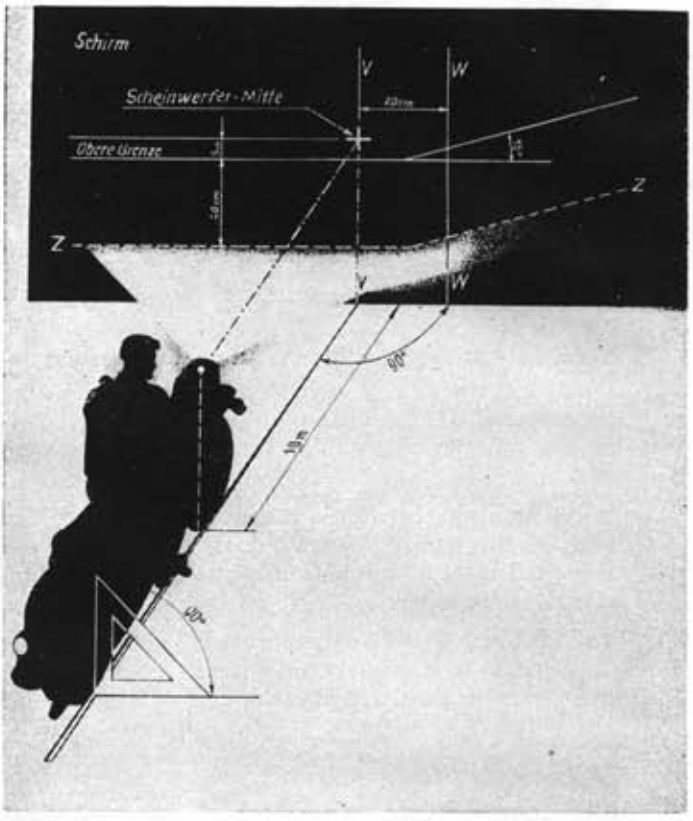


Fig. 99

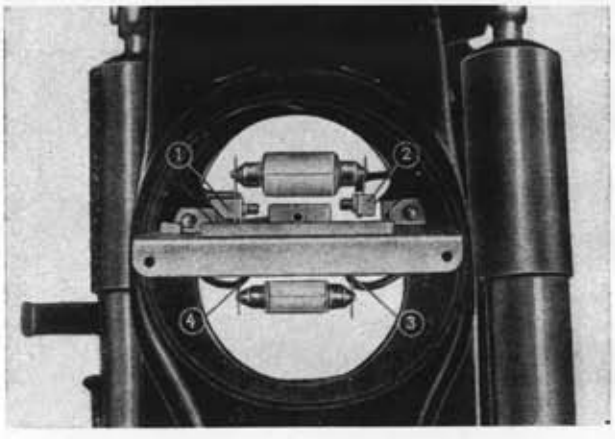


Fig. 100

5.14. Rear Lamp and Stop-light Switch

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

Wipe the parabolic reflectors with a dry cloth only.

To re-adjust the stop-light switch (in the example shown here the stop light is shorted to earth) withdraw the rubber cap with plug and slacken back the nut (SW 9) by a quarter of a revolution. An assitant steps on the brake pedal to apply the brake shoes in such a way that they slide when the rear wheel is turned. Retain the brake lever in this position and turn the slotted screw until, with the ignition system switched on, the stop light flashes up. Tighten the nut with the necessary care because the insulation bushing is of plastic material that may break.

If the operating range of the adjusting screw is insufficient, the contact spring at the brake spanner can be re-adjusted.

5.15. Flasher Unit

The flasher unit is susceptiple to impacts and shocks; that is why the elastic suspension (tension spring or foam rubber) must not be changed. When work-

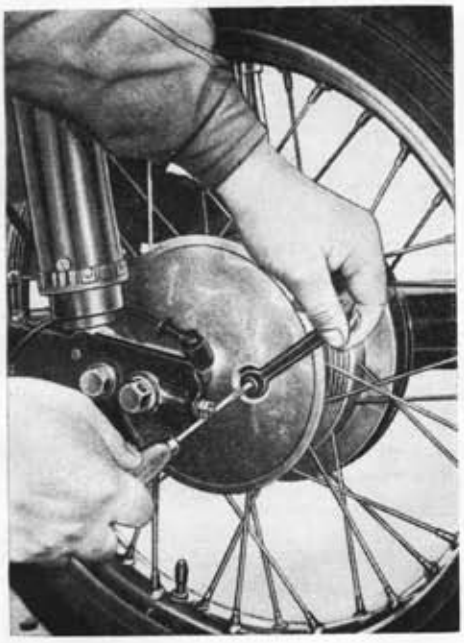


Fig. 101

ing at the flasher unit, always withdraw the ignition key – because a short-circuit causes the failure of the unit.

18-W tubular lamps should only be used; lamps with a higher or lower wattage change the flashing frequence 90 ± 30.

The lead may be connected to terminal 49 or 49a.

(A) Older design with spring clip and tension spring suspension. Dark-light operation, without ground lead.

(B) The actual transmitter is embedded in foam rubber in the case of the unit. Dark-light operation, without ground lead.

It is recommendable for both flasher types to fit a fuse cartridge (C) with a 4-A fuse into the supply line (the fuse is available in any radio shop).

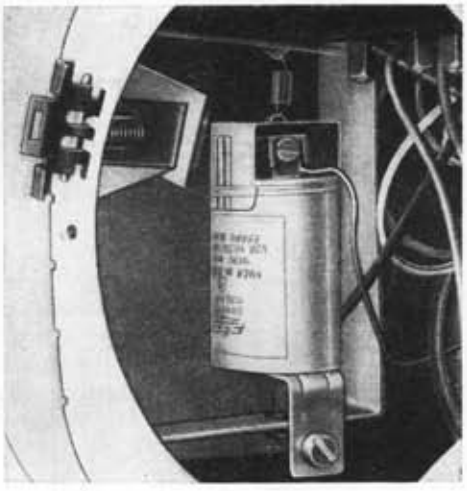


Fig. 102

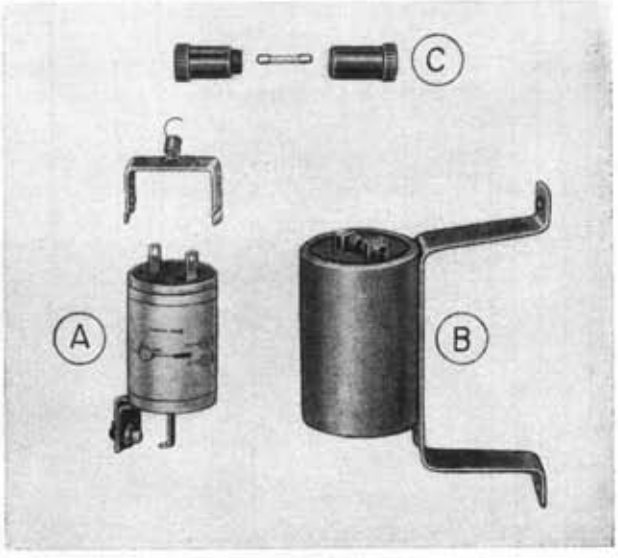


Fig. 103

5.16. Wiring diagram

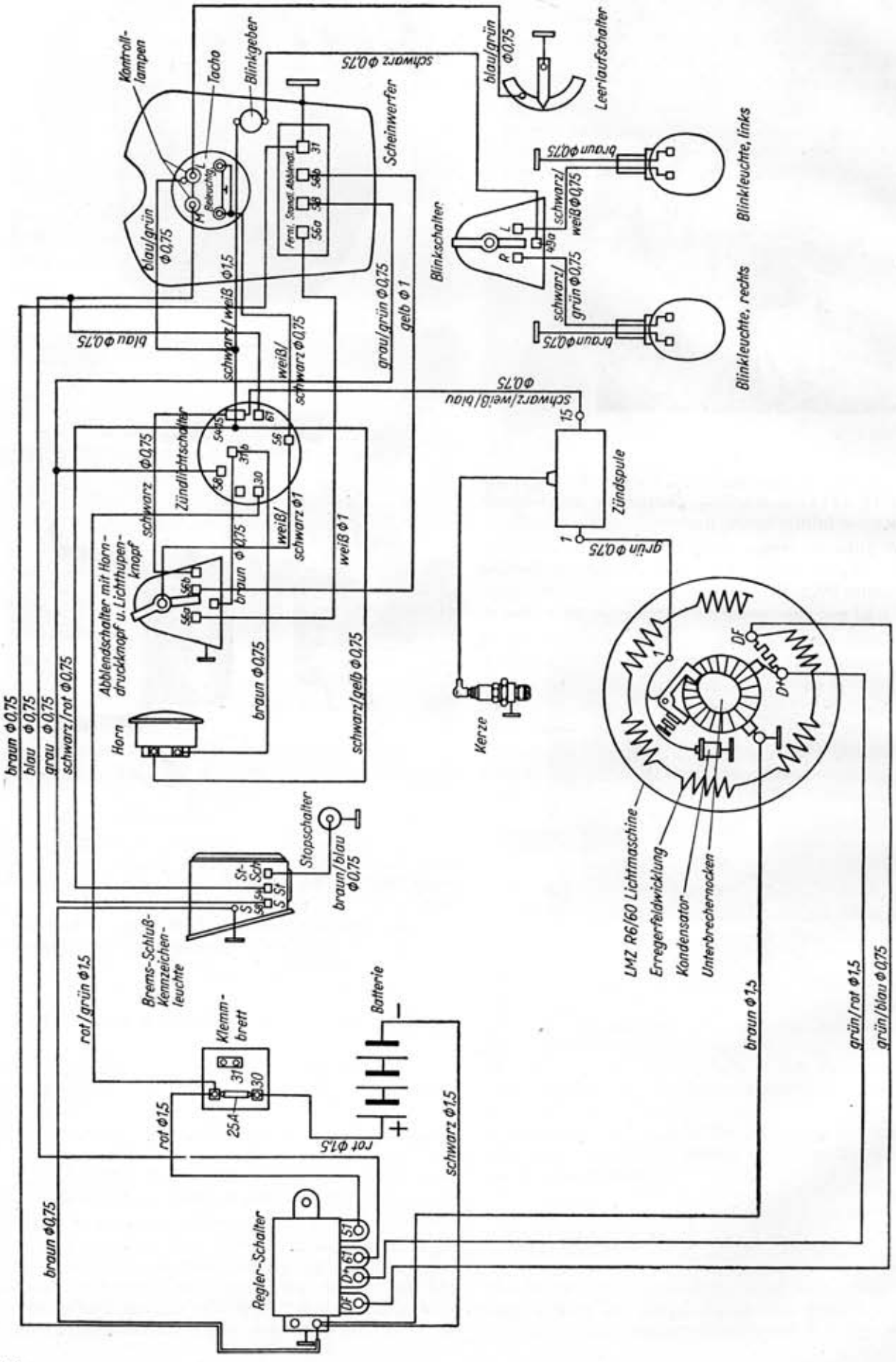


Fig. 104

6. Slip-on Type of Connectors for the Electrical Equipment

From January 1965 the electrical equipment has exclusively been provided with slip-on type connectors in the place of screwed-on connections.

At the same time, the terminal strip (a) has been provided with 15-A fuses. The charging circuit is separately protected by the second fuse. Please, pay attention to the circuit diagram (Fig. 108).

Electric components to be installed in the case of repairs are only available with the slip-on type of connector. It is not soldered to the cable end but has to be clamped by means of a pair of beading tongs.

List of suppliers of these tongs available from MZ Service.

When connecting the regulator, do not slip on the cable connectors automatically but pay attention to the identification numbers and colours: With the former design, D+ and 61 were at a terminal on the right-hand side, whereas the regulator with slip-on type connectors is provided with a double-terminal arranged in the centre.

With the ignition system switched on and the engine inoperative, line 61 connects the charging control light via the reverse current circuit-breaker reed (magnet angle) of the regulator to earth – the red charging control light flashes up.

If the engine has been started and exceeds the making speed (between 900 and 1,100 r.p.m.), the dynamo supplies current. The magnetic angle is attracted; as a consequence, the charging control light goes out because it is disconnected form earth. 61 now is connected to the positive pole from D+.

Slip-on type connectors at the dynamo (Fig. 107).

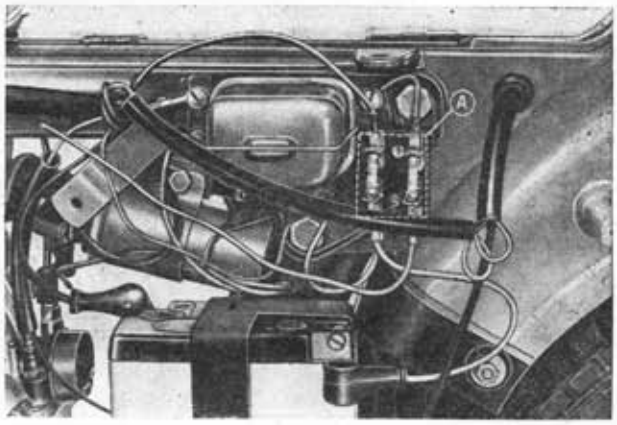


Fig. 105

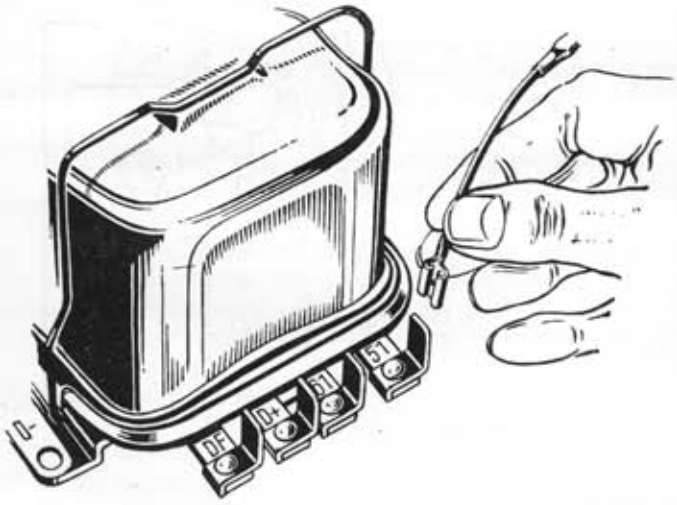


Fig. 106

Fig. 107

Explanation to fig. 104:

Regler-Schalter	Regulator-cutout switch	Tacho	Speedometer	Blinkleuchte, links	Flashing trafficator, left
Klemmbrett	Terminal strip	Scheinwerfer	Headlamp	Beleuchtung	Lighting
Brems-Schluß-Kennzeichenleuchte	Stop, tail and number-plate light	Blinkschalter	Flasher switch	Fernlicht	Headlighting
Batterie	Battery	LMZ R 6/60 Lichtmaschine	LMZ R 6/60 Dynamo	Standlicht	Parking light
Stopschalter	Stop switch	Erregerfeldwicklung	Exciter winding	Abblendlicht	Dimmed light
Horn	Horn	Kondensator	Capacitor	braun	– brown
Abblendschalter mit Horndruckknopf u. Lichthupenknopf	Dimmer switch with horn push-button and by-pass light control knob	Unterbrechernocken	Contact-breaker cam	blau	– blue
Zündlichtschalter	Ignition-light switch	Zündspule	Ignition coil	grau	– grey
Kontrollampen	Control lamps	Leerlaufschalter	Idling switch	grün	– green
Blinkgeber	Flasher unit	Blinkleuchte, rechts	Flashing trafficator, right	rot	– red
				gelb	– yellow
				schwarz	– black
				weiß	– withe

6.1. Circuit diagram of the electrical equipment with slip-on type connectors

(1) combined stop, tail and license plate light
(2) horn
(3) dimmer switch with horn button and by-pass light signal button
(4) ignition and light switch
(5) headlight
(6) speedometer
(7) flashing transmitter
(8) pilot lights
(9) speedometer illumination
(10) upper-beam headlight
(11) parking light
(12) lower-beam headlight
(13) stop light switch
(14) fuse box
(15) regulator cut-out
(16) storage battery
(17) spark plug
(18) flashing trafficator switch
(19) neutral-gear indication switch
(20) flashing light, left
(21) flashing light, right
(22) ignition coil
(23) generator LMZ R 6/60
(24) exciting-field winding
(25) condenser
(26) contact-breaker cam

braun	— brown
blau	— blue
grau	— grey
grün	— green
rot	— red
gelb	— yellow
schwarz	— black
weiß	— white

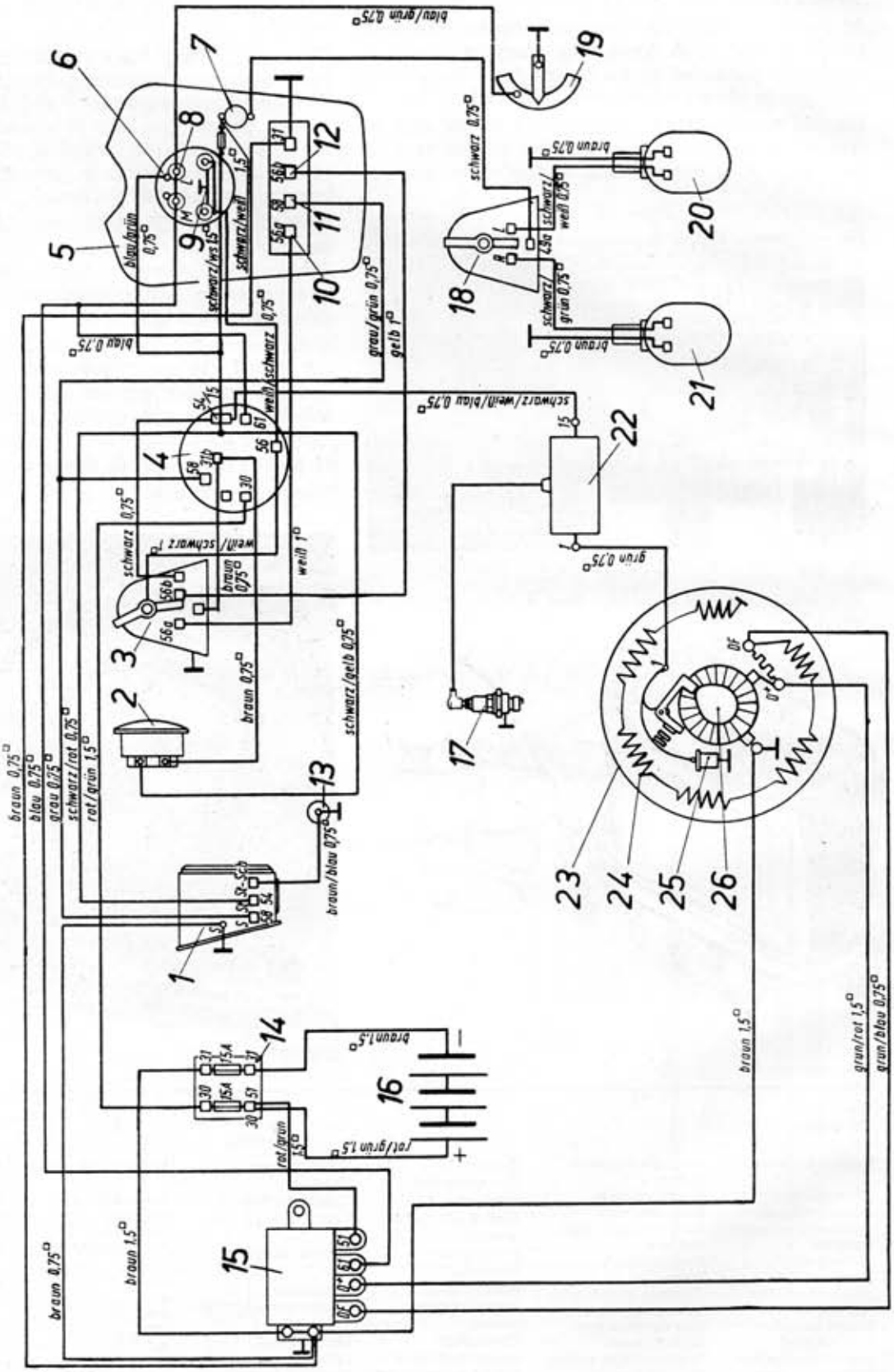


Fig. 108

7. Induction System

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

Symptoms of Overheating, Inclination for Jamming, Deposits at the Sparking-plug

a) Air filter damaged, unrestricted air passage.
b) Filter receptable fails to provide a proper seal on the intake muffler (rubber seal missing).
c) Rubber sealing flange at induction pipe does not fit tightly or hose for dynamo ventilation withdrawn.
d) Insulating flange between induction socket and cylinder is untight or porous.
e) Joint at crankcase or cylinder foot untight, crankshaft seal rings defective.

These "air bleed openings" in front or or behind the carburetter reduce the suction at the upper edge of the needle jet; as a consequence, l e s s f u e l is carried off.

Difficult Starting, Engine Lacks Power, Sparking-plug Oiled up

1. Wet air filter nearly choked. In the case of dry air filter: filter paper element has become wet or is worn out (more than 10,000 km of operation).
2. Silencer choked by products of combustion or silencer element has worked loose and blocks the bore-holes.

The largely choked passages at filter increases the suction at the needle jet; consequently m o r e f u e l is carried off. Although the carburetter is correctly tuned, the fuel-air mixture becomes too rich.

The bore in the induction system must be closed with a rubber stopper (1). Without it, the carburetter provides too lean a mixture – further, unfiltered air is supplied to the engine.

Make sure the packing (2) at the filter is in proper condition.

Clean the w e t - t y p e f i l t e r in petrol and moisten it with air filter oil.

Beat out the d r y a i r f i l t e r until the filter paper labyrinth is free of dust. Exchange the filter element after ever 10,000 km. Elements that have become wet must be replaced because they are more or less choked.

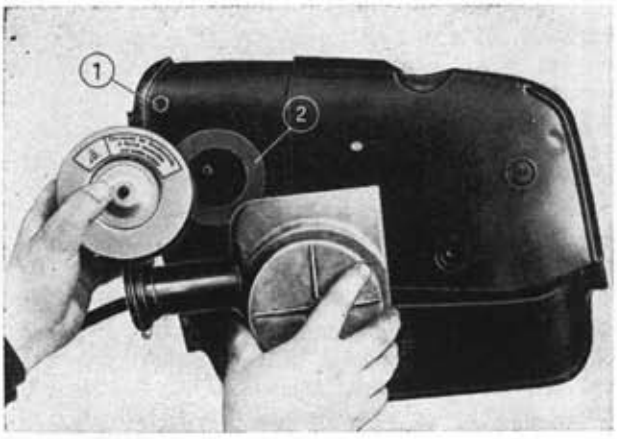


Fig. 109

Item 2. regards an excessive back pressure in the exhaust system.

Due to the narrowed sections, the gases of combustion cannot be expelled quick enough. Consequently, larger amounts of gases remain in the cylinder. This means a reduced intake capacity and reduced output.

The abnormal back pressure acts up to the carburetter intake socket and the carburetter itself – which intensely "sprays" back.

The i n t a k e p i p e is screwed in place only after mounting the engine to avoid handling or transporting the engine at the pipe. If overstressed, the insulating flange of moulded material may crack or become untight. As a consequence an air leak is produced in the induction system.

When assembling, see to it that the transition from the intake port of the cylinder, the insulating flange and the intake pipe is smooth (also take the packings into account).

Here is a task which is worth while for the amateur constructor: the engine output can significantly be increased by smoothing the inner surface of the intake pipe casting and the transitional edges which are conditioned by the technological process. The transitions concerned are those from the carburetter to the induction pipe connection – from the pipe connection to the insulating flange and to the inlet port. The lower edge of the pipe connection bore must slightly drop towards the cylinder.

8. Carburetters 22 KNB and 24 KN

The correct tuning and proper functioning of the carburetter is not only decisive for a good engine output, a reasonable fuel consumption, and excellent startability, but also for reliability in operation and minimum wear. Since, again and again, serious engine troubles that could be avoided are caused by irregularities in the carburetter function which are overlooked or not perceived and detected, we hold a detailed description of the interrelations to be necessary.

The phrases "gasifier" (for carburetter) or "to step on the gas", used in some countries, are incorrect. The carburetter is not used to "gasify" anything because this would require heat from which the carburetter must be protected (thermal insulation flange). Heated air has a larger volume than cold one and would impair the charge of the engine. (That is why the engine lacks power in the heat of midsummer, whereas the full output is given in the cool morning.)

For the internal combustion of 1 litre of petrol, 9,300 litres of air are required. This enormous quantity of air (with only about 20 per cent of oxygen) must be mixed with fuel by the carburetter so thoroughly that a fine fuel "mist" is produced. Everything depends on the correct "density" of this vapour for the engine to produce the rated output.

In this connection the terms "fuel-air mixture too lean", and "fuel-air mixture too rich" are used. How can this be distinguished? Which effects are produced? (It goes without saying that the carburetter is tuned according to standard values and that it is clean.)

For the ratio of air to fuel in the mixture the unit λ is used. The mean value adopted for $\lambda = 1$ ($\widehat{=}$ 13.8 parts by weight of air and 1 part by weight of fuel). Values over 1 have a surplus of air, values below 1 lack air.

(1 m^3 of air has a weight of 1.2 kg at 10 °C and a pressure of 1 atm.)

The tuning of the carburetter must be correct at an ambient temperature of plus and minus 20 °C, therefore the standard tuning provides for a slightly richer mixture ($\lambda = 0.9$).

This small lack in air of about 7 per cent ensures:

a) a good full load performance (full load operation requires a slightly rich mixture because the suction at the needle jet is slightly reduced due to the completely open carburetter passage).

b) good cold starting and proper transition (the slightly rich mixture provides for a compensation for the fuel drops condensing in the cold intake pipe and crankcase).

The permissible carburetter tuning range (partial load needle) is given with $\lambda = 0.9$ to 1.1. Since neither a repair shop nor an amateure constructor normally has an engine test bench with the appertaining measuring equipment, a test run over a distance of at least 10 km is the only alternative for adjusting the carburetter. The engine must have reached normal operating temperature, otherwise misinterpretations of the engine behaviour will be inevitable.

The driving performance and the plug appearance are the criteria of the correct tuning.

Too Rich Mixture Below $\lambda = 0.9$

If the mixture is too rich, a lack of oxygen is locally given, consequently "retarded combustion" = poor performance.

Due to the incomplete combustion, not only the relatively harmless carbon dioxide (Co_2) but also the colourless but poisonous carbon monoxide (CO) are produced. The latter is combustible, that is to say, fuel energy is wasted.

Especially in short-trip riding, hydrocarbon particles remain in the engine which cause corrosion at the big-end bearing, cylinder liner and piston.

This is the cause of premature wear. A certain quantity of oil found in the crankcase after its disassembly is no counter-evidence but the proof for too rich a mixture. This "emulsion" is motor oil which is "saponified" with hydrogen and has no lubricating properties.

Symptoms: Engine starts from cold state even with the air choke fully open. The putput of the engine is satisfactory as long as the engine is cold, but decreases with increasing engine temperature. Inclination for "four-stroke cycling". Black exhaust gases, high consumption, sparking-plug of correct thermal value is oiled up.

Causes: Air filter choked, float chamber at too high a level, float needle seat pocketed, seal below carburetter adapter defective, needle jet loose or worn out. Main jet too large.

Too Lean Mixture over $\lambda = 1.1$

The air percentage in the mixture is excessive, the speed of combustion is extremely high, the exhaust gases are not visible and contain only little poisonous gases, there are no deposits in the engine which increase the rate of wear.

Symptoms: Engine starts well with correct setting of the pilot air screw, however, it must be run with a more or less closed choke for a longer period. The engine output is satisfactory up to about two thirds of the throttle valve opening, with increased throttle opening drop in output. If the engine is run within the range from two thirds to full load, the operating temperature will rise abnormally.

The engine causes the carburetter to "splash"; pinking and inclination to seize, or the small-end bush is worn out rapidly. Due to overheating the sparking-plug shows blue-grey deposits and beads.

Causes: Air leak in induction system or directly at the engine. Float chamber is at too low a level. Silencer components have been removed, therefore, the back pressure is too low.

Trouble shooting at the carburetter starts at the float needle seat (1). After about 15,000 kilo-

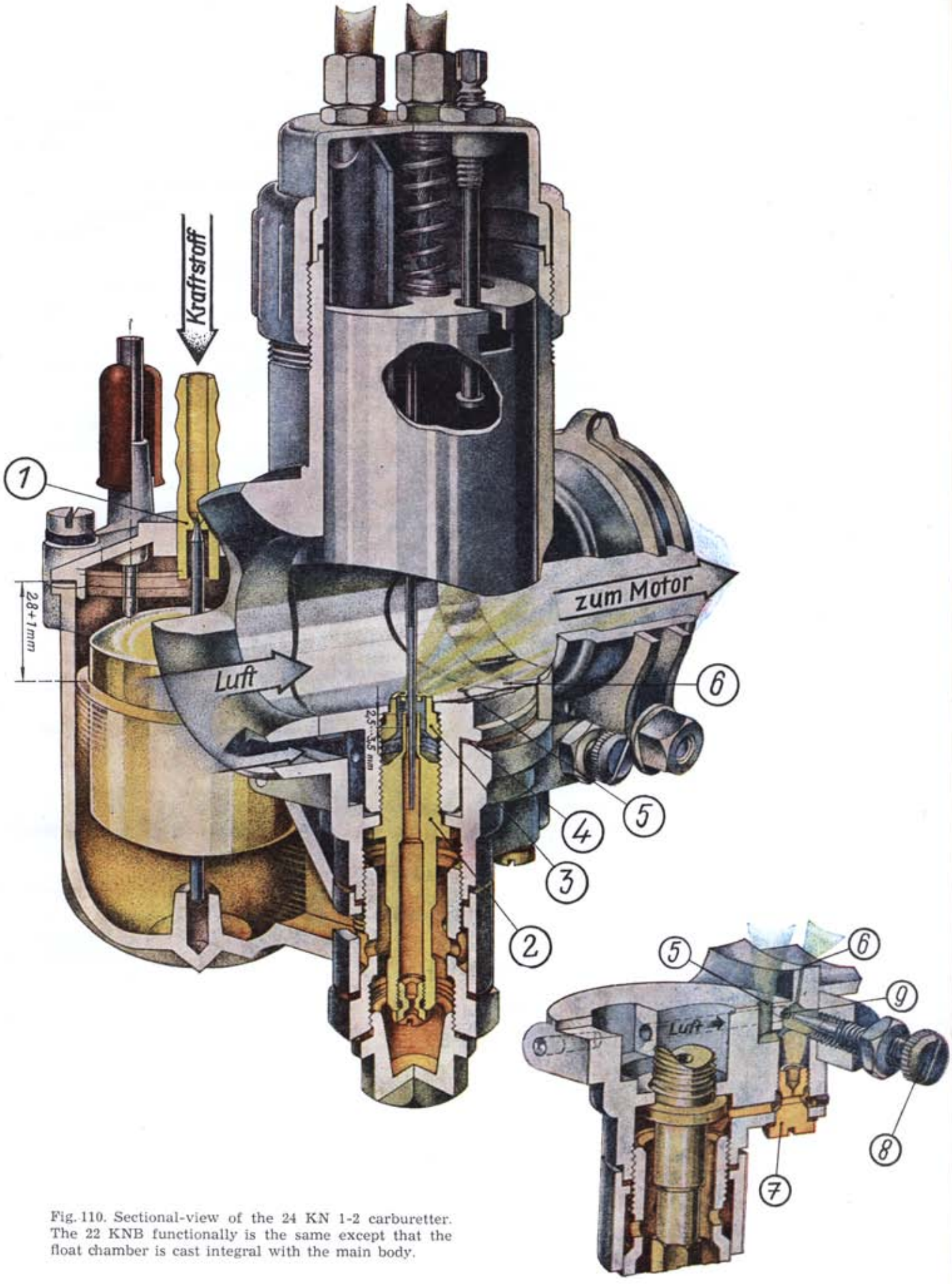


Fig. 110. Sectional-view of the 24 KN 1-2 carburetter. The 22 KNB functionally is the same except that the float chamber is cast integral with the main body.

metres covered, float needle and float chamber cover are indended (visible to the naked eye) to such an extent that the fuel level is higher than permissible due to a leak in the needle valve, the carburetter tends to spill fuel and thus the fuel-air mixture becomes too rich. Therefore, when the engine is generally overhauled, the carburetter must always be included.

Fuel level from upper edge of float chamber:

carburetter 22 KNB = 21 + 1 mm,
carburetter 24 KN = 28 + 1 mm (with the float inserted)

This is equal to 2.5 to 3.5 mm below upper edge of needle jet.

When this is to be checked precisely, a gauge glass with an inside diameter of at least 8 mm has to be screwed to the carburetter in the place of the screw plug below the main jet. The fuel level in the float chamber can then be measured by means of a slide caliper rule. ("Level tester", see "Sketches for Making Special Tools".)

The vehicle must stand on a horizontal plane, a ruler may be put on the float chamber to check that the carburetter is vertical.

Too low a fuel level results in a lean fuel-air mixture (excessive air), entailing the above-mentioned overheating effects. The vibration of the column of gas (gas-change process) also has an effect on the partial load needle. To prevent the premature wear of the needle jet (2), the multiple hole atomizer (3) guides the partial load needle. The marking "70" on the needle jet shows that the calibrated part has a diameter of 2.70 mm. Since the size is accurate to hundredth of a millimetre, it is obvious that everything depends on the precision of the passage at the annular groove between needle cone and needle jet bore. A wear of 0.02 mm convert a 70 needle jet into a 72 needle jet which means a very rich mixture.

A preliminary measure is to suspend the partial load needle at a lower notch.

Wear limit: about 25,000 km.

The partial load needle with retaining spring and the needle jet with multiple hole atomiser must be replaced.

A too narrow needle jet bore causes overheating, jamming of the piston and damages at the small-end bush.

Another part subject to wear is the throttle valve. Its service life ends with 20,000 kilometres covered. However, due to the coincidence of tolerance limits (positive limit at carburetter body, negative limit at throttle), a clattering throttle valve may be the source of noise even before this distance has been covered. This noise is frequently misinterpreted as "piston tipping" or "excessive vertical clearance of the piston rings". Useless repair work thus is done.

After withdrawing the intake pipe, use a lead-pencil and press on the throttle valve through the intake port with the engine running. Short-time accelerating shows whether the "ticking" sound is produced by the throttle valve or not.

If an abnormally high fuel consumption is observed, although the carburetter and engine are mechanically in proper condition, the packing (4) between carburetter body and adaptor may be the cause. If this packing is defective, fuel gets into the engine from a source, other than the jet system.

After unscrewing the needle jet, the adaptor can be pushed upward. In assembling take care to see to it that the projection of the packing engages with the recess in the adaptor. If this is not the case, the passage to the "change-over" drilling (5) is covered and a poor transfer in accelerating will be the result. If, after screwing down the needle jet, the adaptor is not firmly fastened or is located too deep, a second packing must be inserted, otherwise the same fault will occur before long. It is not recommendable to insert more than two packings because the adaptor would then form an edge in the suction port, producing air swirls. Further, the distance between upper edge of the needle jet and the atomiser would become excessive. Both facts exert a detrimental effect on the preparation of the mixture and the transfer.

The pilot jet (7) and the pilot air screw (8) are not subjected to any significant wear, provided the pilot air screw is not srewed down with abnormal force If this is done, burr is formed at the annular groove of the mix chamber (9) (in the illustration the air screw is screwed out for the sake of clearness) and thus the cross-sectional area reduced. This means that the pilot air screw must be slackened back through about 4 revolutions, instead of $2^1/_2$, to ensure perfectly true running in the slow-running range.

When cleaning and assembling the carburetter components take every care to keep them clean. The change-over drilling (5), the slow-running drilling (6) and the pilot jet (7) must not be cleaned by means of a piece of wire but by compressed air (an amateur constructor should use the air pump and a rubber or insulation tube). Gelatinous substance (colourless) is lead oxide and is precipitated from overaged fuel and the admixed tetra ethyl lead (anti-knock agent).

Carburetter Tuning:

	ES 125	ES 150
Type of carburetter	BVF 22 KNB 1-3	BVF 24 KN 1-2
Opening in mm	22	24
Main jet	110	115
Needle jet	70	70
Partial load neddle No.	1 with 5 notches	3 with 7 notches
Needle position from top	2nd to 4th[1]) (4th for running-in period)	3rd to 6th[1]) 6th for running-in period)
Pilot jet	35	45
Throttle opening	3.5 mm	4 mm
Pilot air screw	1.5 to 3 rev. open	1.5 to 3 rev. open
Fuel level	21 ± 1	28 + 1

[1]) Take the sparking-plug appearance into consideration

The carburetter has four working ranges:

a) Range of regulation of the slow-running system from 0 to 1/8 of the travel of the throttle valve (exerts an influence on the full range, decreasingly towards the full load position).

b) Range of regulation of the throttle opening up to 1/4 of the throttle travel.

c) Range of regulation of the partial load needle from 1/4 to 3/4 of the throttle valve travel.

d) Range of regulation of the main jet from 3/4 to full load (exerts an influence on the full range down to the idling position).

However, only two ranges [(a) and (c)] are subjected to adjustments because throttle opening and main jet must be considered constant, unless the regular engine has been provided with a degree of boost. In this case a larger main jet can be fitted because 1 kg of petrol contains 10,500 to 11,000 thermal units (kcal/kg). To produce 1 h.p. (75 kg-m/sec), a certain quantity of thermal units is necessary, depending on the efficiency of the engine (cf. Figs. 4 and 5 "specific consumption"). If the ES 125 engine has an output of 7.35 kW (= 10 metric h.p.) instead of regular 6.9 kW (= 8.5 h.p.), it calls for more thermal units, that is to say, more fuel.

The adjustment of the slow-running system is dependent on two factors: the correct ratio of mixing fuel and air (the position of the pilot air screw) and the idling speed when the motor-cycle is stationary.

With the vehicle standing on a horizontal plane, the engine running and having reached operating temperature, screw the pilot air screw down until you just feel a stop and then screw it out through 2½ revolutions.

Adjust the throttle stop pin until the motor just continues to run when the throttle twist-grip is in the closed position.

Screw the pilot air screw slowly down and out repeatedly until the maximum speed is found.

Screw the stop pin down until the idling speed has again become normal.

Repeat these adjusting operations until the idling speed with the motor-cycle stationary does no longer increase when the pilot air screw is slackened back.

Then screw down the pilot air screw by 1/8 turn; this is necessary to provide a good "change-over" with cold engine.

Screw the stop pin completely down until the throttle valve completely closes the carburetter opening and the engine stops. Retain the pilot air screw and the pin and lock them by means of a check nut.

The idling speed with the engine stationary is now set at twist-grip; a small retaining screw (slotted screw) at the twist-grip collar prevents the automatic return of the control.

This setting shows the following two advantages:
When driving downhill, the transmission members are not jerkily loaded by the individual expansion strokes.
This leads to a longer service life of chain, gears and bearings.

When stopping the engine, the throttle valve closes the carburetter opening. **Now ignitable mixture is supplied into the engine – as a consequence surface ignition is not possible.**

Since not all motor-cycle riders are disposed to do without a particular idling setting motion, MZ has developed a twist grip which provides for both possibilities in the following way:

A small compression spring, length 8 mm, arranged between twist-grip control member and cable control retaining member is, if it is relaxed, the idling speed stop.

If the throttle twist-grip is further closed, overcoming the resistance offered by the idling speed stop spring, the throttle valve will close the carburetter opening.

The result of this motion has already been described above.

In the latter case the idling speed is pre-set by means of the adjusting screw of the throttle cable control – not by means of the throttle valve stop pin. The function of the latter is restricted to that of a lock preventing the throttle valve from displacement and must be screwed down until the throttle valve completely closes the carburetter opening.

If the compression spring, catalogue No. 13-829.17-0, is to be fitted to the conventional twist-grip later on, only a few alterations are involved which can be carried out by any amateur constructor. Below follows a detailed description of what has to be done.

Remove the twist-grip and unfasten the cable control. Withdraw the connecting sleeve from the cable control and cut a piece of 5 mm off from the end of the flexible steel conduit. Take every care when doing this to protect the wire from damage. The best thing to do is to uncoil the flexible steel conduit to the required length and then cut off the end. Replace the connecting sleeve, thoroughly oil the cable control and fit it in place together with the spring.

Remove the stop lug (1) from the twist-grip (unless you prefer to buy a new twist-grip without stop lug). For this purpose roll back the rubber cover and punch the stop in the centre, as shown in Fig. 111. The linear measurement is given, as to the lateral position take sight through the tubular handle bar. Put a suitable piece of round wood into the tubular handle bar for punch-marking and drilling (as a makeshift, a broom handle will do) to protect the spot-welded flexible steel conduit from damage. For the same reason sharpen the 4- or 4.5-mm drill before drilling.

Finally, starting from the drilling, the stop lug is filed off in such a way that nothing projects from the flexible steel conduit. Burr must be removed.

As has already been said, the "idling speed with the motor-cycle stationary", must be regulated by means of the cable control adjusting screw (2) in the case of throttle twist-grips with stop spring. The throttle stop pin (3) is screwed down to such

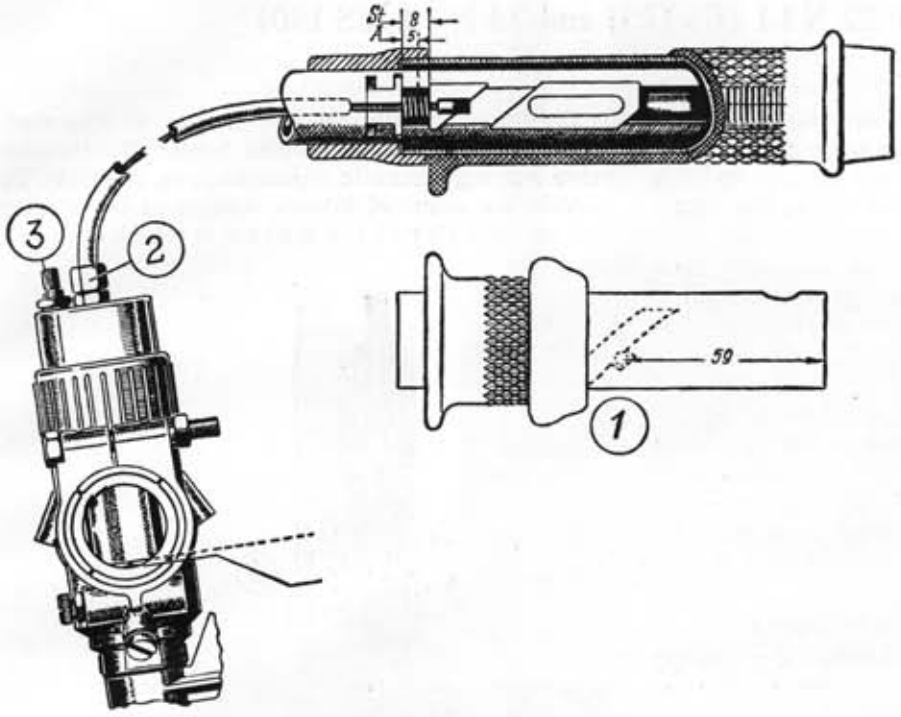


Fig. 111. Stop spring

an extent that the throttle valve closes completely. To be in a position to shift gears silently and without any interruption, the idling speed must be as low as possible. A high speed almost always hides errors of adjustment, air leaks and the like.

If the air-fuel mixture supplied in idling is too rich, the engine tends to imitate the "four-stroke cycle"; a person without the necessary technical knowledge then would think of a defect at the gudgeon pin or the big-end bearing.

For adjusting the partial load needle a test run of at least 10 km is required to allow the operating conditions of the new setting to be reflected by the sparking-plug appearance.

Starting from the basic setting, the partial load needle may be suspended at the next higher or lower notch, if required. If this turns out to be insufficient, one of the faults described above is at the bottom. If necessary, replace the main jet by one of the same size, because the jet bore-hole may no longer comply with the flow rate marked on it.

If, for example in foreign countries, high-octane fuels (octane number from 85 to 100) are only used, the slight enrichment of the air-fuel mixture can be compensated for by suspending the partial load needle at a lower notch or by inserting a smaller main jet.

The carburetter is correctly tuned if after the test run the specified Isolator sparking-plug has a "light fawn-coloured" appearance. It is a light colour because the additives contained in the two-stroke motor oil reduce the deposition of products of combustion not only in the engine but also in the interior of the sparking-plug, at the insulator.

The same effect will be produced with additive-type special two-stroke oils such as Zwo-Ta-Mix, Shell X 100 or similar brands.

9. Carburetters BVF 22 N 1-1 (ES 125) and 24 N 1-1 (ES 150)

These two types of carburetters are starting carburetters which are basically of the same design. They are only distinguished by different throttle opening widths, different sets of jets and tuning characteristics.

The name "starting carburetters" indicates that these types of carburetters are provided with a cold-starting device in the place of the conventional "choke". This cold-starting device pratically is a small carburetter in itself.

It is actuated by the starter lever, so far known as "choke control", which is arranged at the right-hand handle- bar; however, the direction of operation is opposite, namely,

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

Starter lever pushed forwards = driving position

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

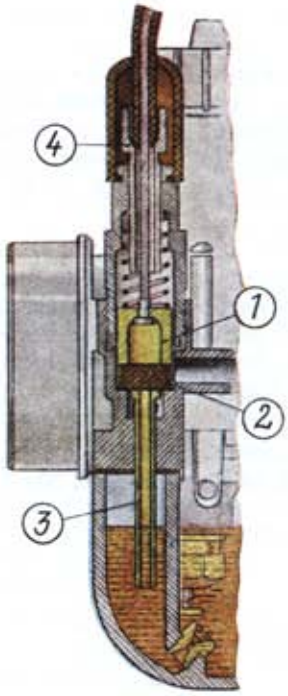


Fig. 112. Starter piston in the closed position (driving position)

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

When starting from cold, the starter piston is lifted by drawing the starter lever. The fuel in the starter-mixture delivery duct is carried off and sucked up by the engine through the starter duct (5). This duct discharges into the intake pipe behind the throttle valve (see digrammatic representation, Fig. 115). To provide the required intense suction in the starter system, the throttle valve must be closed.

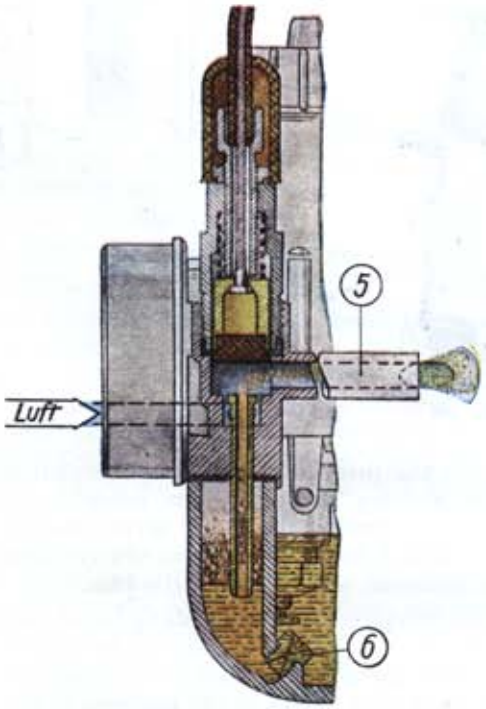


Fig. 113. Starter piston lifted (cold-starting)
Luft — Air

Otherwise, the starter device is of no effect. The starter-mixture delivery duct discharges into a duct which is in connection with the float chamber through the starter jet (6) whose bore is designed in such a way that, after the full quantity of fuel

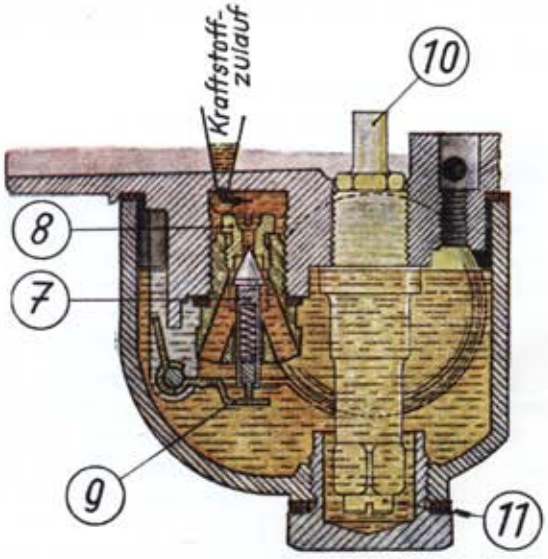
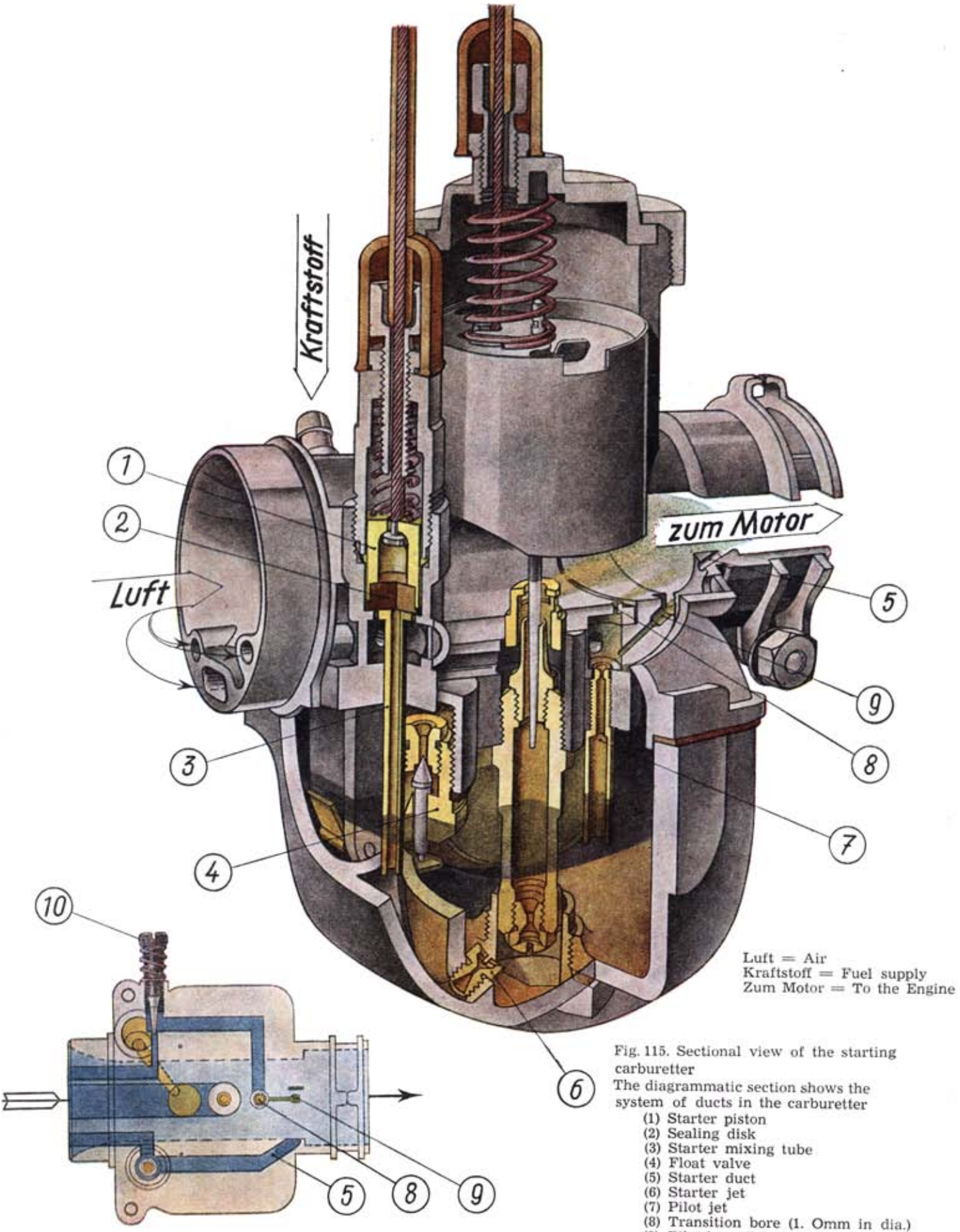


Fig. 114. Section of float valve
Kraftstoffzulauf — Fuel supply



Luft = Air
Kraftstoff = Fuel supply
Zum Motor = To the Engine

Fig. 115. Sectional view of the starting carburetter
The diagrammatic section shows the system of ducts in the carburetter

(1) Starter piston
(2) Sealing disk
(3) Starter mixing tube
(4) Float valve
(5) Starter duct
(6) Starter jet
(7) Pilot jet
(8) Transition bore (1. Omm in dia.)
(9) Pilot bore (0.6 mm in dia.)
(10) Pilot air screw

has been sucked up from the duct, only such an amount of fuel is allowed to pass through the starter jet that the engine gets too rich a mixture but will not be "flooded" if the starter lever is drawn too long a period.

The float needle (7) is of the elastic type in order to reduce wear and to keep the fuel level on an almost constant level. In the event of a worn float valve (more than 30,000 km), the float needle and the valve seat (8) have only to be replaced.

When ordering valve seats, state the size, please, as in the case of the jets.

Treat the central float with every care when dismantling the carburetter. If the two float bodies are displaced in relation to each other or the link (9) lifting the float needle distorted, the fuel level is no longer 3 mm below the upper edge of the needle jet, as required for a proper functioning.

At the top of the jet holder, the needle jet (10) (working part) and at the bottom the main jet (11) are screwed in place.

For the problems associated with tuning the starting carburetter, all that has been said about "KN carburetters", Section 8, applies.

Tuning

	ES 125	ES 150
Type of carburetter	BVF 22 N 1-1	BVF 24 N 1-1
Main jet	90	92
Needle jet	67	65
Partial-load needle No.		c 3
Needle position, from top	2nd to 3rd[1]) (3rd notch for running-in period)	2nd to 4th (4th notch for running-in period)
Starter jet	70	75
Pilot jet	35	40
Pilot air screw	1 to 2 rev. open	2.5 rev. open
Throttle opening		3 mm (30)
Fuel level		11 mm

[1]) Range of adjustment within neddle postion 2nd to 4th notch, always take the plug apperance into consideration.

10. Chassis

Note: SW = width over flats; e.g. "SW 26" means width over flats 26 mm

10.1. Dismounting the handle-bar

Loosen the check nut (SW 26) by means of a socket wrench or double box wrench with double offset heads. To protect the varnish coat from damage, place a paper packing or similar material below the wrench.

Remove the intermediate ring (arrow), slacken back the clamping screw about 8 revolutions by means of a socket wrench (SW 14).

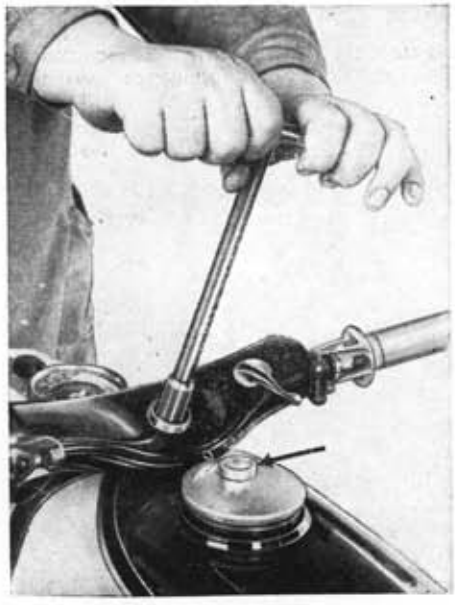


Fig. 116

By striking on the clamping screw, the cone (1) moves downwards and the expanding sleeve (2) becomes loose.

The central part of the handle-bars is fitted with its two webs (3) into the recesses (4) of the shaft tube. That is the reason why the handle bars cannot be screwed out but must be drawn out, while slightly tilting them sidewards.

Do not beat the handle bars out of the assemly, otherwise the handle-bar fittings or the handle-bar itself might be damaged.

Always make sure the expanding cone is actually loose.

10.2. Removing the Fuel Tank

After removing the headlamp stop and the reflector, loosen the front fastening means (1).

The headlamp may remain at the vehicle; here it has been removed for the sake of clarity.

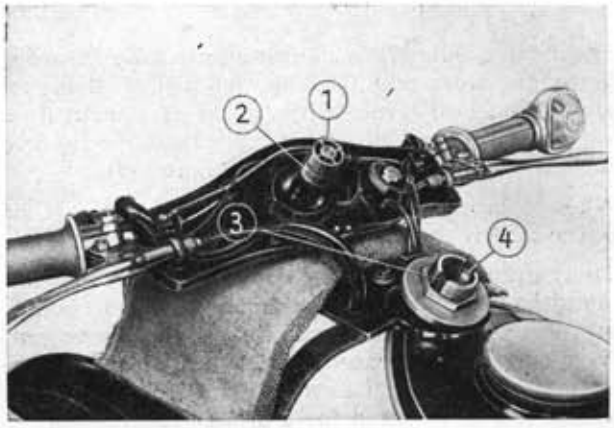


Fig. 117

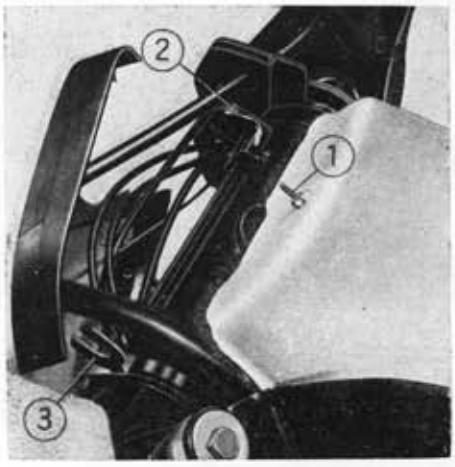


Fig. 118

(2) Upper headlamp holder (with rubber lining).

(3) Lower headlamp holder (the headlamp is being adjusted).

After removing the two rear retaining screws (arrow) and folding open the two cable holders (right-hand and left-hand), the fuel tank can be withdrawn towards the rear.

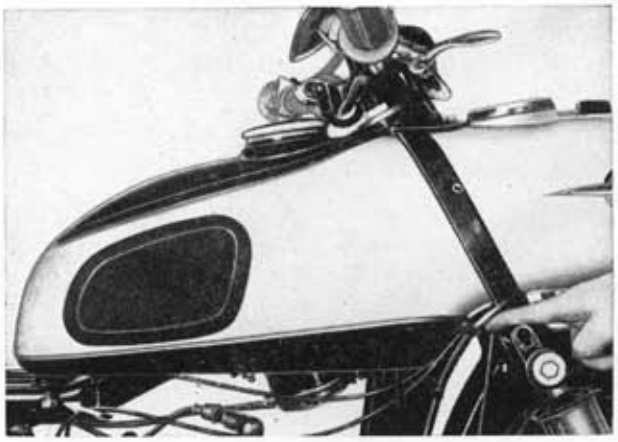


Fig. 119

When assembling, take care to see to it that air-feed cable control and the throttle cable control are not clamped.

10.3. Front Fork and Steering Bearing

Front carrier with lower and upper bearing ring of the fork (Fig. 120).
Replacing the "dotted" frame and fork bearing rings on the ball races. Touching-up by polishing or grinding is not recommendable because this changes the radii of the races in an uncontrollable way.
Fit the lower fork bearing ring in hot state (about 100 °C) and press it down by means of a suitable piece of tube until it properly contacts its seat.
Provide the two rings with 22 balls each (6.35 mm in diameter), using vicous anti-friction bearing grease.
The steering system must be adjusted in such a way that it is free from play but it must not jam because the "steering stability" of the vehicle depends on the correct adjustment.
For checking, shake the mudguard (up and down) with one hand, while feeling the upper and lower steering bearings with the other hand.

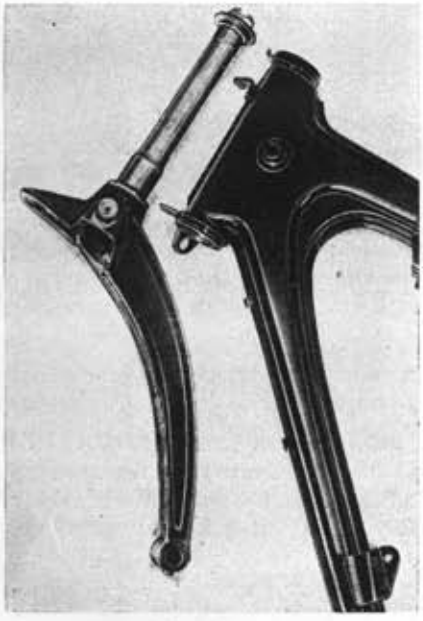


Fig. 120

10.4. Brakes

This illustration shows the front brake plate, one brake shoe removed.
The two pivot pins must be reliably held in the cover, otherwise the brake tends to block.
Grease the pivot pins and brake spanner by means of high melting-point grease. In the case of continuous braking for a longer period, temperatures of up to 150 °C may occur.
Before removing the brake shoes mark them for identification so that they can be re-fitted to the place where they have run in.
Clean all parts, remove wear marks, provide the leading edge of the brake shoe with a chamfer.

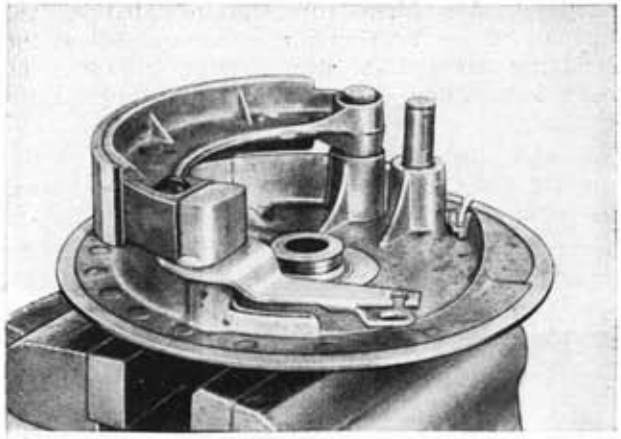


Fig. 121

The original brake shoes are re-ground on a fixture so that they correspond to the dimensions of the brake cover and thus have a good bearing.
Reconditioned brake shoes or shoes lined by yourself (riveted joint) must be touched-up with the help of chalk lines and elevated spots removed by means of a roughing file.
At least three quarters of the surface must have a good bearing otherwise the efficiency of the newly lined brakes is insufficient.
For touching-up, the road wheel in question is fitted, turned by hand and two times shortly braked.

10.5. Swinging Arms Bearing Pin

Replacing the front swing arm bearing pin. The bearing pins are made of seamless tube. That is why old pins should not be beaten out (because they

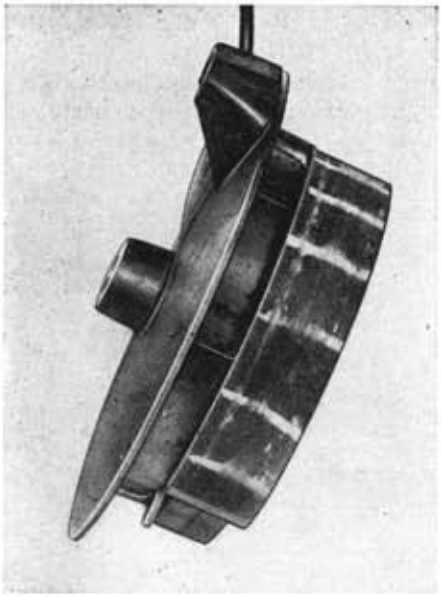


Fig. 122

may be distorted) but drawn out by means of the adjusting nut.

First insert short pieces of tubes, then longer ones. Fit the swing arm by means of the 05-MW 26-4 centring bolt and push the new pin in place from the left-hand side. Make sure the indicated surface (arrow) of the bearing pin is located below the retaining screw of the front carrier, otherwise the next dismantling operation will meet with difficulties.

The end clearance is balanced by means of the counter nuts; the swinging arm must slide down by virtue of its own weight.

Tighten the retaining screws and lock them by means of nuts.

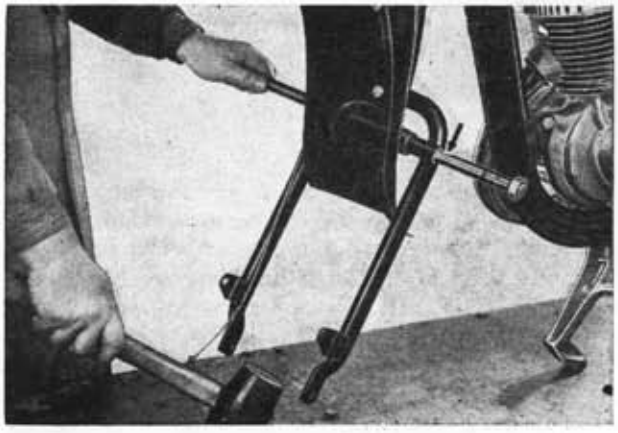


Fig. 123

The two bearing points of the front and rear swing arm bearings are provided with two rubber packings to prevent the lubricating oil (only use engine oil) from leaking.

For fitting the rubber packings use the 13-MV 26-4 tapered sleeve to prevent damage.

Bearing pins lubricated with grease by mistake must be taken out and cleaned thoroughly.

Only use engine oil because of the narrow fits. Use perfectly tight lubricating nipples; the bearing pins must be full of oil.

In order to ensure a certain permanent lubrication, the use of molybdenum sulphide suspensate is recommended.

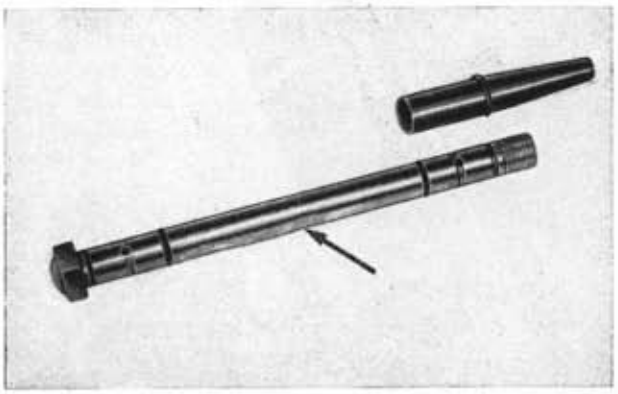


Fig. 124

10.6. Exchanging the Foot-rest Tubes

To replace one of the foot-rest tubes, loosen the clip in question by means of the socket wrench (SW 14) and withdraw the tube.

When assembling, take care to see to it that the recess in the foot-rest tube comes in engagement with the lug at the frame. This is of special importance for the left-hand side; if the foot-rest tube is allowed to turn, the prop stand is released during driving.

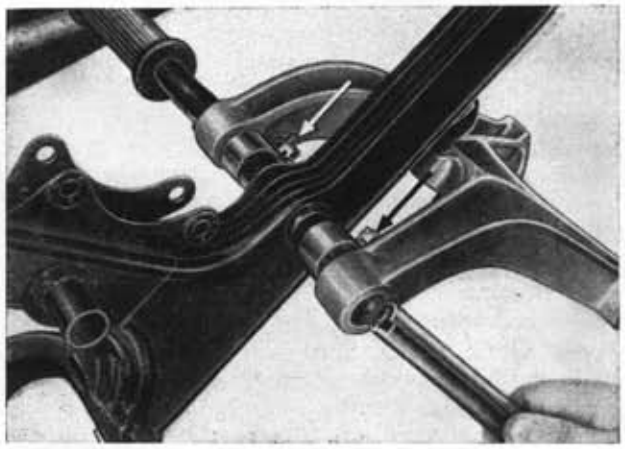


Fig. 125

10.7. Checking and Exchanging the Secundary Chain

To check the secondary chain, open the chain lock, attach an old (but clean) chain to it. The locking spring is put on the chain lock. Then withdraw the chain to be check just far enough to expose the chain lock.

The checked chain is re-fitted in the inverse order of the dismantling operations.

If the clearance between pin and rollers of the chain is excessive, the chain must be replaced by a new one. The damage due to a suddenly breaking chain is considerably higher than a new chain!

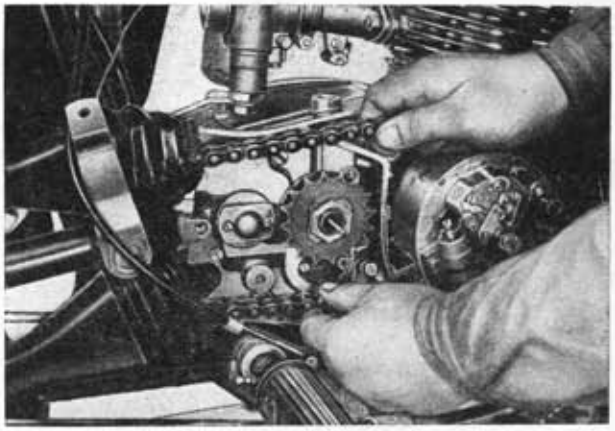


Fig. 126

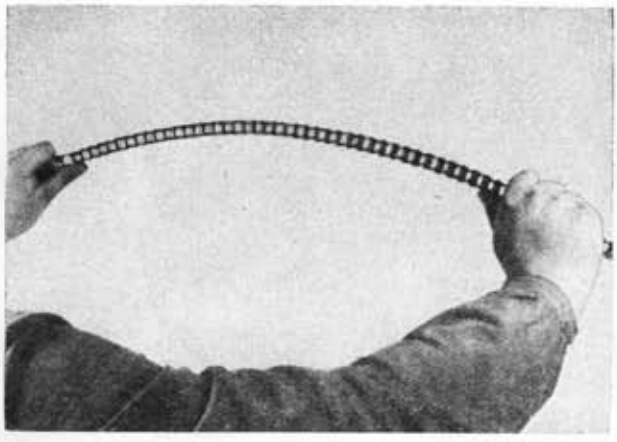


Fig. 127

A gearbox sprocket wheel worn in the way shown in the accompanying illustration – a sprocket wheel with so-called "shark teeth" – must also be replaced. It would wear out the new chain prematurely.

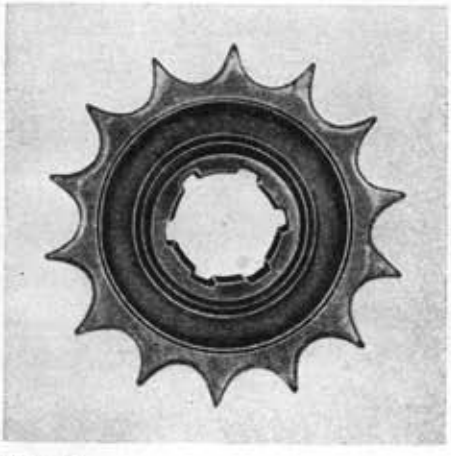


Fig. 128

To insert the chain lock, the chain is tightened by means of pointed pliers and the lock inserted from the rear.

Only use original chain locks, the pin diameter of the various chain makes is different. A lock which has too much clearance in the chain sleeves, allows this chain part to "mount" the sprocket wheel – a fact which may also lead to the breakage of the chain.

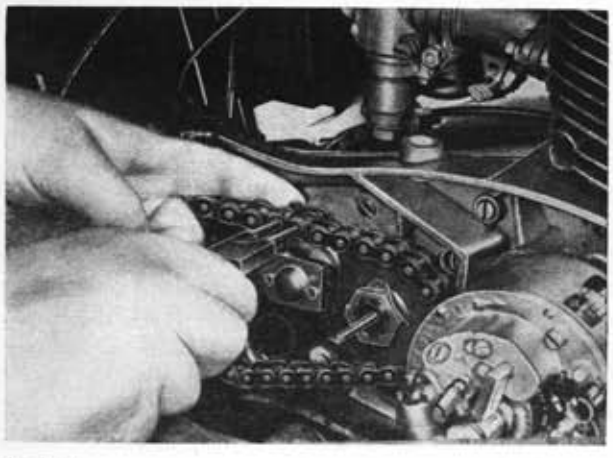


Fig. 129

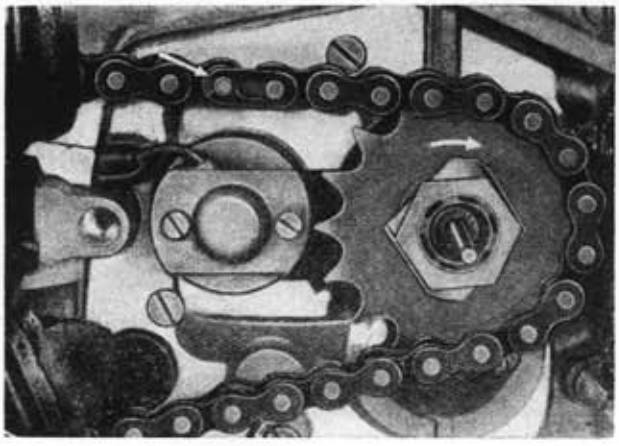


Fig. 130

This shows how the chain lock spring must be fitted. The chain is guided by the inner section of the protective chain hoses. Thus the "whipping" of the chain, a fact which increases the rate of wear, is reduced to a minimum. To avoid resistance to the chain motion inside the hose, the chain must be lubricated every 2,000 km of distance covered by means of engine oil.

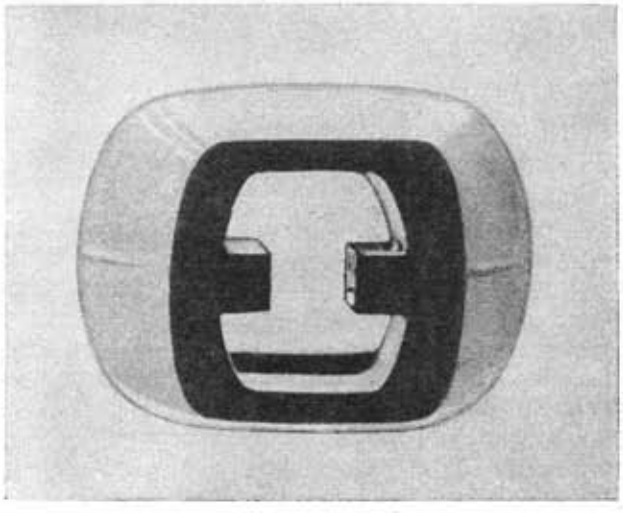


Fig. 131

10.8. Removing and Dismantling the Rear Axle Drive

Driver pin at the hub (Fig. 132).

The damping rubber is screwed to the drive by means of the retaining plate.

Loosen the nut from the flanged bolt (1).

(2) lubricating nipple for the speedometer drive. For this part, F-8 gear grease should be used as lubricant (in foreign countries Shell Ambroleum). An addition of graphite of MoS_2 is recommended. The grease drain bore-holes must not be clogged, otherwise, in the case of a rich lubrication, the excessive grease is passed into the speedometer due

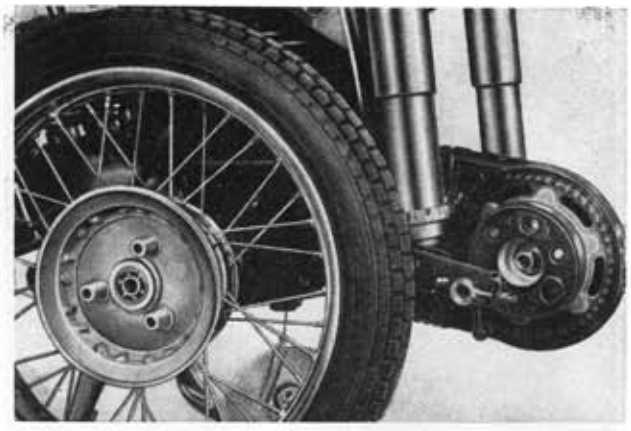


Fig. 132

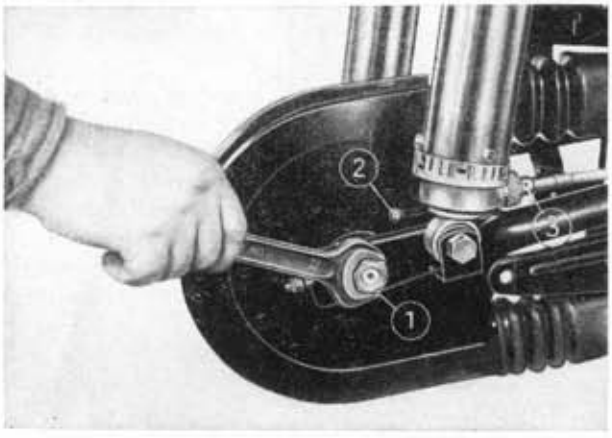


Fig. 133

to the twist of the speedometer shaft and renders the speedometer useless.

The bore-holes must be located at the sides, otherwise dirt and water may enter them.

Withdraw the circlip at the 6004 ball bearing with the aid of two small screw-drivers.

When assembling, do not omit the covering disk between circlip and ball bearing, otherwise the grease packing would leak out (high-melting point grease) and the bearing would run dry.

Withdraw the driving hook of the hook circlip at the helical gear from the bore by means of a screw driver and remove the gear.

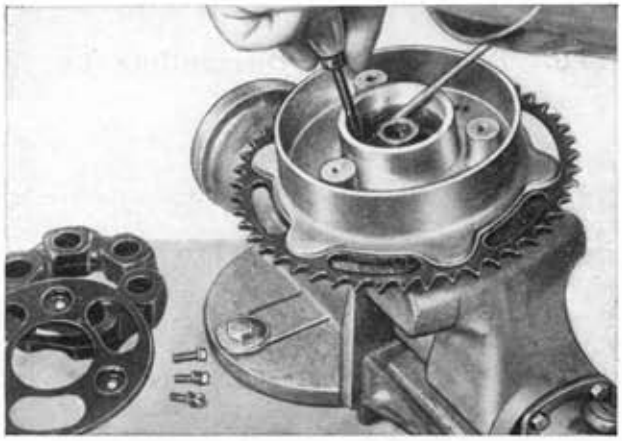


Fig. 134

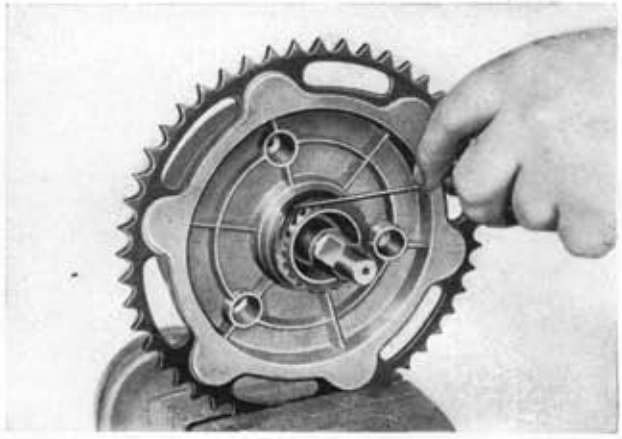


Fig. 135

To prevent the first thread of the flanged bolt from being distorted when the latter is driven out, screw the nut of the bolt in place so that it fits tightly.

The bearing 6004 (20 × 42 × 12) is normally driven out together with the bolt.

Sprocket wheel and damping wheel are cast integrally and must thus be placed as one complete unit.

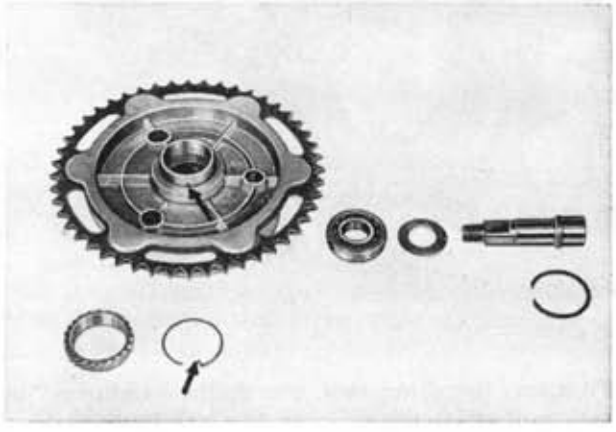


Fig. 136

10.9. Speedometer Drive

Replacing the speedometer pinion. By withdrawing the plug-type speedometer nipple, the bearing bush with pinion are exposed and can be removed.

When assembling, take care to see to it that the lubricating nipple fits tightly. If this is not the case, tap the bore-hole and screw a screw-type nipple in place.

If the loosely fitting plug-type lubricating nipple is fastened by means of epoxies or a similar artificial resin glue, the chain cover must be destroyed when it comes to further repairs because the nipple cannot be detached.

Tighten the union nut at the upper end of the speedometer cable sheath manually, otherwise the drive shaft will be jammed.

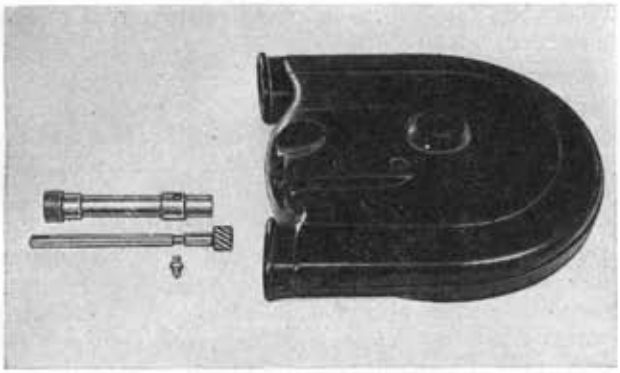


Fig. 137

When assembling, draw the chain through the protective hoses with the aid of a wire hook.
The nut at the flanged bolt should be tightened firmly but not with undue force, otherwise the hub of the chain cover of moulded material could be deformed.

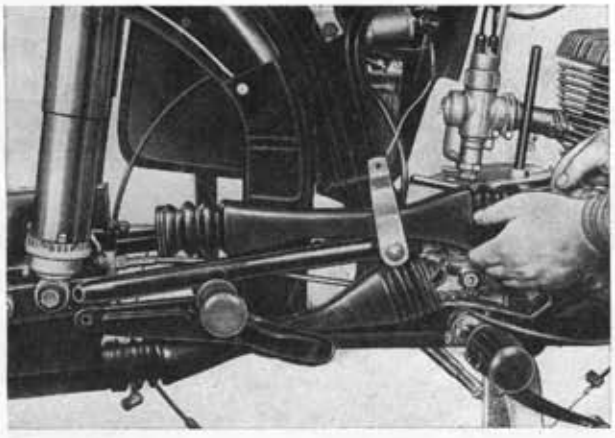


Fig. 138

10.10. Exchanging the Road Wheel Bearings

For exchanging the road wheel bearings, use the expanding mandrel H 8-820-3. Slacken back the M-18 screw until the tapered mandrel no longer has any contact.
After driving out the bearing, tighten the screw; as a consequence sleeve and mandrel will be released and the bearing can be drawn from the sleeve.
Rear brake cover, one brake shoe is removed (Fig. 140).
(1) is the stop light contact (ground contact) which is adjustable from outside. The contact spring (2) must be readjusted in such a way that it makes contact with a slight initial stress.
As to the brake application the same applies what has been said in connection with the front wheel brake.

10.11. Silencer, Dismantling

Remove combustion deposits from the dotted areas. If the whole system is badly soiled, the tuning of

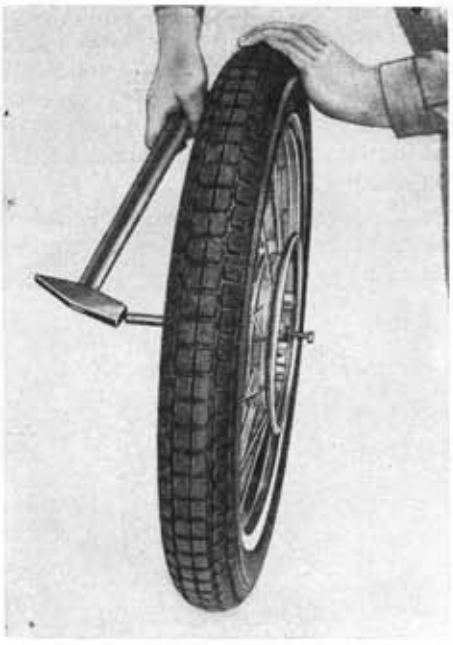


Fig. 139

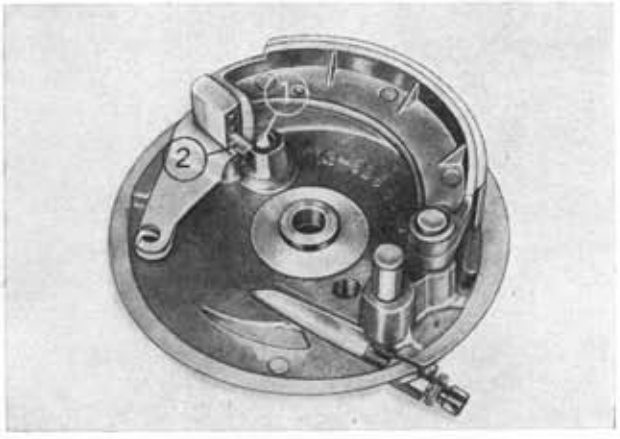


Fig. 140

the carburetter must be checked (wear?); on the other hand, the specified mixing ratio might not have been observed.
Do not clean the exhaust pipe – the layer of oil carbon protects the pipe from uncalled-for heat absorption (chromium). When assembling, at first screw the union nut into the cylinder (to avoid oblique fitting) and then fasten the clips to the frame projection.

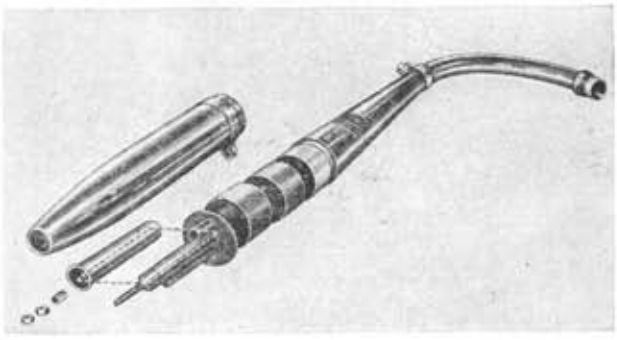


Fig. 141

If the exhaust nut has been leaky, insert one packing ring both at the front and rear sides of the raised edge of the pipe. This is not done because of the uncalled-for oil spots but because of the possibly lost back – pressure in the exhaust system – the degree of charging the cylinder is reduced because fresh gases also excape.

If damping inserts have been changed or removed, restore the system to the original condition, otherwise overheating will be inevitable.

Noise is non-utilised fuel energy!

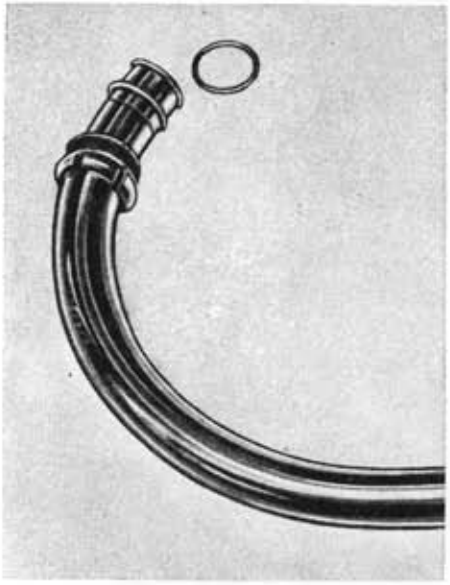


Fig. 142

10.12. Adjusting the Clutch

Before opening an engine because of a slipping clutch, check that the required clearance is given between clutch thrust screw (threaded pin) and push rod (Fig. 3, sectional view of the engine, to be observed).

Loosen the check nut and screw home the thrust screw (1) up to a point where the stop can just be felt. Slacken back the thrust screw ¾ of a revolution, retain it and lock it by means of the nut. The distance is reduced due to the wear of the set of disks, but not increased!

Due to the sliding (scraping) motion of the clutch worm, the use of molybdenum sulphide is recommended. Either apply MoS_2 powder to the clutch worm (2) or add it to the lubricant as suspensate and apply it through nipple (3).

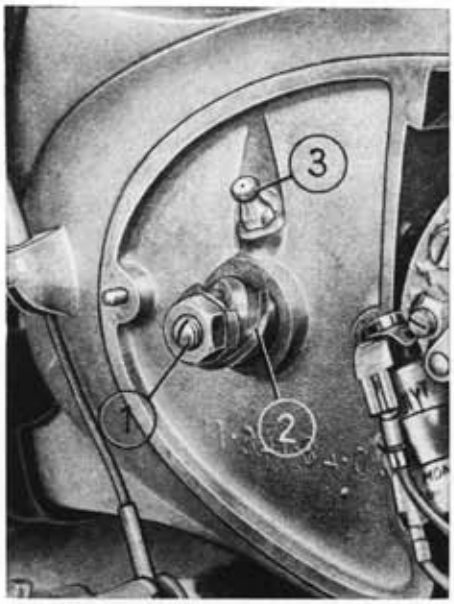


Fig. 143

10.13. Adjusting the Chain Sag

For adjusting the chain sag, the vehicle must be loaded with the rider and then the sag checked with full rotation of the chain.

Not only the protective hose of the chain but the chain itself must move in any position 10 mm up and down.

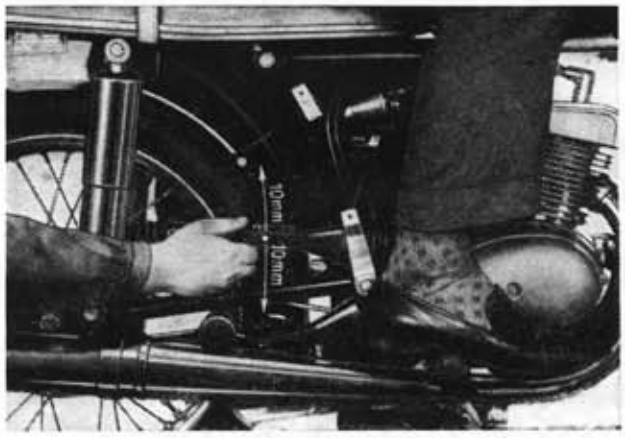


Fig. 144

10.14. Tests in the Case of Poor Roadability

It is a property of any full-swing chassis that it shows a poor roadability (shaking towards the side) if the rear wheel is oblique.

The measuring rod must contact both the rear and the front wheel at two points. Take care to see to it that the tyres are properly fitted, this means the checking line must show the same distance from the rim flange at any point.

The tendency to wobble of the handle-bars may be traced back to the fact that the tyres are out of true, besides loose steering bearings, worn out wheel bearings and loose swing arm bearings pins. It may be the rear wheel that causes the out-of-true motion of the front wheel.

To balance a wheel statically it must be free to rotate with ease or be put on two prisms, using the floating axle. If the wheel is allowed to come to

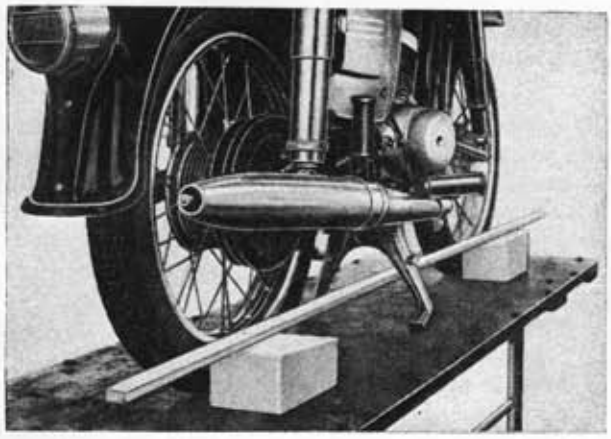


Fig. 145

rest automatically, the lightest point will be on top; it must be wound round with lead wire until there is no longer an centre of gravity. To prevent the weight from working loose, insulating tape or adhesive tape is wound round. After a tyre repair, the wheel must be capable of running still true; therefore, a dot of paint is made on the valve to check the original position.

Fluttering of the chassis may be due to loose screw joints between frame and saddle support. The two screws (indicated by the arrow) must be "fit bolts", that is to say, they must fit in the bore-holes without clearance. That is why screws with rolled thread are unsuitable because their shank diameter is smaller that of the thread.

If the two bore-holes are worn because the vehicle has been operated with loose saddle support for a longer period, the latter must be brought into its original position and clamped by means of a screw. The second screw hole is reamed until it fully bears. For this purpose use an oversize bolt and fit it into the hole (a threaded pin with two nuts also will be sufficient). After tightening the new screw with a torque of about 5 kg-m, prepare the second screw joint in the same way.

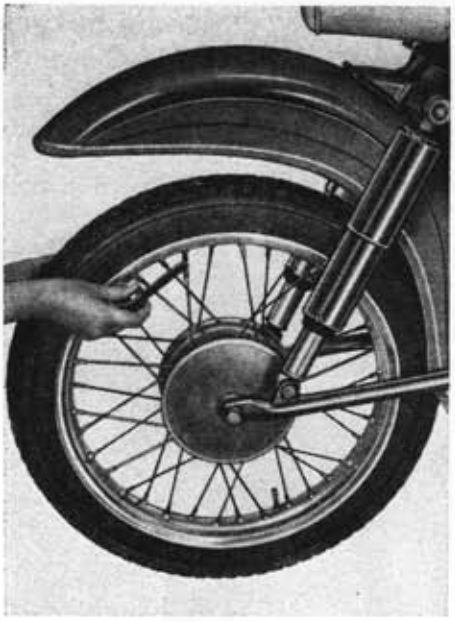


Fig. 146

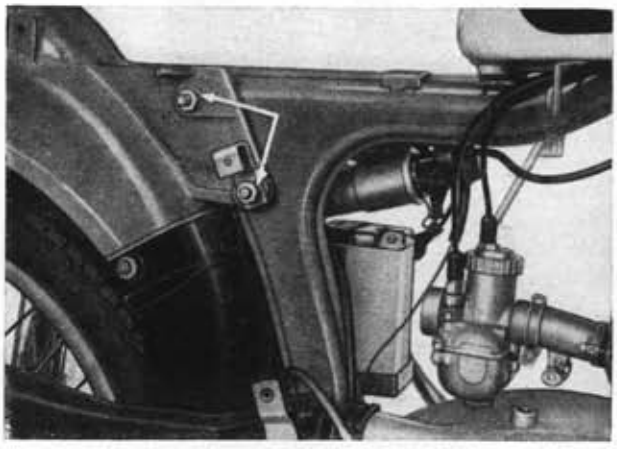


Fig. 147

11. Repairing the Telescopic Suspension Units

Disassembling the telescopic suspension units.

Press down the upper protective sleeve; this releases the two supporting-ring halves which then can be taken out.

Withdraw the protective sleeves and the compression spring. Loosen the locking nut by means of the special wrench 05-MW 82-4 and take out the complete shock absorber unit.

Carefully clean all parts with dry-cleaning spirit – also rinse the tubular shell.

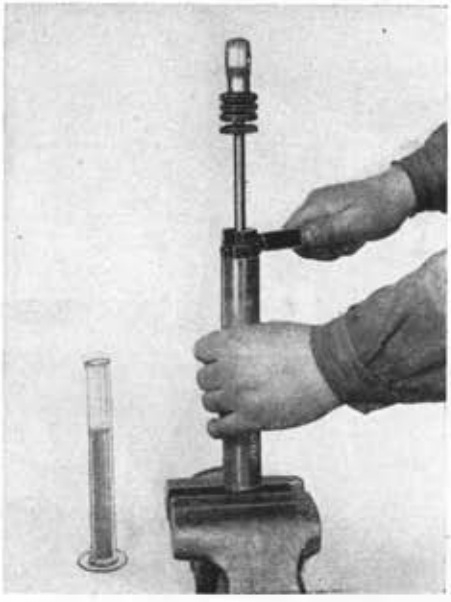


Fig. 148

Cylinder (1) of shock absorber unit and bottom member (2) removed.

A disk-type check valve is arranged at the top of the piston (3) and, at the bottom of the piston, an adjustable damping valve. The latter is used to regulate the damping pressure. The valve at the bottom member functions as a safety valve if, due to overloading or low ambient temperatures, the damping fluid is too viscous to flow quickly through the piston bores. The reservoir between outer shell and cylinder collects the displaced damping fluid which is sucket into the cylinder when the springing action ceases. The reservoir is almost pressureless, the damping action proper takes place in the cylinder.

Common faults and their causes:

1. The shock absorbers are inactive, although there is no visible oil leakage.
   Foreign particles between the diaphragms of the piston valve.
2. The damping action fails to start smoothly but starts jerkily. The telescopic suspension units are said to "stamp".
   Insufficient amount of damping fluid or bottom valve leaky.
3. Damping liquid leaks.
   MM-packing (A) untight.

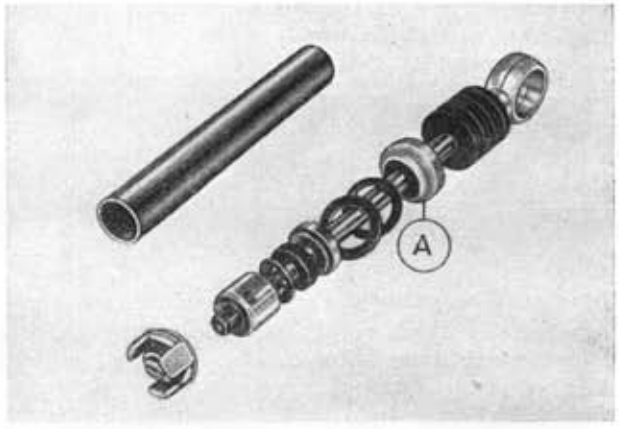


Fig. 150

For replacing the MM-packing $10 \times 19 \times 7$ eg remove the upper holder (1) of the suspension unit: Drive out the 4×20 cylindrical grooved pin (2), applying the drift to the small-diameter end (distinguishable by marks left from driving-in). Mark the upper holder and piston rod to ensure that both parts are re-assembled in the original position (at the sauce sides).

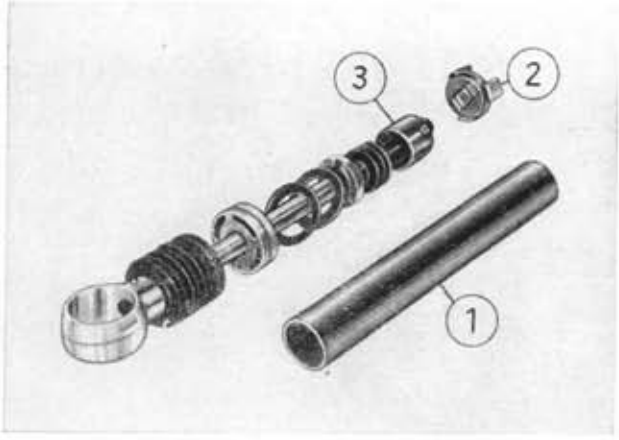


Fig. 149

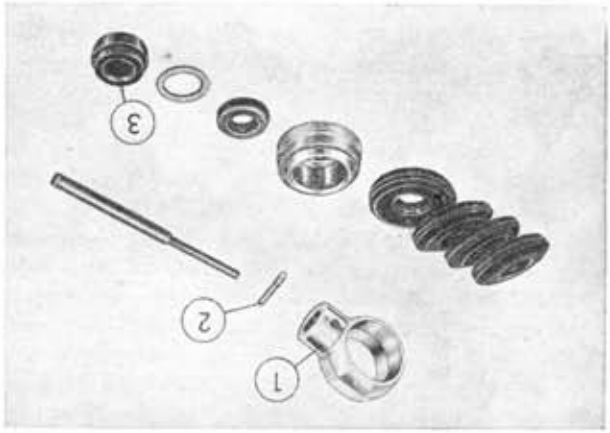


Fig. 151

After withdrawing the holder of the suspension unit, burr the hole for the grooved pin through the hard-chromium plated piston rod on either side by means of an oil-stone.

Pack the interior of the new MM-packing (3) by means of a graphite paste (high melting-point grease Ceritol, Bosch or a similar brand with colloidal graphite).

Fit the packing with the smooth side pointing outside (towards the bottom in the suspension unit).

In any case use the tapered fitting sleeve 05-MV 93-4 (A) to slip the packing on the piston rod, otherwise the sealing lips will be damaged.

The front suspension unit is provided with three, the rear one with four, rubber pads.

When fitting the upper holder of the telescopic suspension unit pay attention to the marking.

In any case use new cylindrical grooved pins. For driving them in place, put them into the wider end of the bore.

Other components of the shock absorber, especially the regulating members, cannot be exchanged because a relatively expensive hydraulic machine is required for adjusting them. That is why two complete shock absorber units must be used in any case to ensure the same damping action.

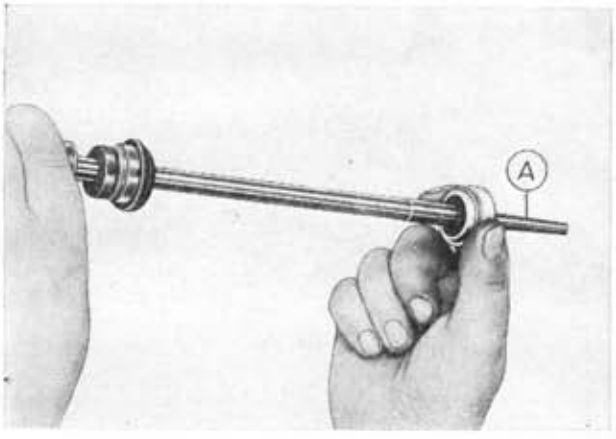


Fig. 152

Use the cylindrical upper part of the special wrench 05-MW 82-4 to press the disk and rubber seal down in the tubular shell and tighten the threaded piece, using a torque of about 5 kg-m – the pressure in the working cylinder may come up to 65 atm. gauge pressure (925.5 p.s.i.).

In any case observe the following:

The front suspension units are filled with 80 cubic cm of damping fluid, the rear ones with 70 cubic cm only.

Provisionally check the damping action in the following way:

Pump both shock absorbers about ten times and suspend them at a pipe (or broomstick). Release the two weights at the same time and watch (if necessary together with an assistant) whether the two shock absorbers reach their final positions at the same time or not.

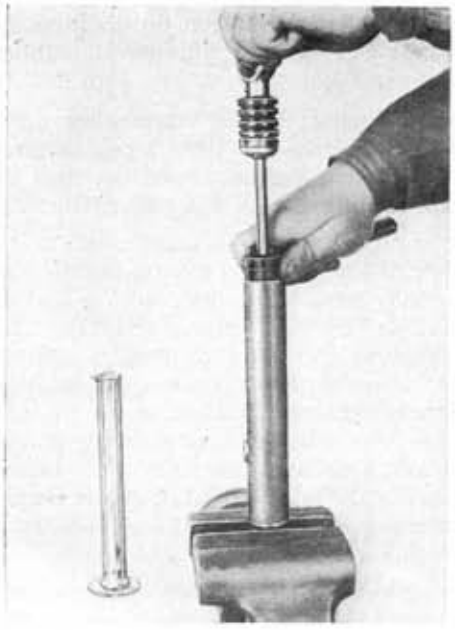


Fig. 153

The same damping action of a pair of telescopic suspension units is indispensable for good roadability.

The test weights should not exceed 2 kg to ensure that the shock absorbers go down so slowly that differences in their damping action can be observed.
Test pressure (flow rate in hydraulic equipment)

	front	rear
Pull (piston valve)	64 ± 8 kg	76 ± 8 kg
Compression (bottom valve)	8 ± 2 kg	8 ± 2 kg

The shock absorber units included in the suspension unit are selected and matched within a tolerance range of 8 kg.

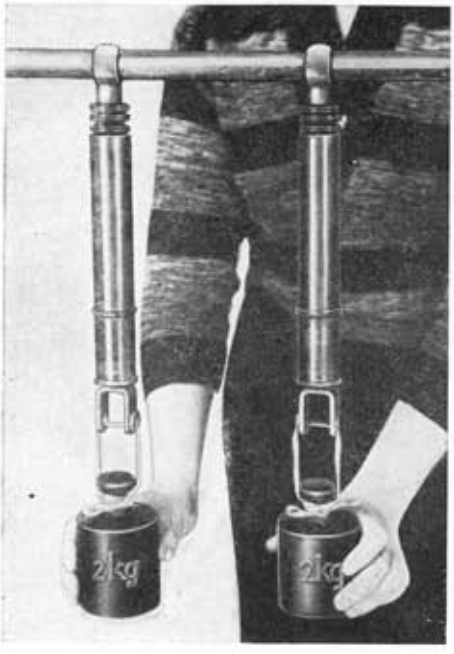


Fig. 154

The front shock absorber unit can be distinguished from the rear one by the number of rubber pads – front 3, rear 4 pads.

The compression springs of the suspension units are also tested and matched to form a pair. Therefore never replace one single suspension unit or compression spring but always the pair of them.

When assembling the telescopie suspension units, grease the compression springs with a highly viscous grease (if they are not provided with a coat of protective varnish by the manufacturer). The grease is to provide not only protection against corrosion but also suppress noise. Automotive grease for general chassis lubrication or oil are not suitable for this purpose because the temperature of the shock absorber units rises under heavy loads; consequently the dripping oil or grease would give the impression of a leaky shock absorber which, of course, is wrong.

When converting to adjusting sleeves with integrally cast lever, take care to see that the sleeve marked "L" (in the circle) is mounted at the left-hand side, the sleeve marked "R" at the right-hand side. Bear in mind that the adjusting sleeves of the light and heavy ES-types are not uniform.

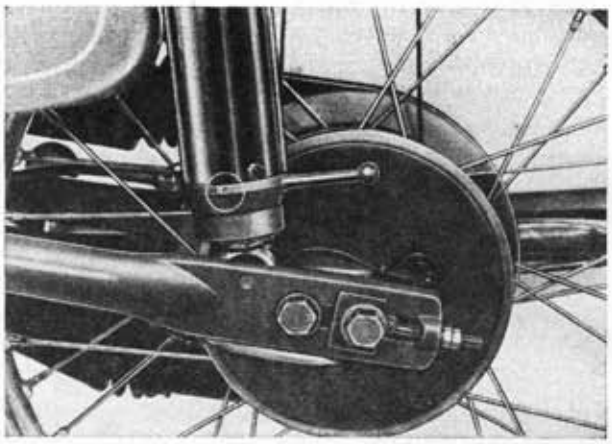
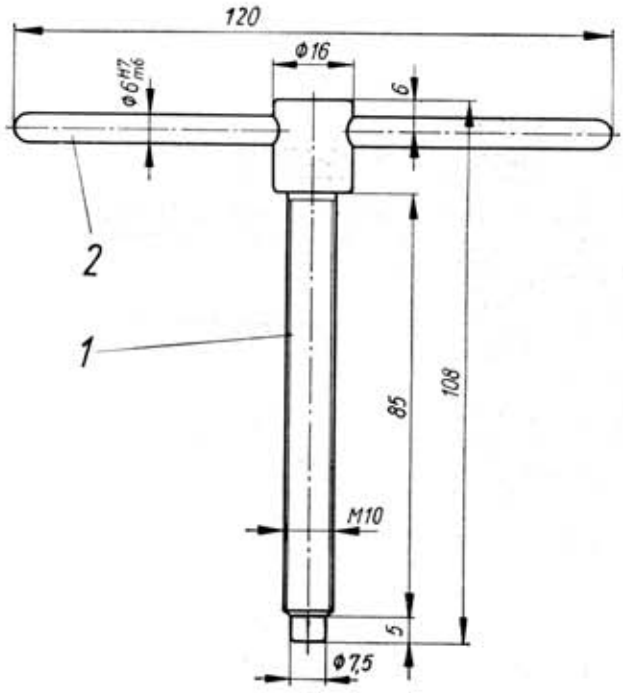


Fig. 155

12. Sketches for Making Special Tools

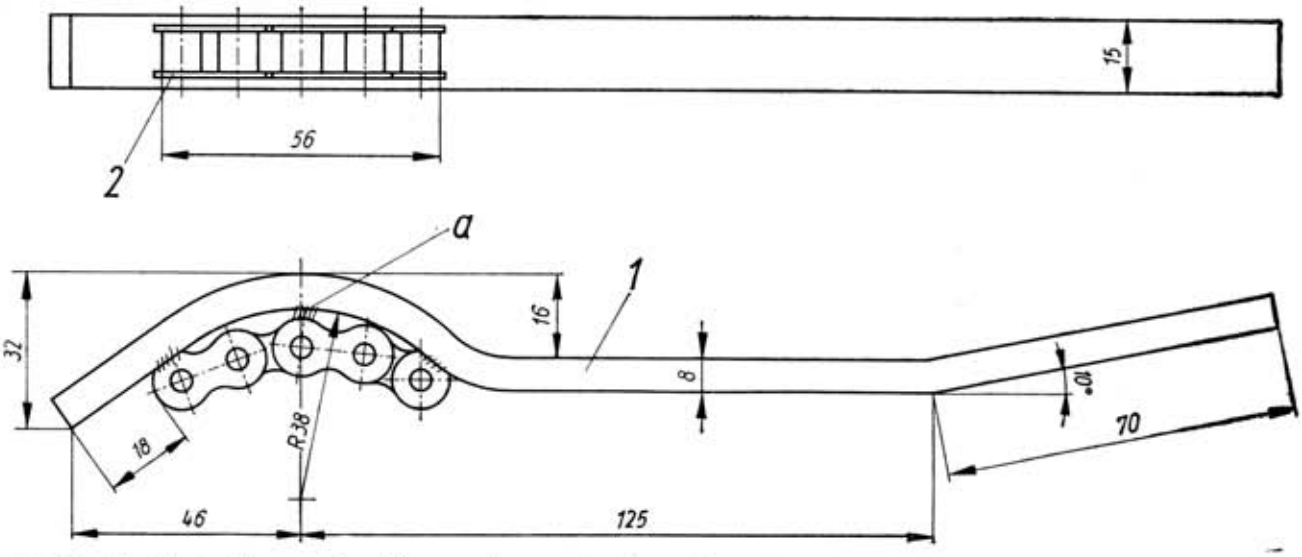
List of Special Tools Page

Armature puller
02-MW 39-4



Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Screw	St 50 K	16 dia. × 112	
2	1	Cylindrical pin 6 m 6 × 120	St 50 K	6 dia. × 120	

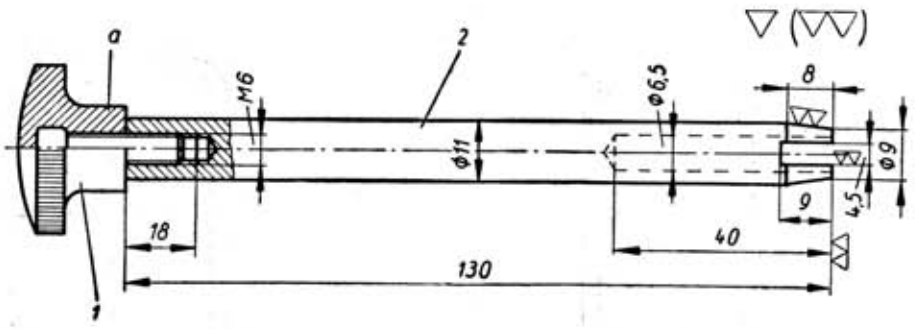
Holder-on for Gearbox Sprocket Wheel
05-MW 45-3



(a) Electrically tacking and welding at three points on either side

Part No.	Number requd.	Description		Material	Rough Size	Remarks
1	1	Spanner	welded part	St 34 K	16 × 8 × 270	TGL 11161
2	1	Roller chain		TGL 0-1652		TGL 0-8180

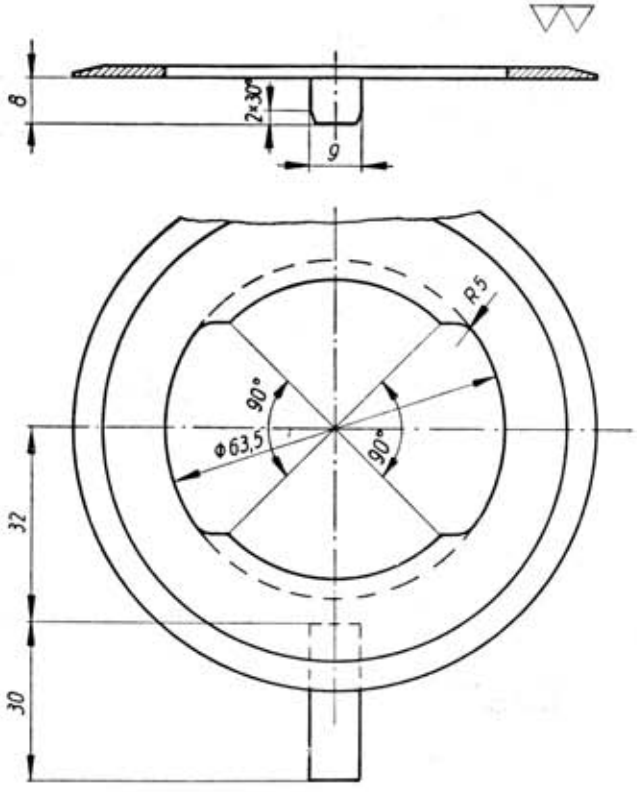
Compression pin for clutch springs
11-MW 15-4



(a) Part No. 06-828.04-1 (knurled screw) to be used

Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Knurled screw			Drawing No. 06-828.04-1
2	1	Compression pin	St 50	15 dia. × 135	

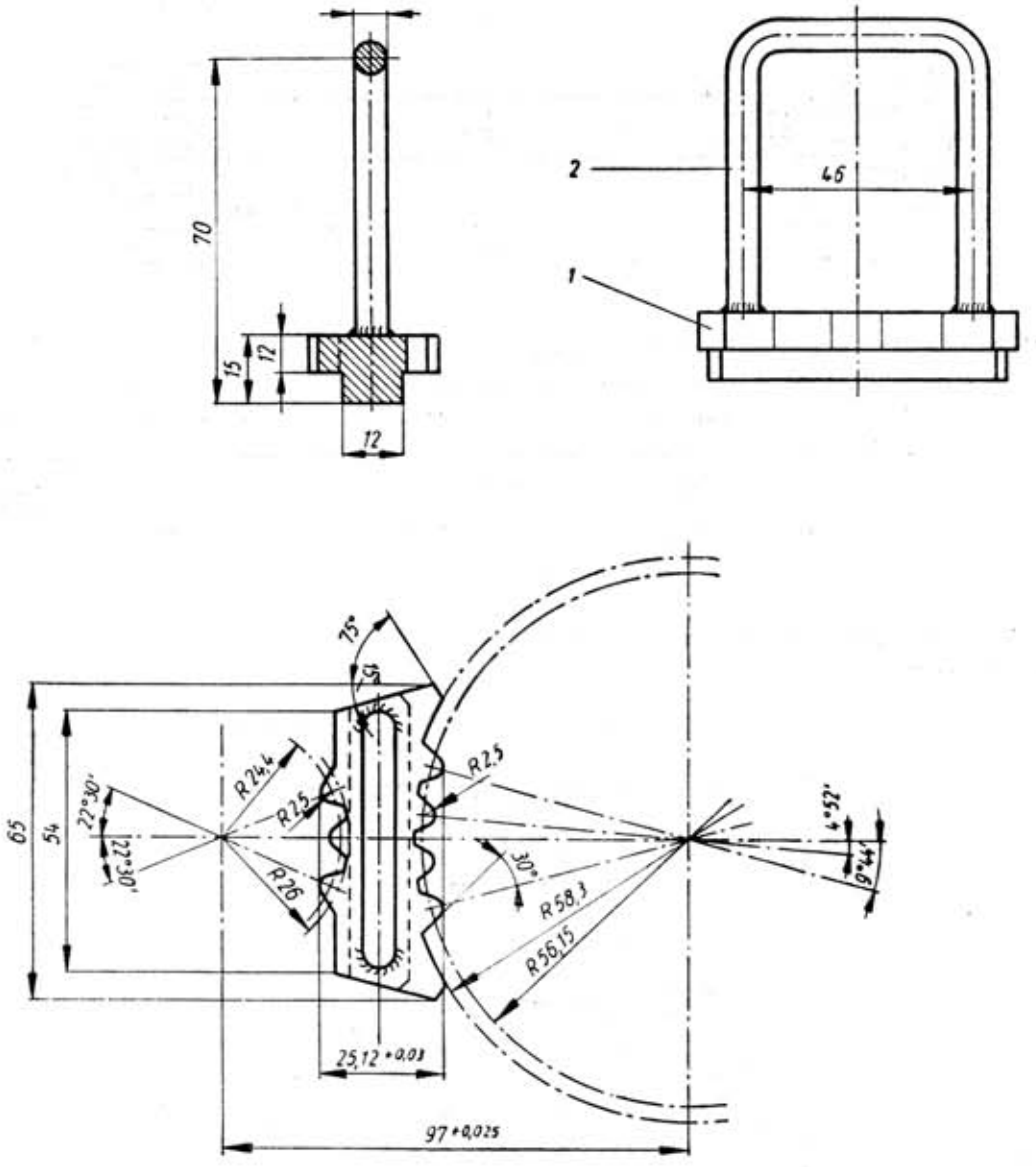
Holder-on for loosening the nut at the clutch shaft
01-MW 22-4



degreased, phosphate-treated

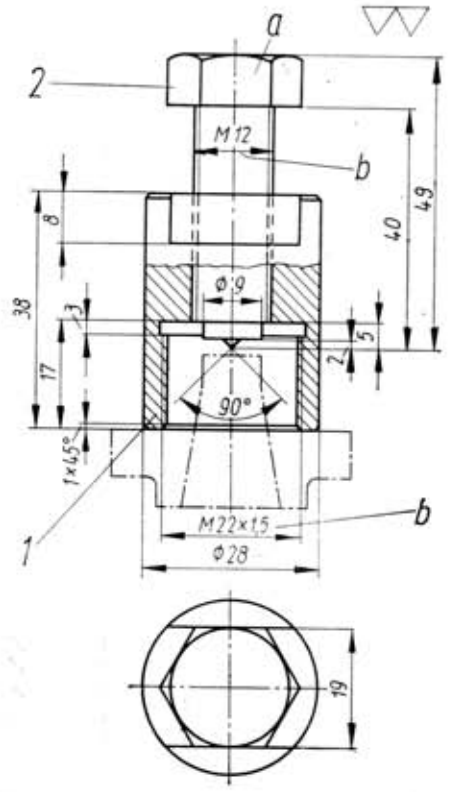
Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Disk } welded part			Drawing No. 01-846.07-0
2	2	Bar } welded part	MSt 3	10 × 10 × 30	

Holder-on for loosening the nut at the driving gear
12-MW 5-3



Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Base plate	C 15	30 × 20 × 70	case-hardened
2	1	Stirrup	St 37 K	6 dia. × 155	

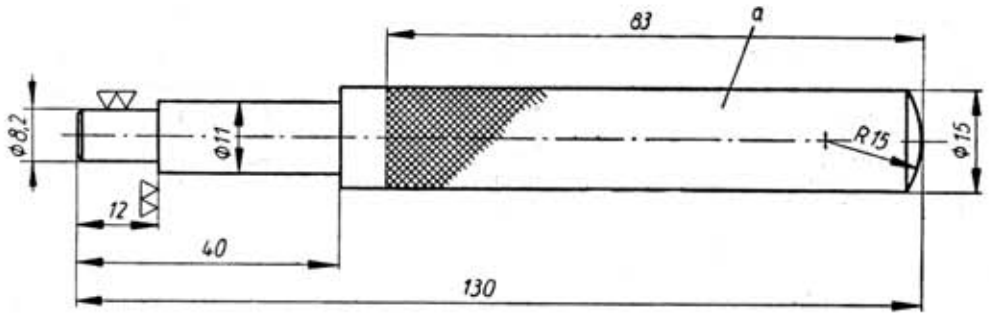
Driving sprocket puller
01-MV 72-4



(a) To be pointed on lathe
(b) Thread soft

Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Pulling sleeve	C 15	30 dia. × 42	case-hardened
2	1	Hexagon head screw M 12 × 40 TGL 0-561			point hardened

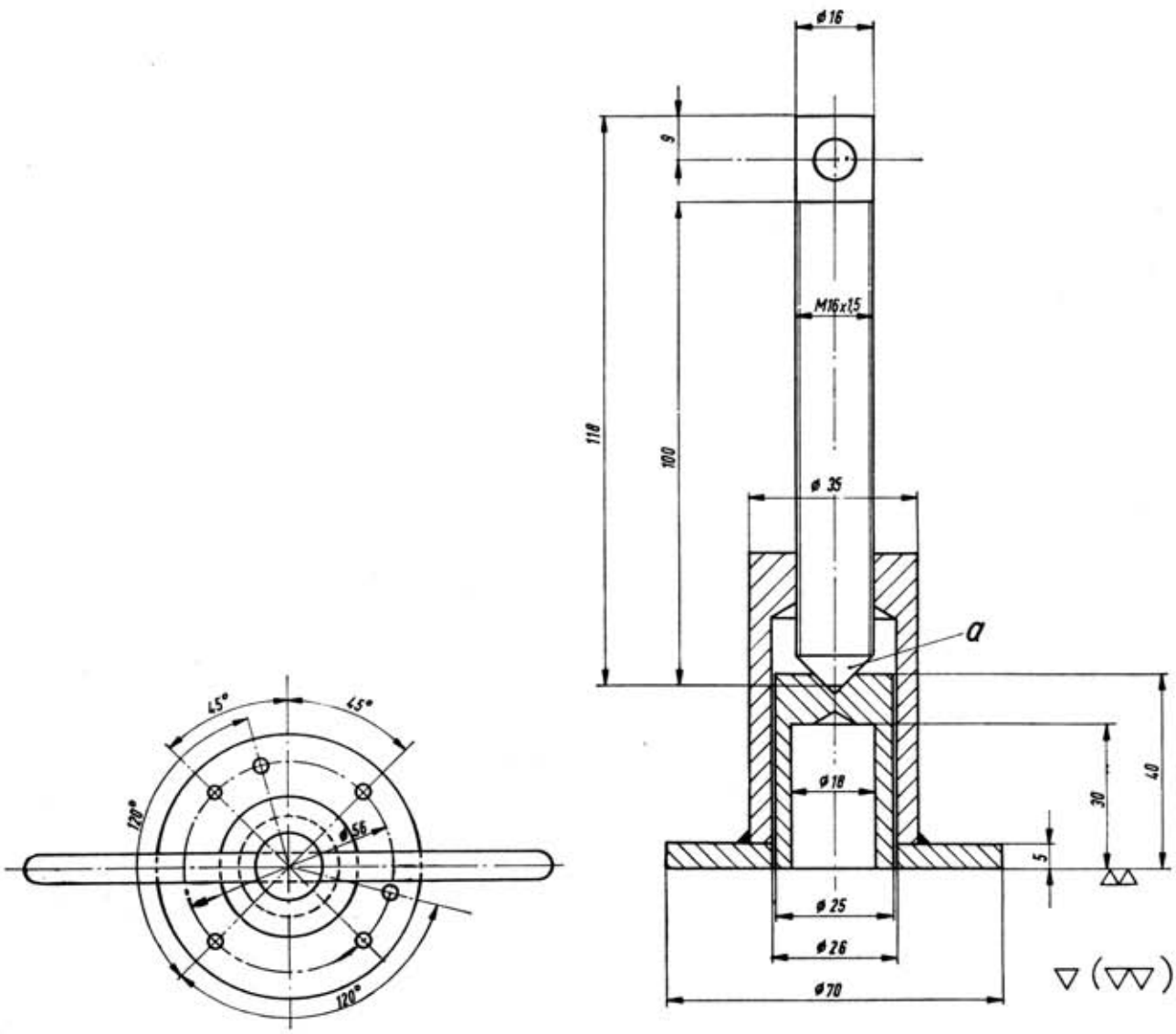
Drift for fitting sleeves
11-MW 3-4



(a) Knurled

Part No.	Number requd.	Description	Material	Rough Size	Remarks
1		Drift	C 15	15 dia. × 135	case-hardened

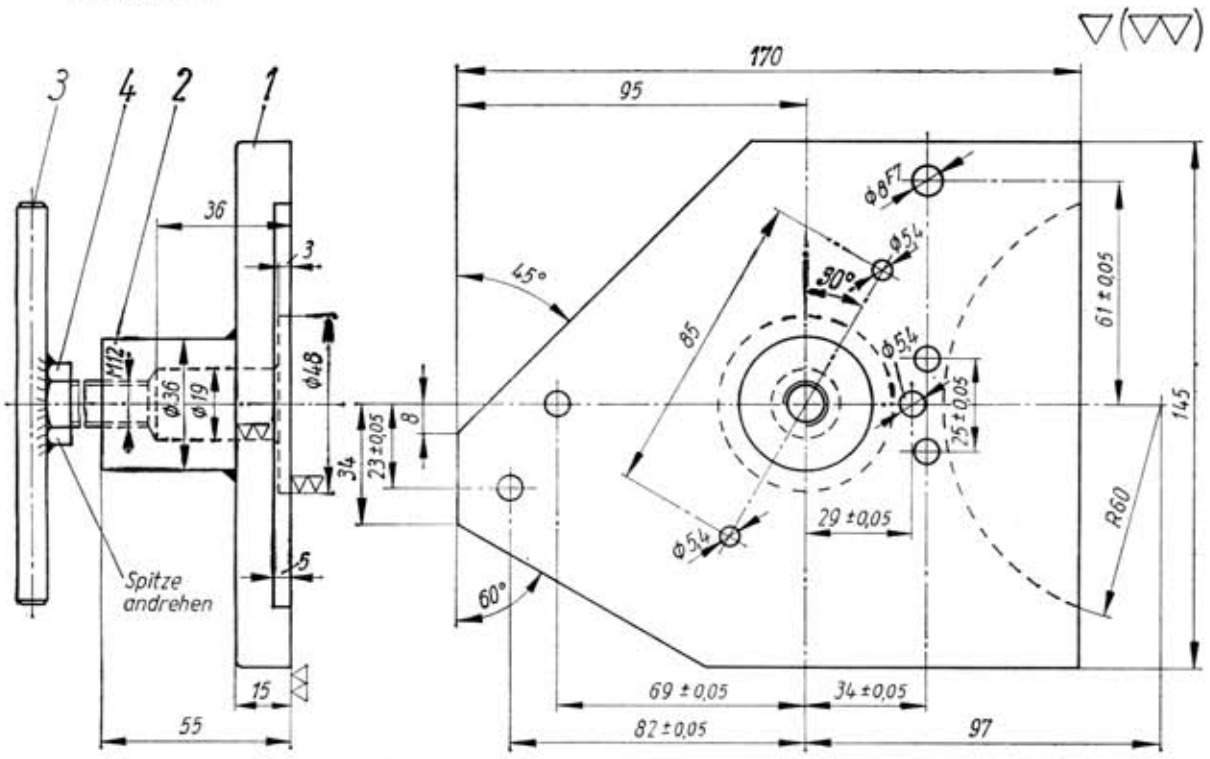
Dismantling screw for right-hand half of casing
05-MV 71-2



(a) Head to be hardened

Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Disk	MSt 3	72 dia. × 8	
2	1	Receiving bush	MSt 3	38 dia. × 65	
3	1	Bush	C 45	28 dia. × 45	
4	1	Screw	C 45 K	16 dia. × 126	
5	1	T-handle	St 37 K	8 dia. × 145	

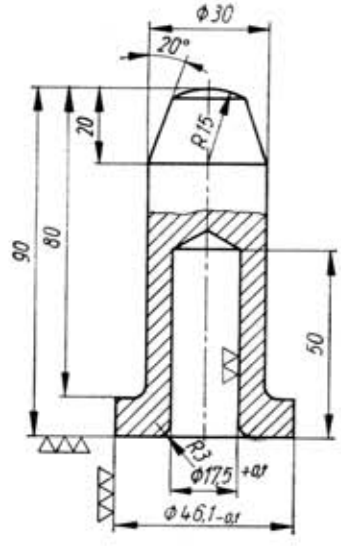
Crankshaft pusher
11-MV 46-3



All bore-holes without specified dimensions 6.4 mm in dia.

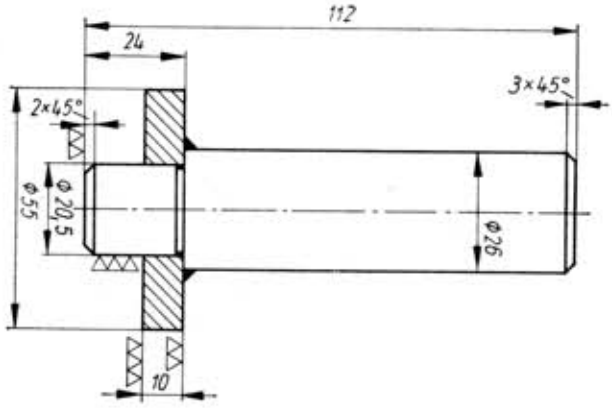
Part No.	Number requd.	Description		Material	Rough Size	Remarks
1	1	Base plate	welded	MSt 3	20 × 150 × 170	Thrust
2	1	Hub	part	MSt 3	40 dia. × 45	end
3	1	Handle		St 37 K	10 dia. × 110	hardened
4	1	Hexagon head bolt M 12 × 100	welded part	4 D		TGL 0-933

Drift for bearing 6303
11-MW 7-4



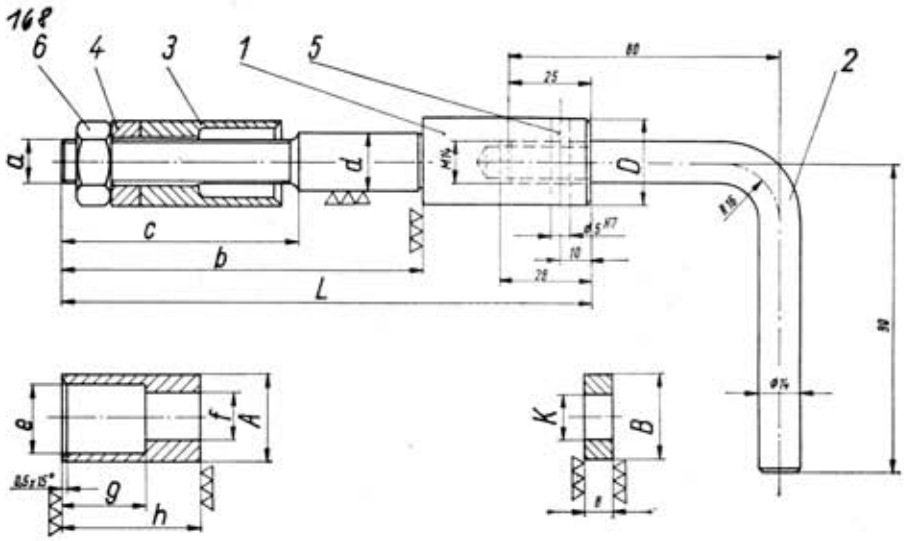
Part No.	Number requd.	Description	Material	Rough Size	Remarks
	1	Drift	C 15	50 dia. × 95	case-hardened

Drift for packing ring 22 × 47
12-MW 19-4



Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Thrust plate	C 15	60 dia. × 15	case-hardened
2	1	Pin	C 15	30 dia. × 115	case-hardened

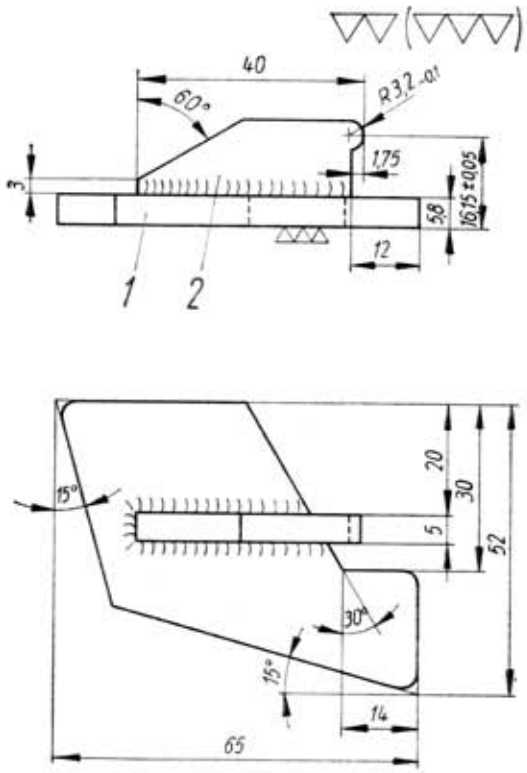
Small-end bush extractor
H 8-594 V 3



Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Pin	C 15	$D+5 \times L \times 5$	case-hardened
2	1	Handle	St 37 K	12 dia. × 175	
3	1	Bushing	C 15	$A+5 \times h+5$	case-
4	1	Washer	C 15	$B+5 \times 12$	hardened
5	1	Cylindrical pin 5 m 6 × 25			TGL 0-7 specifications
6	1	Hexagon nut a			TGL 0-934 specifications

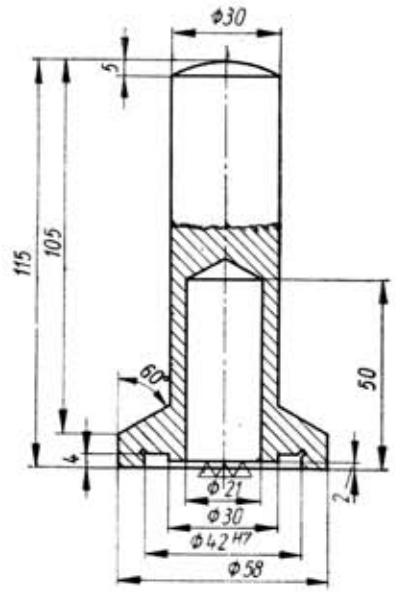
Item No.	D dia.	L	d dia.	a	b	c	A dia.	h	e dia.	f dia.	g	B dia.	K dia.
1	25	138	$12_{-0,05}$	M 12 × 1,5	88	58	25	35	$15,5^{+0,1}$	12,5	20	25	12,5
2	25	145	$15_{-0,05}$	M 12 × 1,5	95	65	25	40	$17,5^{+0,2}_{+0,1}$	12,5	22	25	12,5
3	25	155	$18_{-0,05}$	M 14 × 1,5	105	70	25	40	$21^{+0,2}_{+0,1}$	14,5	24	25	14,5
4	25	155	$20_{-0,05}$	M 14 × 1,5	105	70	28	40	$24^{+0,2}_{+0,1}$	14,5	24	25	14,5

Setting gauge for gear detent spindle
11-ML 8-4



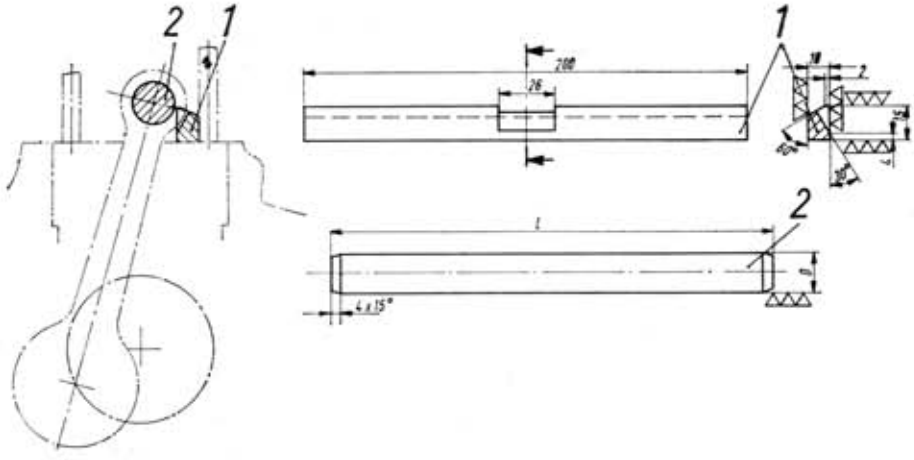
Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Base plate	sheet metal	6 × 55 × 68	hardened
2	1	Gauge	for gauge-making	5 × 17 × 43	

Drift for bearing 6004
11-MW 44-4



Part No.	Number requd.	Description	Material	Rough Size	Remarks
	1	Drift	C 15	60 dia. × 120	case-hardened

Pin and straight-edge (straightening the connecting rod)
H 8-626-3

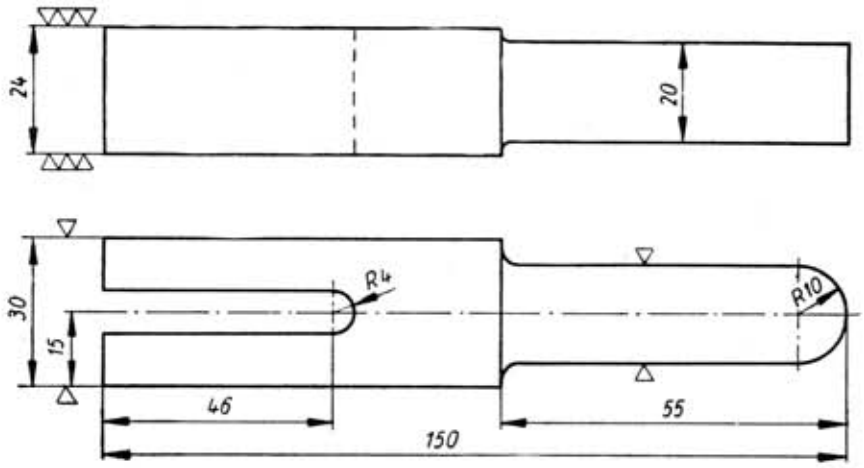


Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Straight-edge	C 15	20 × 15 × 205	case-hardened
2	1	Pin	C 15	$D + 5 \times L + 5$	case-hardened

Item No.	D dia.	L	Type
1	18 dia. g 6	200	ES 250
2	15 dia. g 6	200	ES 125 BK 350
3	12 dia. g 6	200	RT 125/2
4	20 dia. g 6	200	ES 300

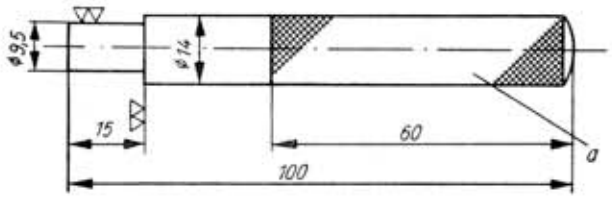
Specified size	Allowance
12 g 6	−0.006 −0.017
15 g 6	−0.006 −0.017
18 g 6	−0.007 −0.020
20 g 6	−0.007 −0.020

Piston support
01-MW 46-4



Part No.	Number requd.	Description	Material	Rough Size	Remarks
	1	Piston support	St 34 u or hard wood	36 × 18 × 175	TGL 7973 specifications

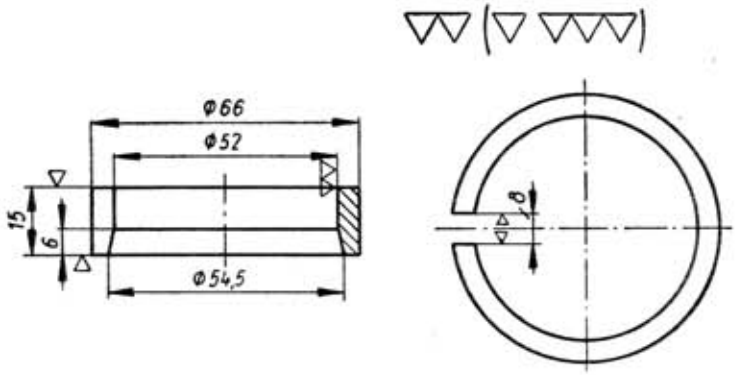
Guide-pin for fitting the gudgeon pin
02-MW 33-4



(a) To be knurled

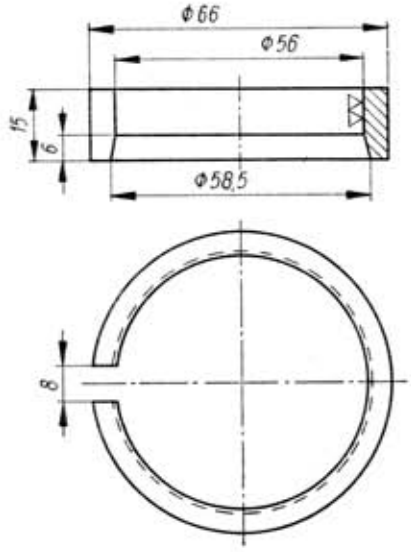
Part No.	Number requd.	Description	Material	Rough Size	Remarks
	1	Pin	St 38 b-2	18 dia. × 130	

Piston-ring tightener for ES 125 (52 mm)
01-MW 46-4



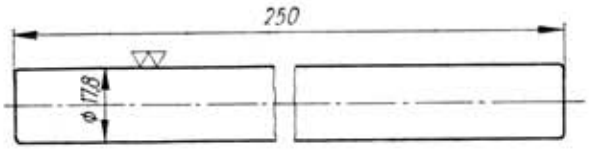
Part No.	Number requd.	Description	Material	Rough Size	Remarks
	1	Ring	St 50	70 × 10 × 18	Tube TGL 9012 specifications

Piston-ring tightener for ES 150 (56 mm)
11-MW 4-4



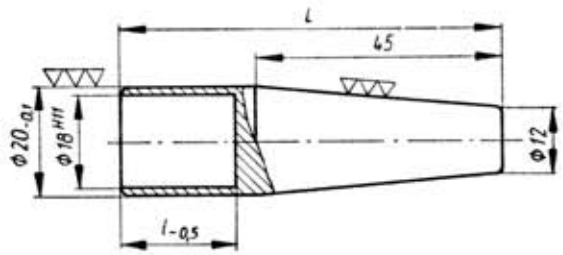
Part No.	Number requd.	Description	Material	Rough Size	Remarks
	1	Ring	St 50	70 dia. × 18	

Centering-pin for setting the swing arms
05-MW 26-4



Part No.	Number requd.	Description	Material	Rough Size	Remarks
	1	Centering-pin	C 15 K	18 dia. × 255	case-hardened

Taper sleeve for packing rings at the swing-arms bearing pins
13-MV 26-4

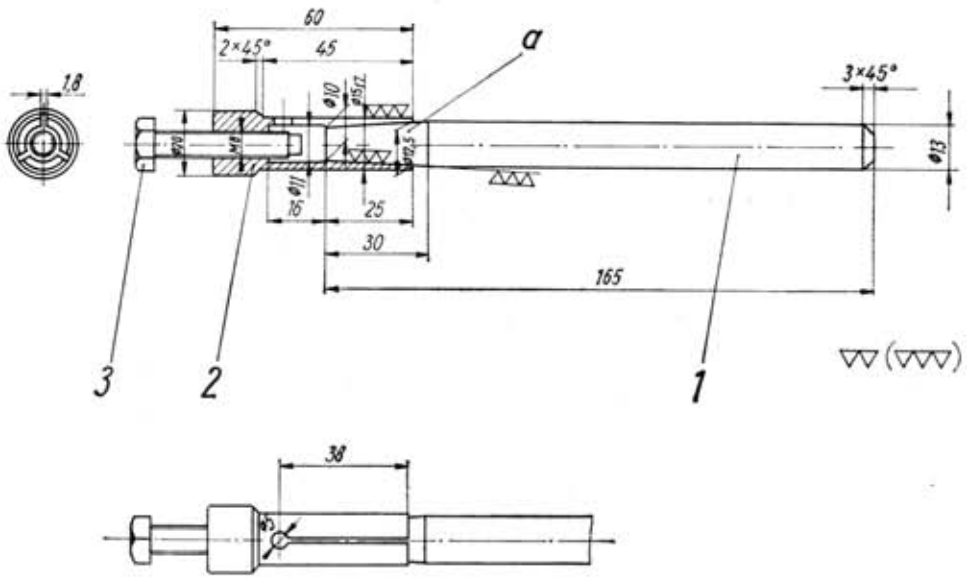


Part No.	Number requd.	Description	Material	Rough Size	Remarks
	1	Fitting sleeve	MSt 3	see table	

Fitting sleeves are to be marked by
l = 24, L = 70

l Nominal Size	L	Rough Size
15	65	25 dia. × 70
24	70	25 dia. × 75
51	100	25 dia. × 105
60	105	25 dia. × 110
50	130	25 dia. × 135

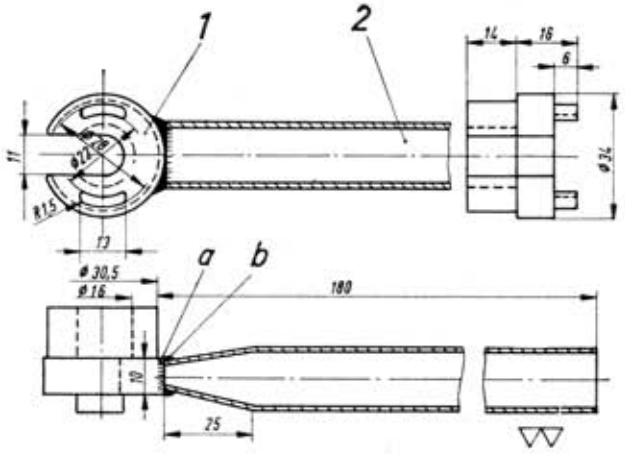
Expanding mandrel for changing the wheel bearings
H 8-820-3



(a) Taper 1 : 10

Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Striking pin	C 15	15 dia. × 170	case-hardened
2	1	Expanding bush	67 SiCr 5	23 dia. × 65	hardened
3	1	Hexagon head bolt M 8 × 45	— 4 D		TGL 0-561 specifications

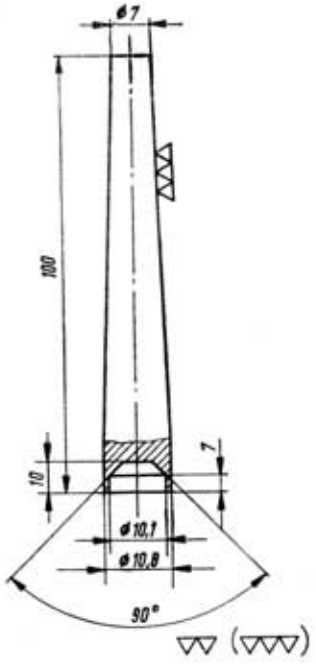
Special spanner for loosening the check nut (telescopic suspension unit)
05-MW 82-4



(a) Tube to be pressed
(b) Welded seem must not project

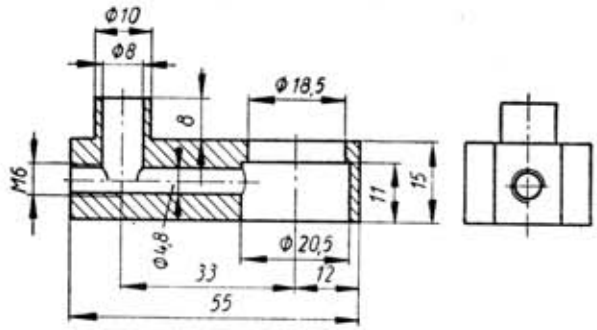
Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Rim	MSt 3	35 dia. × 35	
2	1	Tube 18 × 1.5		185 long	

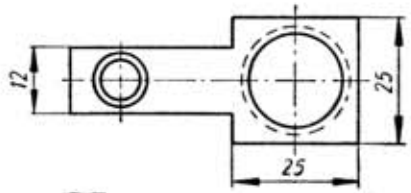
Taper fitting sleeve for MM collar
05-MV 93-4

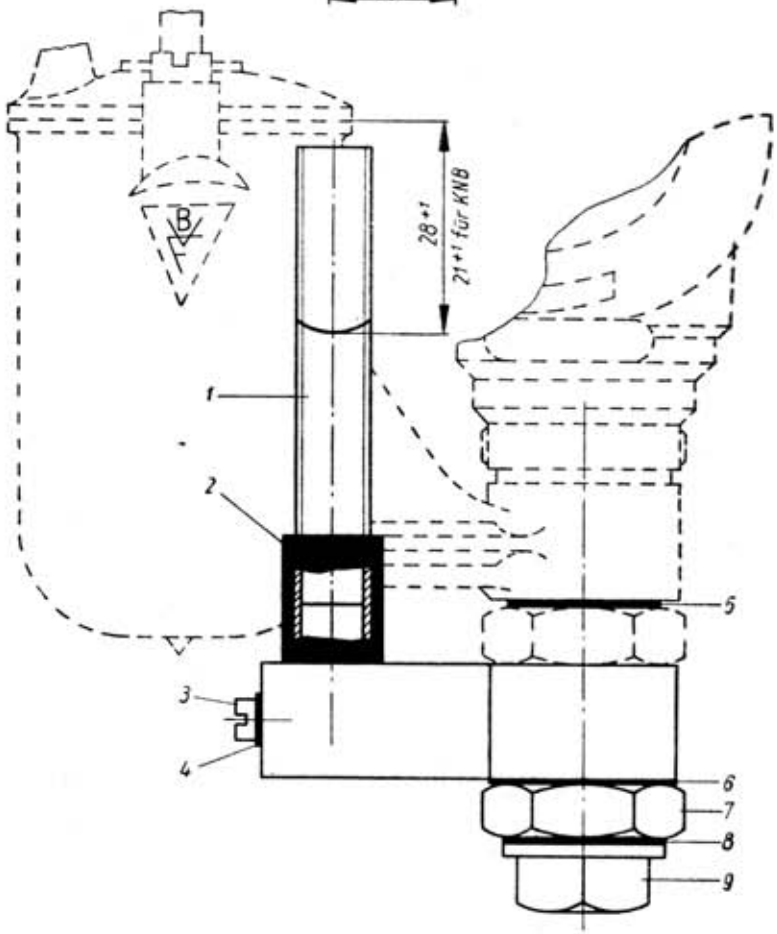


Part No.	Number requd.	Description	Material	Rough Size	Remarks
	1	Fitting sleeve	St 60	12 dia. × 105	

Level tester







Part No.	Number requd.	Description	Material	Rough Size	Remarks
1	1	Glass tube		8 mm internal dia., 60 mm long	
2	1	Fuel pipe			
3	1	Cheese head screw BM 6 × 8			TGL 0-84 specifications
4	1	Packing ring A 6 × 10			TGL 0-7603 specifications
5	1	Packing ring[1]	BVF Catalogue No. 0051		
6	1	Packing ring[1]	BVF Catalogue No. 0052		
7	1	Hollow bolt[1]	BVF Catalogue No. 2047		
8	1	Packing ring[1]	BVF Catalogue No. 0054		
9	1	Screw plug[1]	BVF Catalogue No. 0053		

[1]) Supplier: VEB Berliner Vergaserfabrik, 1035 Berlin, Frankfurter Allee 71

13. Conversion Table

1 Inch (") = 25.4 mm
(There has been no difference between the U.S. and Imperial inch for most engineering purposes since July 1st, 1959)

1 Mile = 1.61 km

a) Conversion of millimetres to inches

1 mm = 0.0394"
0.5 mm = 0.0197"
0.1 mm = 0.0039"
0.01 mm = 0.0004"

b) Conversion of fractional inches to millimetres

$^1/_{64}$" = 0.397 mm
$^1/_{32}$" = 0.794 mm
$^1/_{16}$" = 1.588 mm
$^1/_8$" = 3.175 mm
$^1/_4$" = 6.350 mm
$^1/_2$" = 12.700 mm

c) Conversion of kilometres to miles

1 km = 0.621 miles (1 mile = 1.61 km)

d) Conversion of centigrades to degrees Fahrenheit

−20 °C = −4 °F
0 °C = 32 °F
50 °C = 122 °F
80 °C = 176 °F
100 °C = 212 °F

e) Conversion of litres to pints

1 U.S. gallon = 3.785 litres (l)
1 U.S. pint = 0.4732 litres
1 Imperial gallon = 4.546 litres
1 Imperial pint = 0.5682 litres