

Workshop Manual



HEINKEL

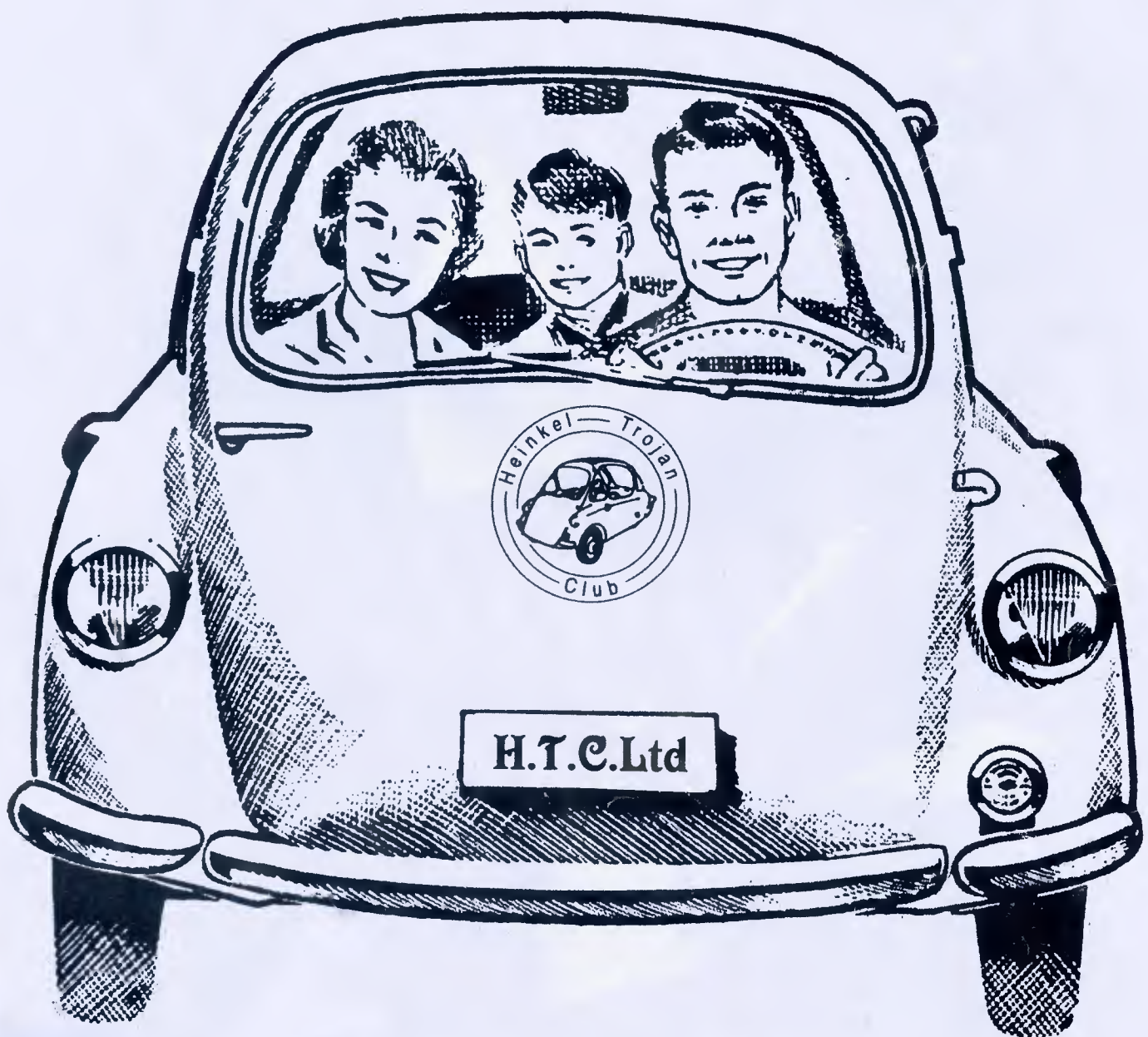
Cabin Cruiser

WORKSHOP MANUAL

HEINKEL / TROJAN 3 / 4 WHEEL

CABIN CRUISER

175cc and 200cc



HEINKEL TROJAN CLUB LIMITED

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Technical Data

Engine	Type 150		Type 154/153														
Engine model	407 B-O/407 B-1		408 B-O 408 B-1/408 B-2														
Engine cycle		Four-stroke															
Number of cylinders		1															
Arrangement of cylinders		Vertical															
Bore	60 mm dia.		65 mm dia. 64 mm dia.														
Stroke		61.5 mm															
Swept capacity	174 cc		204 cc 198 cc														
Clearance volume	27.5 cc		35.2 cc														
Compression ratio	1 : 7.4		1 : 6.8														
Output	9.2 hp at 5500 r.p.m.		10 hp at 5500 r.p.m.														
Compression pressure	9 atmospheres (when fuel valve is open and the engine is warm)		10 atmospheres (when fuel valve is open and the engine is warm)														
Piston play (Mahle)		0.06—0.07 mm															
Diameter of gudgeon pin		18 mm dia.—DIN 73121 standards (watch for identification colour)															
Bore of compression ring		18 mm dia. + 0.025 mm + 0.040 mm															
Seating of crank assembly	407 B-O 2 x Annular groove bearings 6305 C 3	407 B-1	} 2 6305 C 3														
	408 B-O 1 x Annular groove bearing 6004 x C 3	408 B-1															
Seating for clutch shaft		1 x Annular groove bearing 6203 C 3	408 B-2														
Valve arrangement	Overhead valves (V-type) in fully-enclosed light-metal cylinder head																
Valve clearance		Inlet valve 0.15 mm	} measured on cold engine														
		Exhaust valve 0.20 mm															
Valve timing		<table border="0"> <tr> <td rowspan="4">Type 150</td> <td rowspan="4">}</td> <td>Inlet/Exhaust 12° 30' after t.d.c.</td> <td rowspan="4">} measured with 2 mm valve clearance</td> </tr> <tr> <td>Inlet/Inlet 32° 30' after b.d.c.</td> </tr> <tr> <td>Exhaust/Exhaust 27° 30' before b.d.c.</td> </tr> <tr> <td>Exhaust/Inlet 7° 30' before t.d.c.</td> </tr> <tr> <td rowspan="4">Type 154</td> <td rowspan="4">}</td> <td>Inlet/Exhaust 18° 30' after t.d.c.</td> <td rowspan="4">} measured with 2 mm valve clearance</td> </tr> <tr> <td>Inlet/Inlet 22° 30' after b.d.c.</td> </tr> <tr> <td>Exhaust/Exhaust 17° 30' before b.d.c.</td> </tr> <tr> <td>Exhaust/Inlet 13° 30' before t.d.c.</td> </tr> </table>		Type 150	}	Inlet/Exhaust 12° 30' after t.d.c.	} measured with 2 mm valve clearance	Inlet/Inlet 32° 30' after b.d.c.	Exhaust/Exhaust 27° 30' before b.d.c.	Exhaust/Inlet 7° 30' before t.d.c.	Type 154	}	Inlet/Exhaust 18° 30' after t.d.c.	} measured with 2 mm valve clearance	Inlet/Inlet 22° 30' after b.d.c.	Exhaust/Exhaust 17° 30' before b.d.c.	Exhaust/Inlet 13° 30' before t.d.c.
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		Exhaust/Exhaust 17° 30' before b.d.c.															
		Exhaust/Inlet 13° 30' before t.d.c.															
Diameters of valve stems		Inlet 6.975 mm diameter—0.01 mm															
		Exhaust 6.965 mm diameter—0.01 mm (chromium-plated)															
Bores of valve guides		Inlet } 7 mm dia. + 0.013 mm															
		Exhaust } + 0.028 mm															
Valve spring pressure	30.0 kg (valve open)		32.3 kg (valve open)														
	10.3 kg (valve closed)		10.9 kg (valve closed)														
Cooling		Fan-cooling															
Lubricating system		Oil-bath centrifugal lubrication															
Ignition		Battery-magneto with automatic timing															
Type of ignition		408 B-O															
Unit	"SIBA" 12 volts, 90 watts (AZ/Lkx 12/90—1200R)	"BOSCH" 12 volts, 90 watts (AZ/DAQ 90/12/1700 + 0.2R2)	407 B-1/408 B-1 408 B-2														
Spark timing		Retarded Ignition															
		0.3—0.5 mm before t.d.c. using timing tool (408/W 10) or 8°—10° before t.d.c. (when using graduated disc)															
		Advanced Ignition															
		6.5—7 mm before t.d.c. or 33°—35° before t.d.c. (when setting with the governor fully open)															
Gap between contact breaker points		0.35 — 0.45 mm															
Spark plug calorific value		225															

Spark plug thread
Spark gap

M14 x 1.25
0.5—0.6 mm

Carburettor

Needle type carburettor
with accelerating pump

Pallas type 20/13 P

Pallas type 22/15 P

408 B-2

Carburettor passage

20 mm

22 mm

22/17 P

Main jet

85

92

85

Slow-running jet

25

30

25

Needle jet

2721

2701

Needle setting

3

2

Air adjustment screw

 $\frac{3}{4}$ turns open

3—4 turns open

2,5

adjust to best idling

Air filter

"Knecht" micronic air filter

Clutch

Clutch

Oil-bath multiple-disc clutch

Clutch spring pressure

60—70 kg

75—85 kg

Thickness of "Reico" outer plate

max. 5.0 mm min. 4.0 mm

Clutch adjustment

approx. 15 mm at the clutch pedal

Gearbox

Gearbox

4-speed gearbox with reversing gear

Method of engagement

Dogs

Power transmission

Single enclosed chain, $\frac{3}{8}$ " x $\frac{3}{8}$ "

Engine-gearbox

(56 links endless) fully-enclosed and oil-bath immersed

Power transmission

Single roller chain, $\frac{1}{2}$ " x 5/16"

Gearbox-rear wheel

(70 links endless) fully-enclosed and oil-bath immersed)

Reduction engine-gearbox

1.882 : 1

Gear Reduction Ratios

1st Gear 23.04 : 1

2nd Gear 2.07 : 1

3rd Gear 1.38 : 1

4th Gear 1 : 1

Reverse Gear 3.49 : 1

Reduction gearbox-rear wheel

3.10 : 1

Chain Wheels

Gearbox 10 teeth

Rear wheel 31 teeth

Total Reduction

1st Gear 23.14 : 1

2nd Gear 12.07 : 1

3rd Gear 8.08 : 1

4th Gear 5.83 : 1

Reverse Gear 20.37 : 1

Chassis

Self-supporting body

Front wheel suspension

Sprung legs with hydraulic shock-absorbers

Rear wheel suspension

Swing arm, sprung leg with hydraulic shock absorber

Front axle

Individual suspension

Type 150

Type 154/153

Toe-in	3—5 mm (measured at the wheel flange front and back)
Wheel Camber	2°
King pin side inclination	8°
Caster	42 mm

Steering	Steering wheel
Type of steering	Rack steering (adjustable)
Steering transmission	15.2 : 1
Minimum turning circle diameter	8 m

Brakes

Foot brake	Hydraulic ATE internally expanding brake, acting on front wheels		
Diameter of brake drum	160 mm		
Width of brake shoes	30 mm		
Effective braking area	187 sq. cm.		
Hand brake	Mechanical internally expanding brake		
	Acting on rear wheel	Acting on rear wheels	Acting on rear wheel
Diameter of brake drum		rear 140 mm	
Width of brake shoe		rear 25 mm	
Effective braking area		68 sq. c.m.	
Wheels	fully interchangeable		
Rims	3.00 D-10"		
Tyres	4.40 x 10"		
Tyre pressure	front 20 lbs. sq. inch		front 20 lbs. sq. inch
	rear 22-24 lbs. sq. inch		rear 22-24 lbs. sq. inch
	(according to load)		(according to load)

Dimensions

Overall length	2550 mm		
Maximum width	1370 mm		
Maximum height	1320 mm (empty)		
Ground clearance	approx. 125 mm, according to load		
Wheel base	1760 mm		
Track width	front 1225 mm		front 1225 mm rear 220 mm

Weights

			153
Weight when empty	243 kg	285 kg	280 kg
Admissible total weight	475 kg	510 kg	475 kg
Admissible weight on axle	front 300 kg	300 kg	300 kg
	rear 195 kg	240 kg	195 kg

Performance

Maximum speed	86 km per hour		90 km per hour
Climbing power in 1st gear		approx. 28%	

Fuel and Lubricants

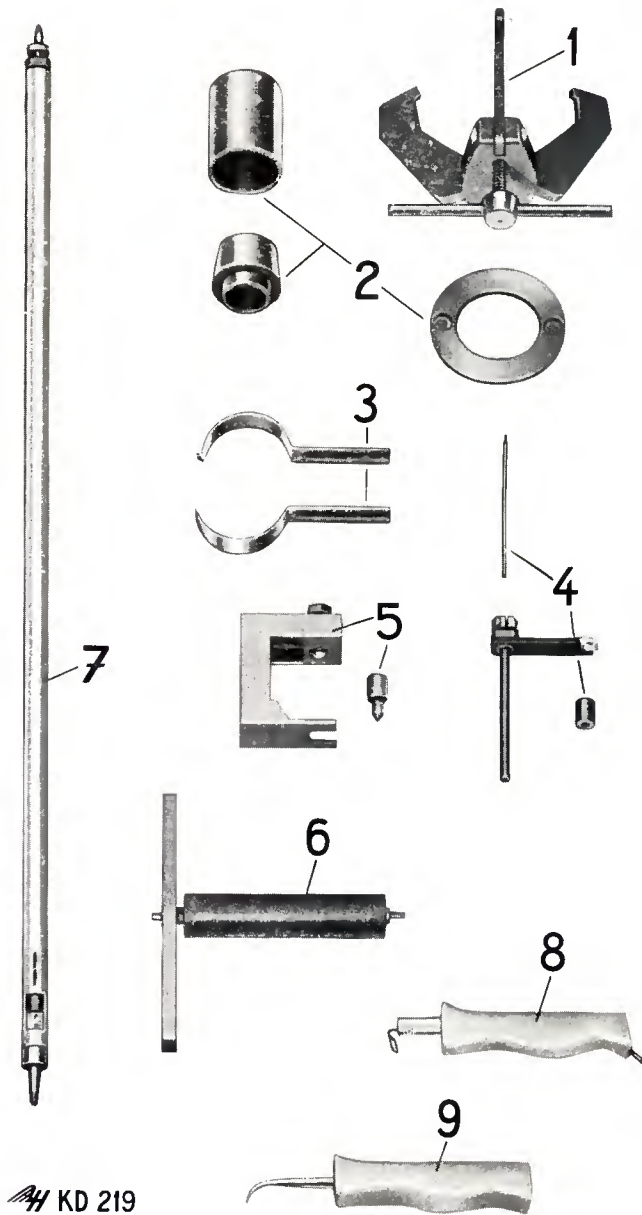
Fuel	at least 82 Octane (ROZ)		
Fuel tanks	16.9 litres, 2 litres of which are in reserve		
Lubricant	Use a proprietary brand such as Mobiloil Special all the year round		
Oil content in engine	approx. 1½ litres (marked on dipstick)	approx. 1½ litres (marked on dipstick)	
Oil contained in the swing arm	0.15—2.20 litres	0.25—0.30 litres	0.15—0.20
Fuel consumption according to DIN 70030	3 litres/100 km at approx. 65 k.p.h.	3.5 litres/100 km at approx. 68 k.p.h.	

Subject to alterations in the interest of further technical development

Special Tools for the "HEINKEL-KABINE" CABIN CRUISER

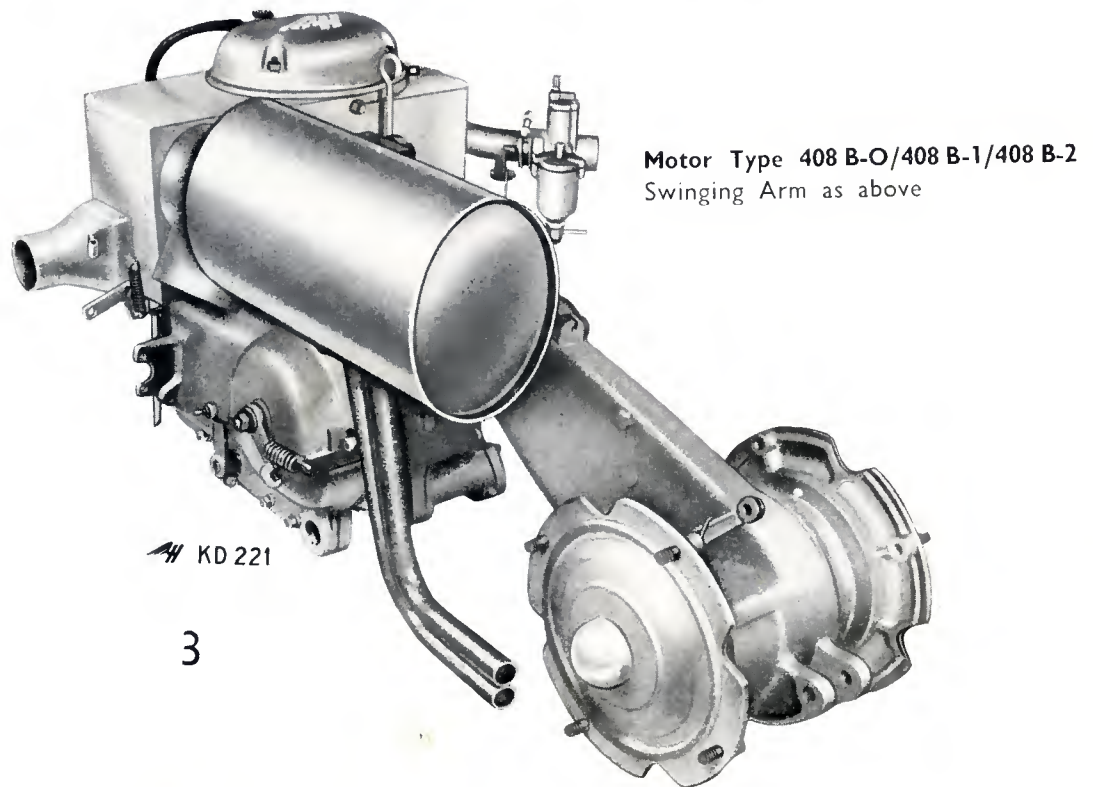
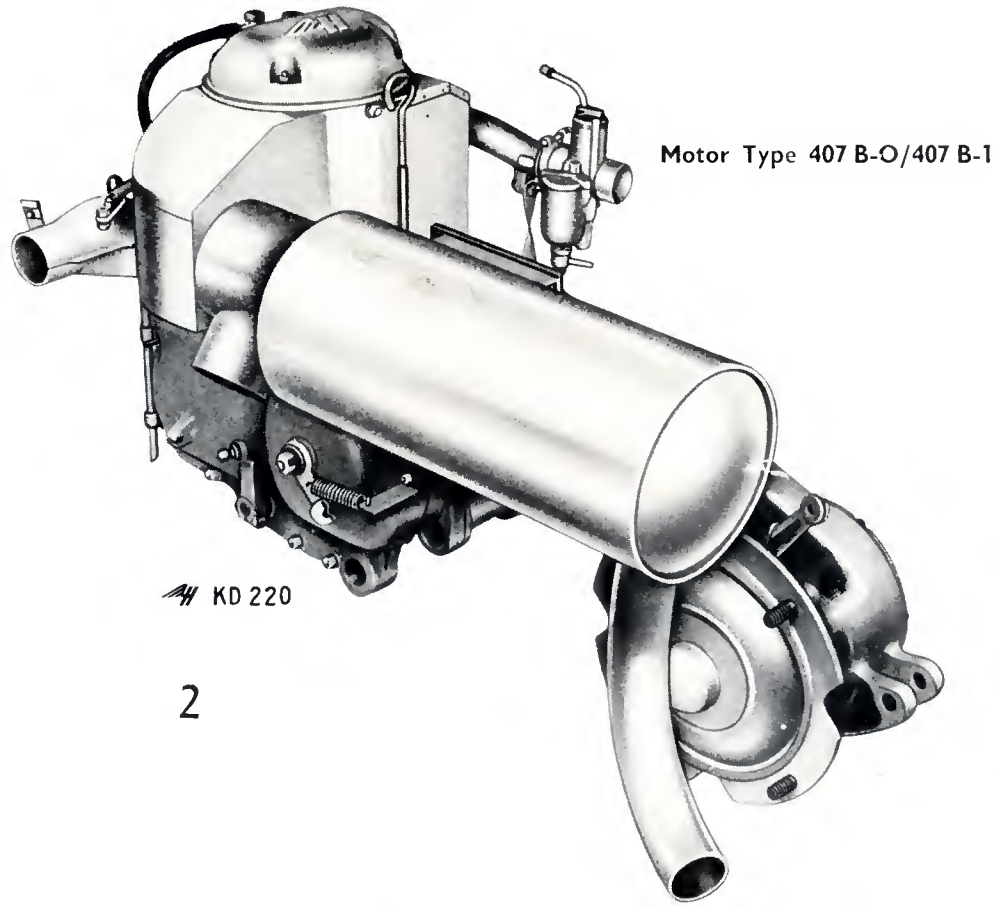
Only Type 154

- 1 408.350/W 1
Extractor for Casing
(Swing Arm)
- 2 408/W 11
Apparatus for Clutch,
in conjunction with 401/W 25
- 3 408/W 3
Piston Ring Tightener
- 4 408/W 10
Ignition Timer
- 5 150/W 1
Steering Wheel Extractor
- 6 150.2001/W 2
King Pin Extractor
- 7 150.2001/L 3
Track Adjuster
- 8 Commercial type
Crack-Filler Applicator
- 9 Commercial type
Glazing Tool



KD 219

Motor "HEINKEL Cabin Cruiser"



Dismantling the Engine

General

To facilitate repair work on the Cabin Scooter, the use of an ordinary assembly trolley (see Fig. 4) is recommended. Any relatively extensive stripping down and assembly work on the engine should only be undertaken on the jig (see Fig. 5) and when using the proper special tools, for the workshop effecting the repair is responsible for its work within the framework of the standard conditions governing the execution of repairs to motor vehicles. On Page 39 there is a drawing of the engine jig which can be made in your own workshop.

Before any repair is carried out, the vehicle as a whole, but mainly the engine, must be thoroughly cleaned, as dirt might otherwise penetrate the driving mechanism and cause trouble later on.

Removing the Engine

Close the fuel cock, raise the vehicle and place it on the assembly trolley (Fig. 4).

1. Engine Type 407 B-O/407 B-1/408 B-2

Remove air filter with tube, as well as carburettor with Bowden control cable. Remove shock absorbers from swing arm. Disengage rear brake cable from brake lever and unscrew the brake cable set-screw from the support on the swing arm. Undo the milled nut on the speedometer drive and seal off the speedometer drive. Undo fixing strip from cooling pipe on the flange side and take off this pipe. Disconnect earthing strip from engine and dismantle wing.

1a. Engine Type 408 B-O/408 B-1

Remove air filter with tube, as well as carburettor with Bowden control cable. Put in gear and dismantle rear wheels and shock absorbers. Disconnect rear wheel brake cable from brake lever and unscrew the brake cable set screw from the support on the swing arm. Undo the milled nut on the speedometer drive and seal off speedometer drive. Remove sealing strip from cooling pipe on the flange side and take off pipe. Dismantle two wings with 8 screws and nuts (caution, tail cowl drops downwards).

2. Engine Type 407 B-O

Disconnect the gear selector arrangement from the shift lever (watch out for the safety bracket) and the clutch control cable from the clutch lever. Unscrew the set screw for the clutch cable from the support on the clutch cover. Put in gear and dismantle rear wheel. Undo heating pipe sealing strip and take off pipe. Dismantle heater control cable at air exhaust plate.

2a. Engine Type 408 B-O/408 B-1/408 B-2/407 B-1

Disengage ball end of gear shift lever (watch out for the safety bracket) as well as the clutch control from the clutch lever. Remove two screws (SW 9) with nuts from the clutch cover and take off flexible ball control. Undo screw M 8 (SW 14) and dismantle clip with heater elbow piece and heater pipe. Remove heating control from air exhaust tube.

3. Engine Type 407 B-O

Dismantle the regulator switch from the splash board and disconnect engine lead. Take out spark plug.

3a. Engine Type 408 B-O/408 B-1/408 B-2/407 B-1

Disconnect earthing lead from the battery and engine lead from voltage regulator. Take out spark plug.

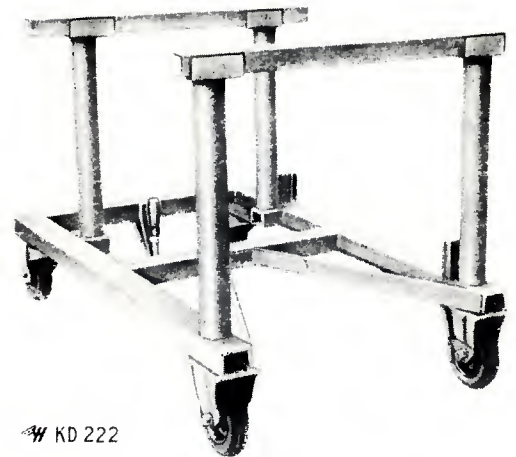
4. Engine Type 407 B-O/407 B-1/408 B-2

Unscrew 4 nuts on the gusset plate of the engine support and lift the engine with swing arm out to the rear.

4a. Engine Type 408 B-O/408 B-1

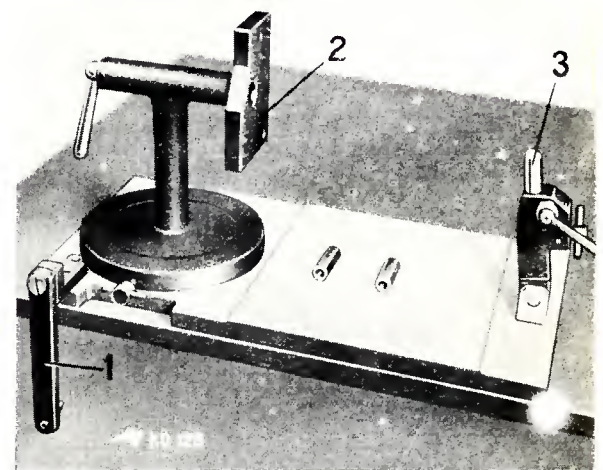
Dismantle 4 nuts on gusset plate of engine support and also clip from rear brake control cable and lift engine with swing arm out to the rear.

Reverse the procedure when reassembling.



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5

Dismantling the Cylinder Head, Cylinder and Piston

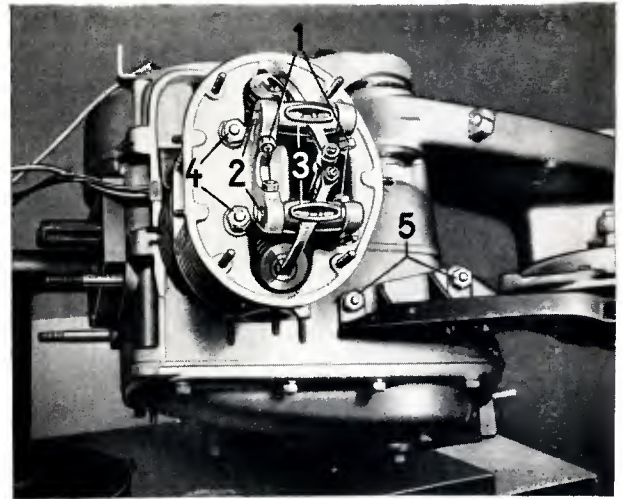
Please Note :

If only assembly work is necessary on the piston and cylinder, there is no need to remove the engine; only the following operations are necessary :

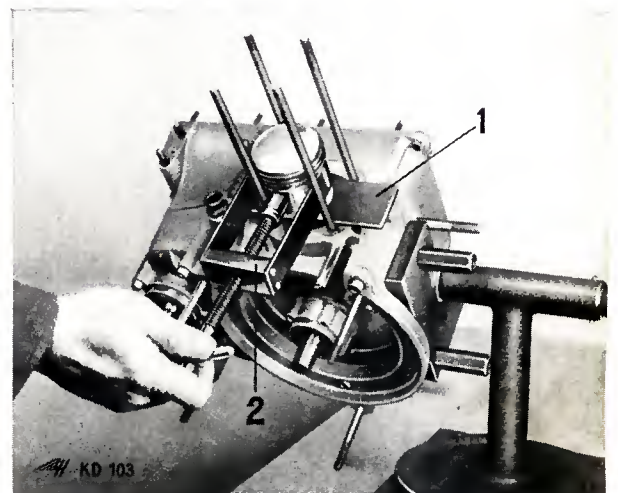
Disconnect fuel pipe, remove carburettor and exhaust.

If the engine has been removed, use the engine jig (Fig. 5) and mount the engine on flange 5/2. In the horizontal position, the engine should be rested on support 5/3, the retaining arm 5/1 being used to secure the fan wheel and armature.

1. Using box spanner (SW 11), undo the nuts on cylinder head cover and remove. Remove cooling baffles. Dismantle induction and exhaust manifolds.
2. With the valves closed, bring piston to top dead centre position and undo set screws 6/1 for rocker arm shafts. Unscrew the valve adjustment screw a little, so that the rocker arm shafts 6/2 can easily be pushed out of their journals with a pin. Remove rockers 6/3 with their spacing washers and remove push rods and spark plug.
3. **Engine Type 407 B-O/407 B-1**
Using box spanner (SW 14), undo fixing nuts of cylinder head 6/4. Remove cylinder head and cylinder. Watch out for the soft-iron washers, since these have to be used again when reassembling.
- 3a. **Engine Type 408 B-O/408 B-1/408 B-2**
Using box spanner (SW 14), undo the fixing nuts of the brackets 6/5 and of cylinder head 6/4 and take off cylinder head. Watch out for the soft-iron washers. Using spanner (SW 14), undo 4 nuts on cylinder foot, remove the washers and spring washers and remove cylinder.
4. For better dismantling of the piston, use the support (401/W 20) 7/1. (Take off crankcase cover with a piece of cleaning rag). With a pair of pointed pliers remove the wire snap rings on the piston and, using the gudgeon pin extractor (401/W 26) 7/2, push out the piston gudgeon pin.
5. To avoid bending the connecting rod, on no account **knock** the gudgeon pin out.



6



7

Dismantling the Clutch

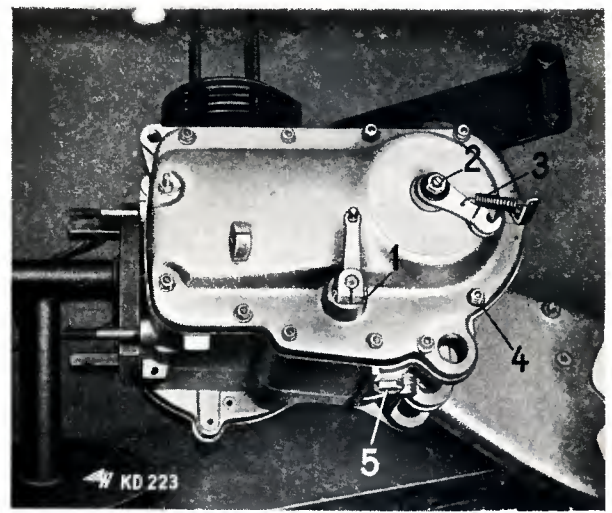
To be noted :

Repair to the clutch can, with engine type 407 B-O, be carried out without the engine being dismantled. However, the gear selector arrangement must be disconnected at the gear shift lever (watch out for safety bracket) and also the clutch control cable should be disconnected from the clutch lever. Unscrew the clutch control set screw from the clutch cover. With type 408 B-O it is advisable to dismantle the engine.

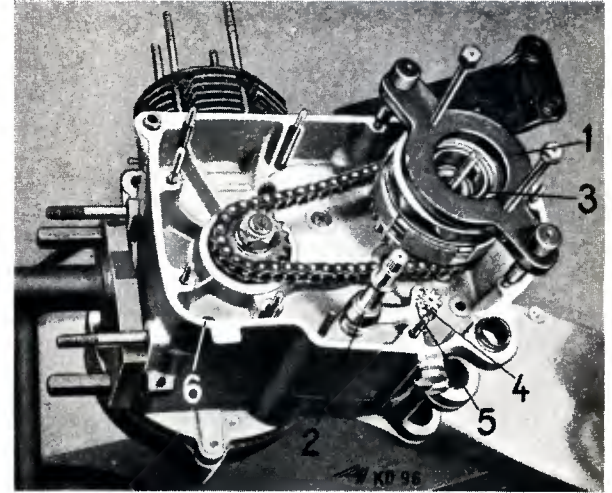
1. Drain off engine oil from oil drain screw (SW 22) 8/5.
2. Undo the clamping screw 8/1 on the shift lever and remove the lever with its rubber washer. Unscrew nuts (SW 14) 8/2 and disconnect clutch lever and spring 8/3. Turn the clutch pin screw to the right so that the clutch worm 33/3 screws out.
3. Undo lock nuts 8/4 from clutch cover; take off clutch cover and air bleed pipe. Watch out for the soft iron washers, since these can be used again.
4. **Engine Type 407 B-O/407 B-1**
Once the clutch cover has been taken off, apply clutch compressor (401/W 25) 9/1 and compress the clutch. Remove the wire snap ring 9/3, loosen the compressor tool and take off the clutch plates. Withdraw the shift segment 9/2.
- 4a. **Engine Type 408 B-O/408 B-1/408 B-2**
Once the cover has been taken off, apply the clutch compressor (401/W 25) 10/1 in conjunction with pressure ring (408/W 11) 10/2 and compress the clutch. Remove wire snap ring 10/3, loosen the compressor tool and take off the clutch plates. Withdraw the shift segment 10/4.
5. Apply the clutch retainer (401/W 18) 11/1, undo the nut (SW 22) on the clutch interior with box spanner 11/2, and the lock nut on the crank drive 11/4 with box spanner (SW 24). Take off the small chain wheel and clutch basket with chain.

Please note :

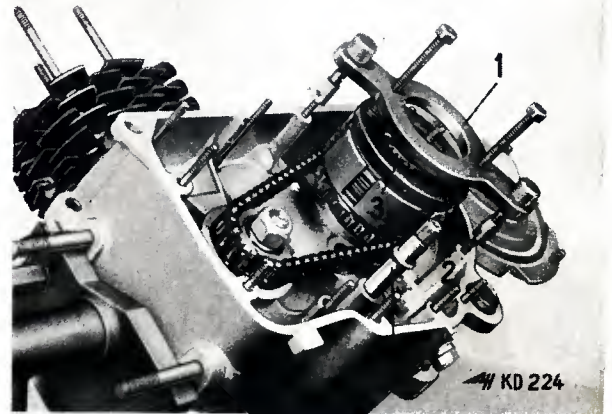
To compensate the play of the chain, shims can be inserted between the small chain wheel and the ball bearing, in addition to the spacer ring of the crank shaft.



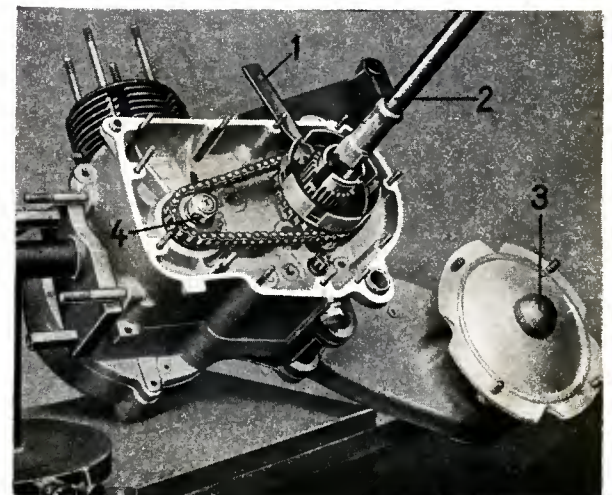
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9



10



11

Dismantling the Dynamo

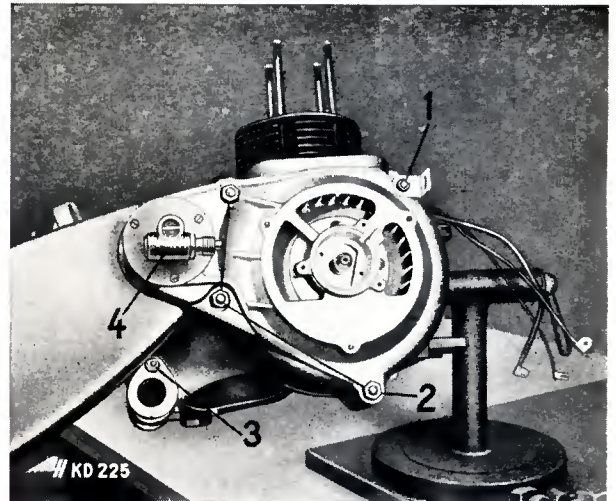
Please note :

If the dynamo is to be repaired whilst the engine is assembled, then disconnect the engine lead at the governor and the earthing lead from the casing. Disconnect speedometer drive, remove cooling air pipe from the flange.

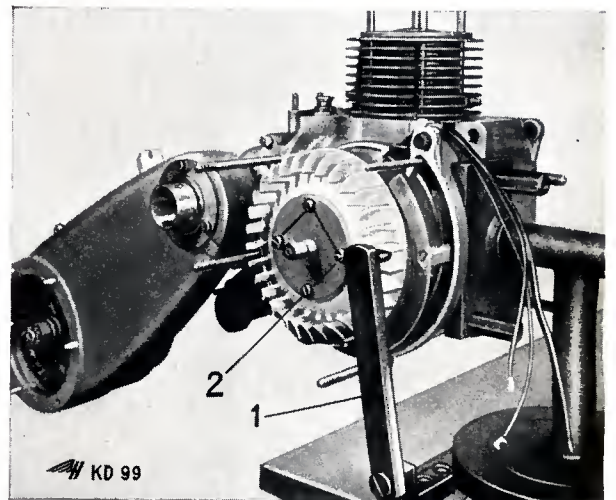
1. Undo 3 fillister head screws and dismantle flange 17/4 for cool air pipe. Take off contact breaker cover plate. Watch for the gasket, as this can be used again. Undo the 2 slot head screws and take off contact breaker plate.
2. Undo 3 counter-sunk screws, take off speedometer drive 12/4. Watch for connecting piece.
3. Using box spanner (SW 10), unscrew 2 nuts 12/1, 12/3 and 3 nuts 12/2 (SW 14) and remove the fan housing.
4. Remove 4 fillister head screws 13/2 and take off cover plate with fan wheel.
5. **Engine Type 407 B-O**
To change the contact breaker cam, remove the disc 39/2 and take out the cam. Remove 2 fillister head screws 39/1 and dismantle the centrifugal governor.

5a. Engine Type 408 B-O/408 B-1/408 B-2/407 B-1

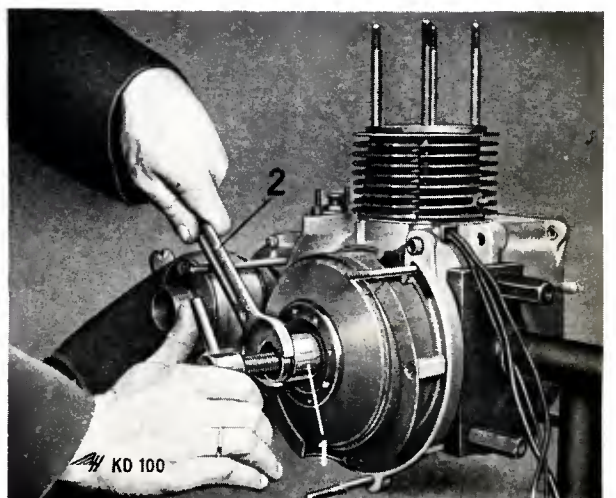
- To change the contact breaker cam, remove wire snap ring, disc and fibre washer. Dismantle cam. Remove 2 fillister head screws and dismantle centrifugal governor.
6. Apply the retaining arm of the jig (401/W 9) 13/1 or the retainer (407/W 21) and undo screw (SW 14) 16/3. Take off washer and spring washer, retighten screw 16/3 slightly. Screw in extractor (404/W 7) 14/1 and, using spanner (SW 27) 14/2 as a counter holder, withdraw the armature; remove screw 16/3.
 7. Remove the plate spring on the right hand crank spindle and undo three Allen screws for the magneto system. Remove magneto system. Watch out for radial gasket. Take out 3 countersunk screws 15/1; remove the spiral.



12



13



14

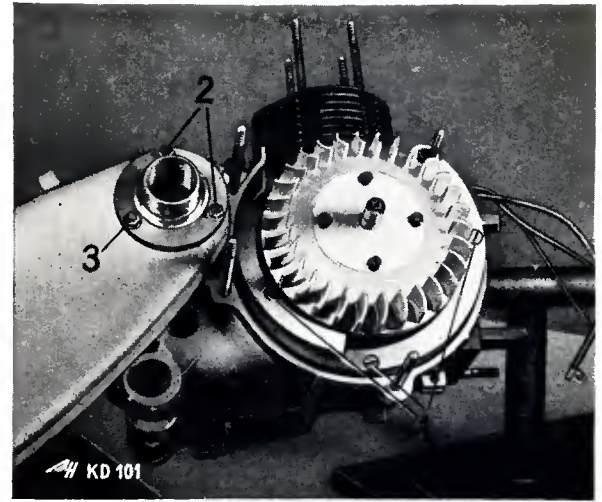
Dismantling the Swing Arm

Please note :

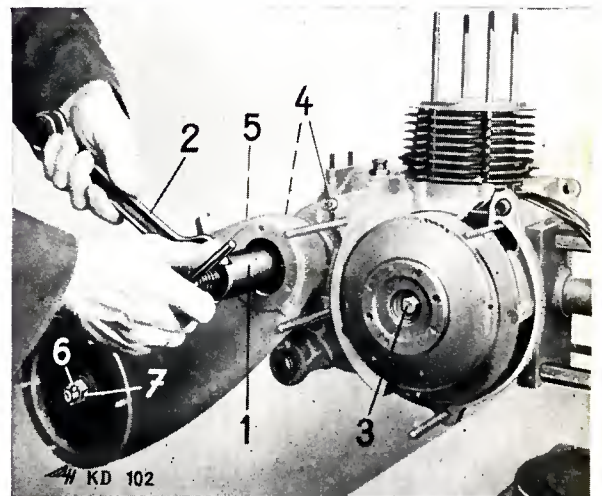
For repairs to the swing arm whilst the engine is fitted, the same preparatory work is necessary as is outlined under "Dismantling the Dynamo" (See Page 12). Also disconnect rear brake control cable from brake lever and unscrew set screw from support on swing arm. Undo shock absorber from the swing arm.

1. Using box spanner (SW 10), undo 2 hexagonal-headed screws 15/2 and 1 nut 15/3. Take off outer bearing sleeve of the swing arm mounting.
2. Engine Type 407 B-O/407 B-1/408 B-2

With the retainer arm 13/1 of the jig (401/W 9), lock the fan wheel in position or remove the fan wheel and use retainer (407/W 21). Open the securing washer of the small chain wheel. Using box spanner (SW 19), undo nut 35/4 for chain wheel and driving shaft (left hand thread). Take off the rubber cap 11/3, remove cotter pin and undo the crown nut (SW 24) with retaining washer. At the opposite end of the spindle, remove the cotter pin 16/6, crown nut 16/7 (SW 24) and remove. Apply the extractor tool (401/W 22) 16/1. Use the spanner (SW 32) 16/2 as a counter holder and take off the chain wheel. Tap the rear wheel axle back until the threaded portion is flush with the ball bearing. Wind off the chain on the large chain wheel and remove the chain wheel. Between the swing arm mounting and the crank case is one nut 16/5; undo this, using spanner (SW 10) whilst the swing arm is taken off simultaneously. Remove chain and small chain wheel.



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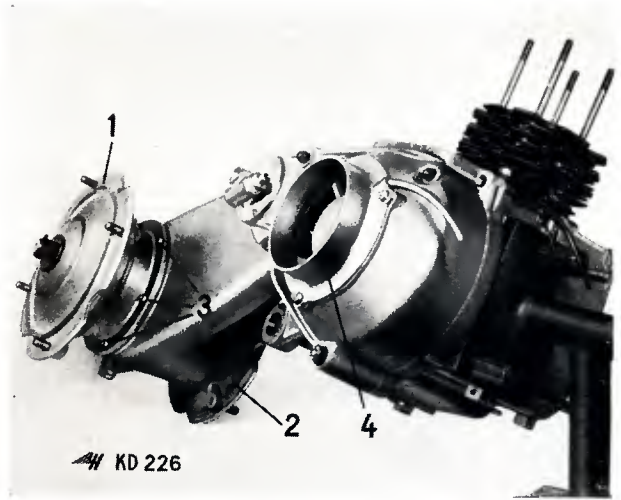


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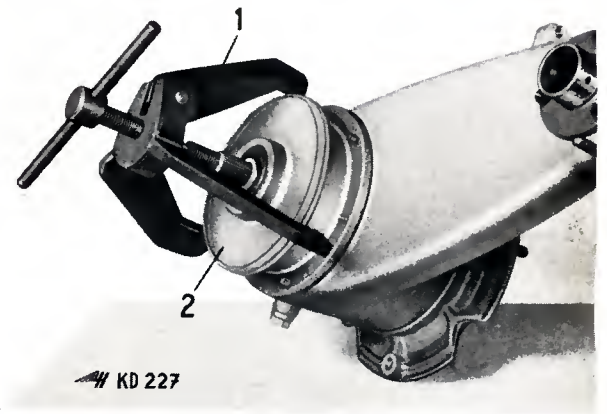
2a. Engine Type 408 B-O/408 B-1

With the retainer arm 13/1 of the jig (401/W 9), lock the fan wheel in position or remove the fan wheel and use retainer (407/W 21). Open the securing washer of the small chain wheel and driving shaft (left hand thread). Take off the rubber cap 11/3, remove cotter pin and undo the crown nut (SW 24) with retaining washer. At the opposite end of the spindle, remove the rubber cap, take out the cotter pin and undo crown nut (SW 24) with securing washer and remove. Take off right hand wheel hub 17/1 (without braking ring) and left hand wheel hub 17/2 (with braking ring). Remove 6 nuts 17/3 with spring washers from the casing. Apply extractor tool (408.350/W 1) 18/1 and take off casing 18/2 with ball bearing and radial gasket. Apply extractor tool (401/W 22) 16/1 and, using spanner (SW 32) 16/2 as a counter holder, take off the chain wheel. Between the swing arm mounting and the casing is one nut 16/5; undo this, using spanner (SW 10) whilst the swing arm is simultaneously removed. Remove small chain wheel. Lift chain 19/1 off chain wheel 19/2 and lay it on inner wall of the casing. Knock the spindle together with the chain wheel through from the brake shoe side (using a rubber or similar hammer) and dismantle.

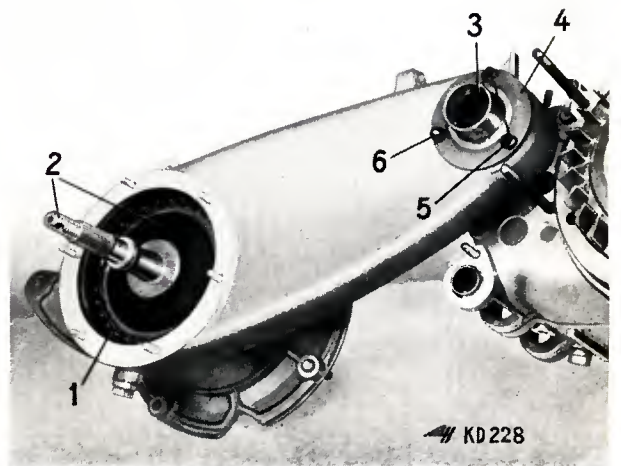
3. Remove the plate spring 34/5 from the output shaft and take off the rear bearing sleeve 34/4.



17



18



19

Dismantling the Crankcase

1. Undo and remove 2 nuts (SW 10) 16/4 on the right hand side of the crankcase and one hexagonal-headed nut (SW 10) 9/6 on the left hand side of the crankcase.
2. Separate the two halves of the crankcase by tapping them with a rubber hammer. **On no account** strike the crankshaft. Remove the left hand half of the crankcase.

Dismantling the Gears

Please note :

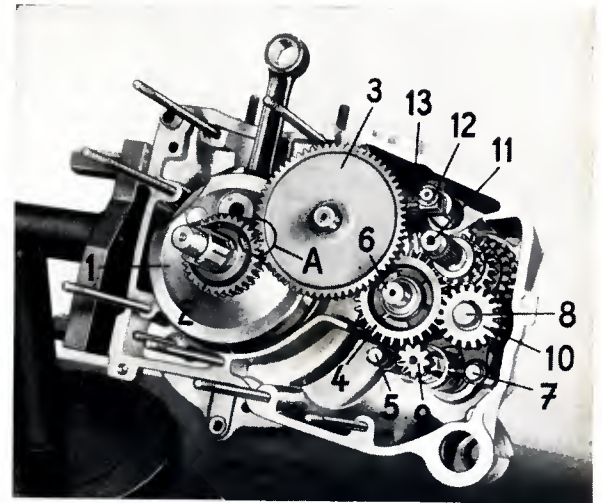
When repairing the gears, there is no need to dismantle the dynamo and swing arm.

1. Remove the small timing sprocket 20/2 and the large timing sprocket with camshaft 20/3.
2. Remove spacing bush from clutch shaft and first gear wheel 20/4 from the transmission shaft.
3. Lift the shift lever spindle 20/5 (10 mm diameter) out of its guide. Twist the gear lever to the left and withdraw it. Take off transmission shaft 20/6 with gear wheels.
4. Raise gear lever spindle for reversing gear 20/7 and also return bolt 20/8 and twist to the right. Lift off shift roller 20/9, watching for the washer.
5. Disconnect gear lever spindle 20/7 for reversing speed from reversing cylinder 20/10. Disengage gear shift fork with return bolt and return roller from the gear shift wheel for the second and fourth. Remove securing washer for return bolt.
6. Take off clutch shaft 20/11 with toothed wheel. Dismantle output shaft by light blows with a rubber hammer; the swing arm must be dismantled.
7. With a screwdriver, force the retaining disc of the spindle 20/12 and remove the drag lever. Between the 2 drag levers is an abutting disc.
8. Heat the right half of the crankcase on a hot plate to about 80 to 90°C (do not use a welding torch or any naked flame) and remove the crank assembly 20/1.
9. Before removing the drag lever spindle, remove the seeger ring on the outside of the right hand half of the crankcase. Heat up the casing and remove the spindle.
10. Using ball bearing extractor (407.201/W 4) 21/1**, and extractor (407.201/W 5) 21/3, extract ball bearings 21/2* and 21/4.

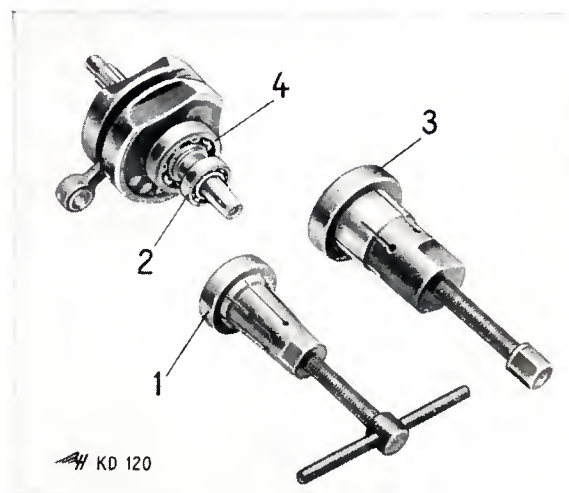
To avoid damaging the crankshaft, use only the necessary special tools.

* Not Type 407 B-1/408 B-1/408 B-2

** Not Type 407 B-1/408 B-1/408 B-2



20



21

Installing the Engine

After dismantling, clean all parts thoroughly and check their condition. Worn or damaged parts must be replaced by "Original HEINKEL Spare Parts" or "Original HEINKEL Exchange Parts." Spare are supplied solely by HEINKEL Depots and not by the Works direct. When ordering, it is essential that the following details be given :

1. Exact address of the Orderer (and railway station, where this is not the same as the actual destination).
2. Method of dispatch (express, freight, post, etc.).
3. Chassis and engine numbers.
4. Exact description of the spares required and drawing numbers concerned.
5. The quantity required.

Please note :

For perfect assembly of the engine, oil all rotating and sliding parts, such as ball bearings, bushes, shafts, simmer rings, pistons, etc.

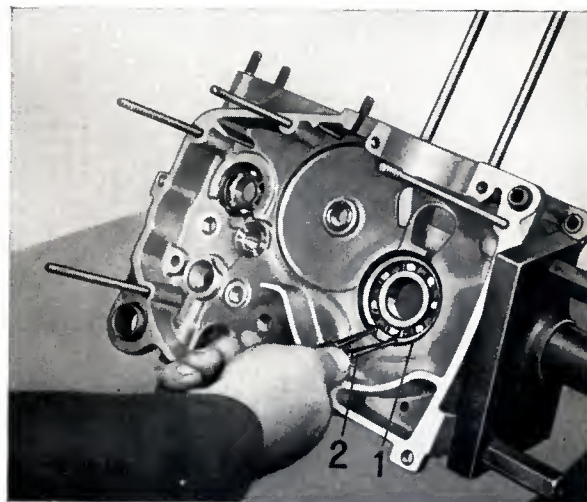
Fitting the Ball Bearings

Before the insertion of ball bearings, heat the left hand half of the housing (clutch side) on a hot plate (do not use a welding torch or any naked flame) to about 80° to 90°C (175 to 195°F). The bearings can be inserted easily and without harming the snug fit. Secure ball bearings 6305 and 6203* with Seeger rings 22/1. These rings are fitted by means of Seeger ring forceps 22/2.

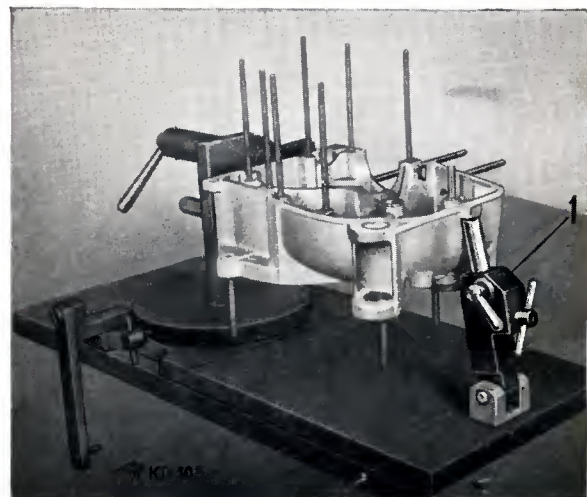
Fitting the Crankshaft

1. Place the right hand crank disc on the channelled plate (recess for the big end) and press ball bearings 6305 and 6004* on to the right hand crankshaft.
2. Heat the right hand half of the crankcase (power take-off side) on a hot plate (do not use a welding burner or any naked flame) to about 80° to 90°C (175 to 195°F). Fix the half crankcase on the flange of the assembly jig, resting it on the support 23/1. Insert the metal strip 24/1 (180 x 25 x 0.3 mm) between the right hand crank disc and the ball bearing 6305 so that during the assembly work the crank arrangement does not rest on the casing.
3. Fit crankcase 20/1 and gear mechanism.
4. Remove metal strip 24/1 so that whilst the left hand half of the casing is being screwed on, the crank assembly can adjust itself to the proper spacing.

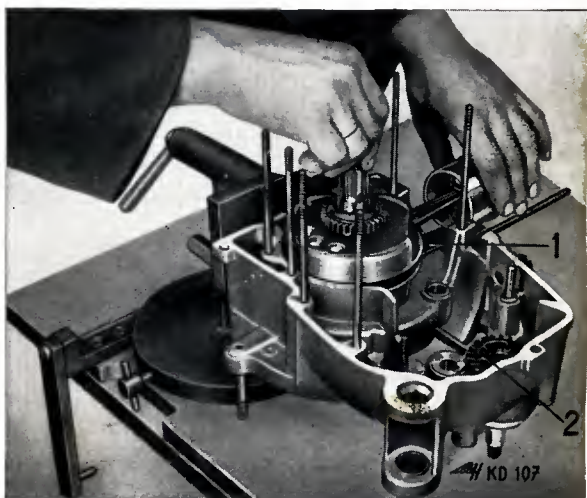
* Not Type 407 B-1/408 B-1/408 B-2



22



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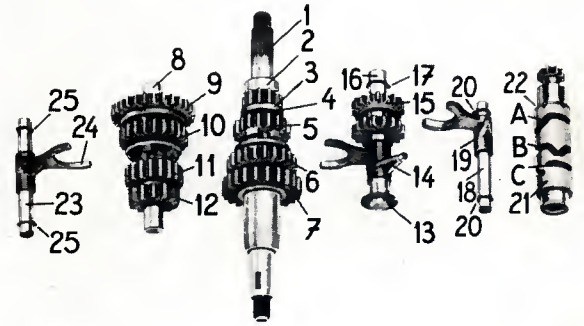


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Assembling the Gears

Clutch Spindle

1. Coat needle bearings (two part) with ball bearing grease and place on clutch spindle 25/1. Push sleeve ring 25/3 with snap ring 25/4 on to 2nd gear wheel 25/5. The strongly gripped inner side of the sleeve ring points towards the toothed part of the 2nd gear wheel.
2. Push the 2nd gear wheel 25/5 as far as it will go over the needle bearing of the clutch spindle. Insert segment disc in the recess in the 2nd gear wheel 25/5. Push sleeve ring 25/3 over segment disc and press snap ring 25/4 into position between sleeve ring 25/3 and the 2nd gear wheel.
3. Fit the indexing wheel 25/6 for 2nd and 4th gears on the clutch spindle in such a way that the figure 4 points towards the output shaft 25/7.
4. Insert the clutch spindle 25/1 into output shaft 25/7 (24/2).



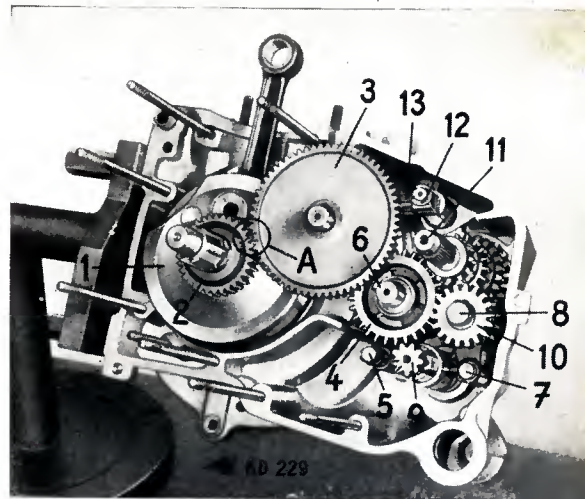
KD 230

25

Transmission Shaft

1. Push the thrust collar as far as it will go over the short shaft section of the transmission shaft 25/8.
2. Fit the 3rd gear wheel 25/11 so that four dogs point towards the large key shaft section of the transmission shaft 25/8.
3. Fit the small gear wheel for the 4th gear 25/12 (with key shaft section). The shoulder is turned to the 3rd gear wheel 25/11.
4. Fit the 1st and 3rd gear index wheel 25/10.
5. Fit the retaining washer 25/13 in such a way that the edge engages in the slot in the casing. Into the 2nd and 4th gear indexing wheel 25/6 place the gear selector fork 25/14 and turn to the right.
6. Fit the reversing wheel 25/15 on reversing pin 25/16, so that the flat-turned end face (18 teeth) points towards the Seeger ring 25/17 and faces the observer. Place reversing pin in gear selector fork 25/14.
7. Fit gear selector fork spindle 25/18 with fork 25/19 for reversing gear and fitted Seeger rings 25/20 into reversing wheel.
8. Place gear shift roller 25/12 into its bush and fit abutting washer 25/22.
9. Insert gear shift fork 25/14 for 2nd and 4th gears into groove A and fork 25/19 for the reversing wheel into groove C of the gear shift cylinder 25/19. Fit both spindles into their journals. When fitting the reversing pin, care should be taken that the machine-cut surface of the bolt corresponds to the recess in the securing washer 25/13.
10. Fit transmission shaft 25/8 into its journals. Place gear selector fork 25/24 with spindle (10 mm diameter) 25/23 and fitted Seeger rings 25/25 into the recess in the 1st and 3rd gear wheel 25/10. Twist the selector fork 25/24 to the right, so that the guide pin engages in groove B of gear shift cylinder 25/21 and fit the spindle into its journals.
11. Fit 1st gear wheel 25/9 on to transmission shaft 25/8, the shoulder pointing to the 1st and 3rd gear wheel 25/10. On to clutch spindle 25/1 fit spacer 25/2.

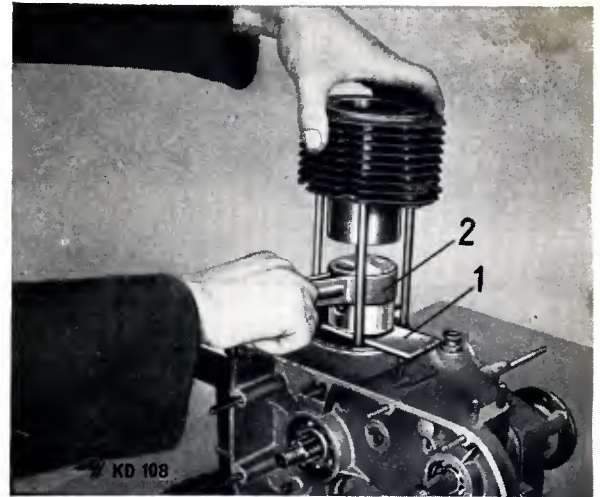
12. Fit drag levers 26/13. Between the 2 levers, place spacer. Afterwards, check the levers for easy movement, seeing that they do not rub against each other.
13. Fit the small timing sprocket 26/2 on the left hand crank disc with the guide groove engaging with the guide pin. Fit large sprocket wheel 26/3 with camshaft. To obtain correct timing adjustment, make sure, when fitting up this part of the assembly, that the marked tooth on the small timing sprocket 26/2 engages in the two marked teeth on the large timing sprocket 26/3 (See Fig. 26/A).
14. Place left hand half of the crankcase in position and secure, as shown in Figs. 9/6 and 16/4.



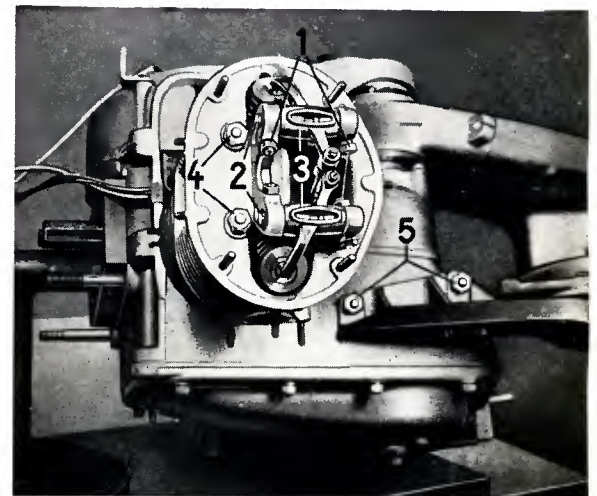
26

Assembling Piston, Cylinder and Cylinder Head

1. Lay the cylinder foot gasket (dry) and the forked retaining piece (401/W 20) 27/1 on the crankcase.
2. Fit the wire snap ring for the gudgeon pin in the piston. Heat the piston on a hot plate (to approximately 175°/195°F) and place in position. Insert the gudgeon pin quickly in the piston and push the compression ring as far as the wire snap ring, holding the piston tightly with the left hand. (Cover the crankcase with a cleaning rag).
3. Fit wire snap ring. Make sure, by twisting them, that the snap rings are properly seated.
4. Oil the working surfaces of the cylinder and also the piston. Twist the piston rings so that the gaps are not all facing in the same direction.
5. **Engine Type 407 B-O/407 B-1**
Using piston ring tightener (407/W 20) 27/2, squeeze the piston rings together, fit the cylinder and lower carefully over the piston. Remove piston ring tightener and forked retaining piece (401/W 20).
- 5a. **Engine Type 408 B-O/408 B-1/408 B-2**
Using piston ring tightener (407/W 20) 27/2, squeeze the piston rings together, fit the cylinder and lower carefully over the piston. Remove piston ring tightener and forked retaining piece (401/W 20). Fit cylinder.
6. Lay on the cylinder head gasket (dry) and place cylinder head in position. Smear washers and stay bolts with safety lacquer. Using the tension wrench, secure cylinder head by alternately tightening diagonally opposite fixing bolts ($2\frac{1}{2}$ to 3 mkg). After tightening nuts 28/4, seal with safety lacquer.
7. Set piston at its top dead centre position. Fit push rods and make sure they are all set to the same height. Fit rockers 28/3 with spacing washers and spindles 28/2. Tighten clamping screw 28/1 for rocker arm spindles. If there is relatively large axial play between rocker arm and bearing blocks, eliminate it by fitting shims, which are inserted opposite the bush rods. These shims are 0.2 mm, 0.3 mm and 0.4 mm thick.
8. Adjust the valves as described on page 26. Place the gasket for the cylinder head cover in position and fix the cover. Fit intake and exhaust manifolds, air baffles and carburettor.



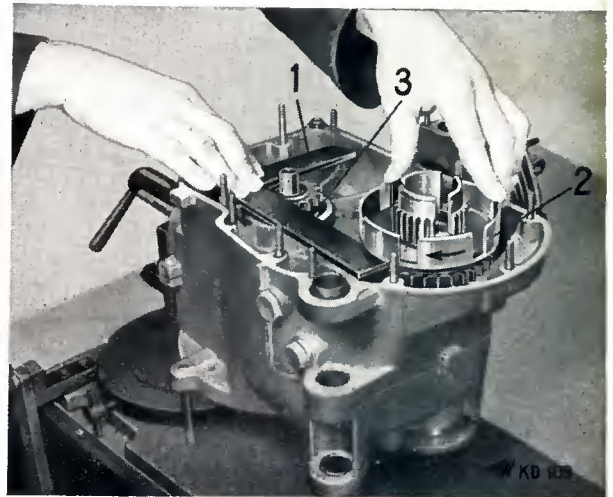
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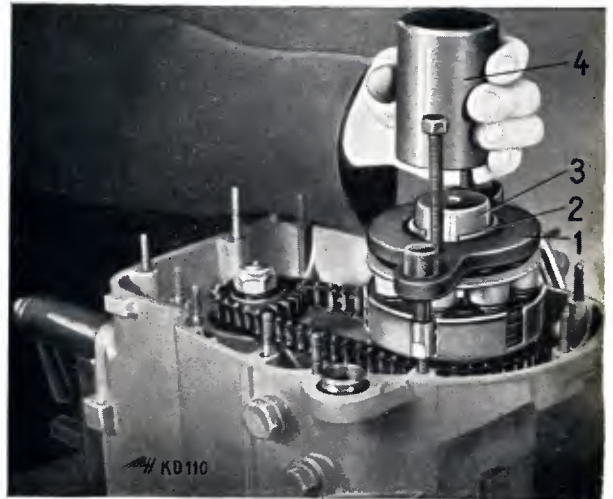
28

Fitting the Clutch

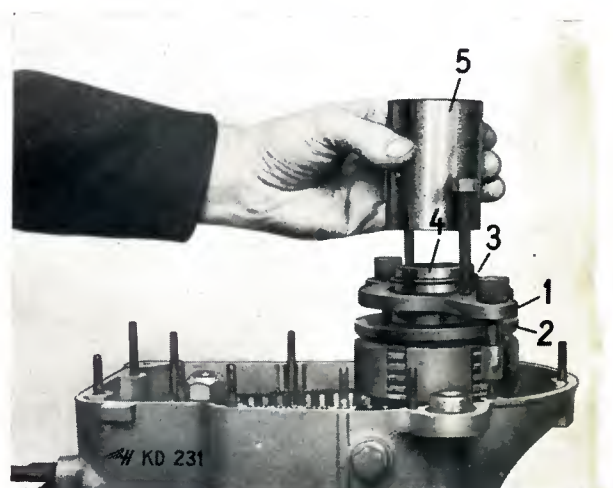
1. Place a spacer on the clutch handle and another on the left hand crank shaft.
2. Place in position the chain wheel, clutch basket 29/2 and the clutch interior. The chain play can be tested with a square 29/1. Any tolerances can be compensated by inserting shims 29/3 between the chain wheel on the left hand crankshaft and the abutting ring. Once the chain play has been correctly adjusted, take off the chain wheel and clutch basket, place the chain on the small chain wheel and the clutch basket chain wheel and reassemble. The shoulder of the chain wheel points towards the ball bearing. Apply the clutch retainer (401/W 18) 11/1, tighten nut (SW 22) with tension spanner 11/2 to 14 mkg and stop nut (SW 24) 11/4 to 12 mkg.
3. **Engine Type 407 B-O/407 B-1**
The sequence of clutch discs is as follows : end disc, retaining ring, outer disc, inner disc, outer disc, inner disc, outer disc, lift off ring with thrust bearing and clutch pin, end disc, spring seat with springs.
- 3a. **Engine Type 408 B-O/408 B-1/408 B-2**
The sequence of the clutch discs is as follows : end disc, retaining disc, outer disc, inner disc, outer disc, inner disc, outer disc, inner disc, outer disc, lift-off ring with thrust bearing and clutch pin, end disc, spring seat with washer.
4. **Engine Type 407 B-O/407 B-1**
Fit the clutch compressor (401/W 25) 30/1 or 9/1 and compress the clutch.
- 4a. **Engine Type 408 B-O/408 B-1/408 B-2**
Fit the clutch compressor (401/W 25) 31/1 in conjunction with pressure ring (408/W 11) 31/2 and compress the clutch.
5. **Engine Type 407 B-O/407 B-1**
To fit the retaining ring 30/2, apply the conical lowered portion of the fitting tool (401/W 21) 30/3, place the retaining ring in position and, by applying a sharp blow to the upper portion 30/4, force the ring into the groove on the clutch interior.
- 5a. **Engine Type 408 B-O/408 B-1/408 B-2**
To fit the retaining ring 31/3, apply the conical lower portion of the fitting tool (408/W 11) 31/4. Place the retaining ring in position and, by applying a sharp blow to the upper portion 31/5, force the ring into the groove on the clutch interior.
6. When fitting the gear shift segment 9/2, take care that the mark 9/5 conforms with the 2 lines on the control roller 9/4.
7. Clean the facing surface of the crankcase, smear it with grease to encourage better adhesion of the gasket for the clutch cover, then fit said gasket.



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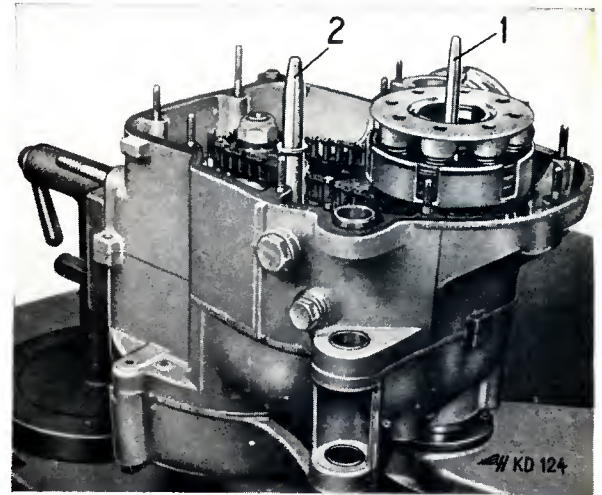


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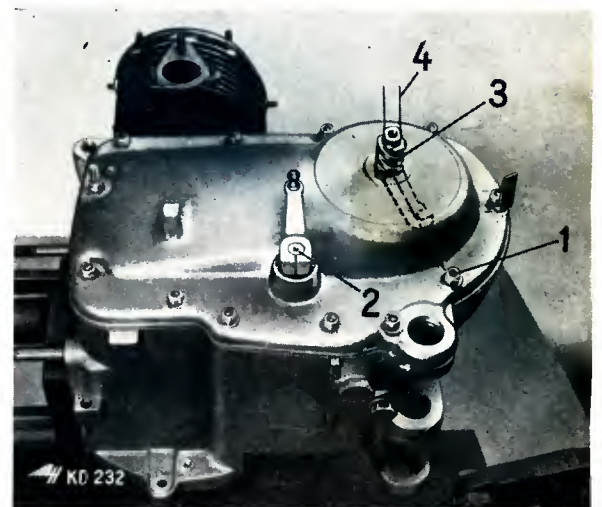


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8. Fit assembly sleeve (407/W 29) 32/1 over the clutch pin and assembly sleeve (407/W 30) 32/2 over the shift segment. Fit clutch cover and air bleed pipe. Tighten nuts 33/1 with no more than 0.75 to 0.80 mkg, or the clutch cover may be damaged. Once this latter has been fitted, there must be a detectable axial gap on the spindle of shift segment 33/2. Fit the rubber washer.
9. Insert the clutch worm 33/3, the surfaces for the clutch lever being vertical 33/4 and the start of the threaded portion of the clutch worm coinciding with the start of the threaded portion of the clutch cover. Screw the clutch pin to the left, turning the worm 33/3 sufficiently far in for the threaded portion of the clutch worm to fall flush with the clutch cover. Secure the clutch lever and connect the traction spring. With this setting, the clutch lever can be slightly moved in the direction of stop nut 33/1.
10. Push the shift lever on to the toothed portion of the shift segment, according to the markings, and secure.



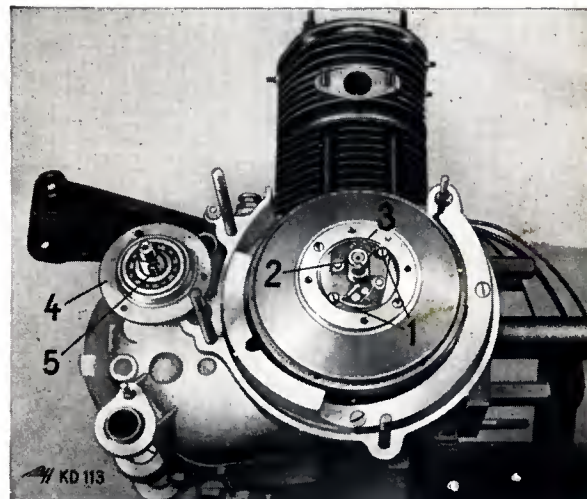
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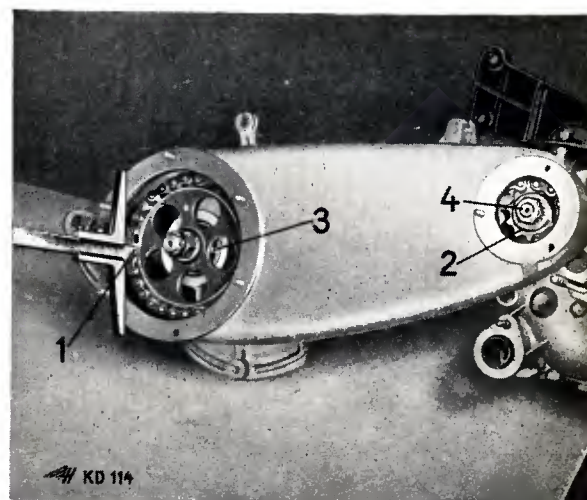
33

Fitting the Swing Arm

1. Into the groove on the rear swing arm journal box, fit the rubber sealing ring with grease and draw bearing sleeve 34/4 with ball bearing on to the output shaft. Insert plate spring 34/5 and place gasket in position.
2. **Engine Type 407 B-O/407 B-1/408 B-2**
Fit chain into swing arm with fitted rear wheel hub. Place the chain on the large chain wheel and the rear axle into the tooth portion of the large chain wheel. Secure the crown nuts, insert the cotter pin. Tap the rear axle into the direction of the brake disc as far as shoulder of the chain wheel. Fit the small chain wheel in the swing arm fitted with the large chain wheel, i.e. to the chain, and place the whole on swing arm bearing sleeve 34/4 and output shaft. Tighten nut (SW 10) 16/5. Using retaining device (401/W 9) 13/1 or retainer (407/W 21), lock the dynamo; put in gear. Tighten nut 35/4 (left hand thread) of the small chain wheel 35/2 with 8 mkg tension and bend over the safety plate.
- 2a. **Engine Type 408 B-O/408 B-1**
Place the rear wheel chain 36/1 in the swing arm and fit rear wheel axle with chain wheel 36/2. Place the chain on the large chain wheel. Fit left hand brake drum 37/2 with retaining washer and tighten crown nut. Fit small chain wheel in the swing arm fitted with the large chain wheel, i.e., into the chain, and place the whole on swing arm bearing sleeve 34/4 and the output shaft. Tighten nut (SW 10) 16/5. Using retaining apparatus (401/W 9) 13/1 or retainer (407/W 21), lock the dynamo; put in gear. Tighten nut 36/3 (left hand thread) for the small chain wheel with 8 mkg tension and bend over the safety plate.
3. **Engine Type 407 B-O/407 B-1/408 B-2**
Using the depth gauge 35/1, measure the chain play in respect of the machine face of the chain wheel, the gauge being applied to the surface of the swing arm cover (without gasket). The small chain wheel (output shaft) is pulled out and the measuring process repeated as for the large chain wheel. Any tolerances found can be compensated by shims 35/3 interposed between chain wheel and ball bearing.

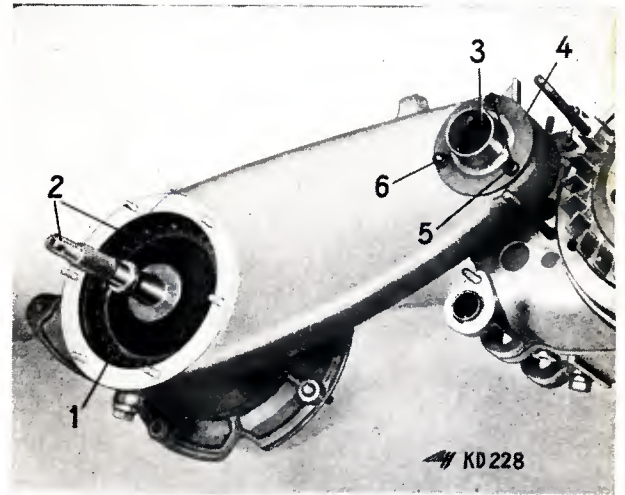


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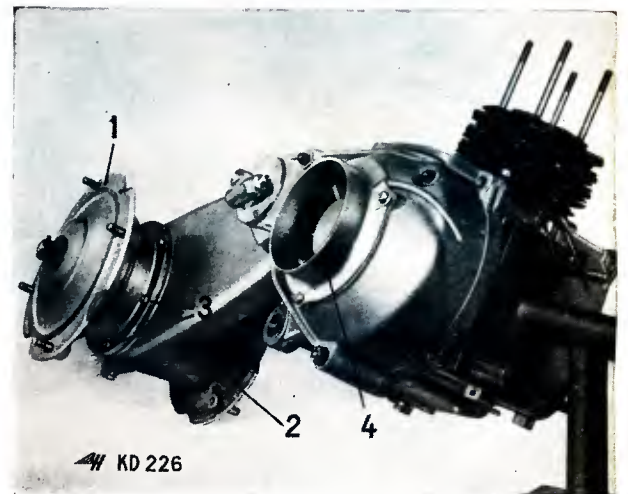


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4. Fit the outer bearing sleeve 36/4 with gasket on the swing arm and secure with 2 screws 36/5 (coat thread with safety lacquer) and 1 nut 36/6.
5. **Engine Type 407 B-O/407 B-1/408 B-2**
Screw crown nut 16/7 on large chain wheel and secure with cotter pin 16/6; only then tighten the crown nut for the brake disc, using 16 mkg tension and secure. Fit rubber cap.
- 5a. **Engine Type 408 B-O/408 B-1**
Place the gasket on the swing arm with grease. Place in position the casing with ball bearing, radial gasket and spacing sleeve. Fix in position with 6 nuts M6 37/3 (spring washers). Place left hand wheel hub 37/2 (without brake ring) on the rear axle. Fit securing washer, tighten crown nut up to 16 mkg tension and secure with cotter pin. Fit rubber cap. The same applies for the right hand wheel hub.



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Assembling the Dynamo

1. Grind the armature with emery paste on to the taper of the crank spindle (cover the ball bearings). After this grinding operation is complete, clean the taper portions.
2. When fitting the magneto system, do not damage the radial gasket.* Fit the magneto portion in position with 3 Allen screws 38/1** (coat thread and facing surfaces with safety lacquer). Insert the collector carbons 38/3 free from grease and tighten up slot-headed screws 38/2.
3. Place plate spring in right hand crank shaft; fit armature and tighten hexagonal-headed screw (with spring washer and plate washer). With light taps (with a rubber hammer) on the armature, tighten the screw 16/3 (10 k) with a tension spanner to 4.0*** mkg tension. Use 6.5 mkg with type 407 B-1/408 B-1/408 B-2.

4. Engine Type 407 B-O

Fit centrifugal governor in groove 39/3 of the armature and secure with slot-headed screws 39/1.

4a. Engine Type 408 B-O/408 B-1

Fit centrifugal governor and fix with slot-headed screws.

5. Engine Type 407 B-O

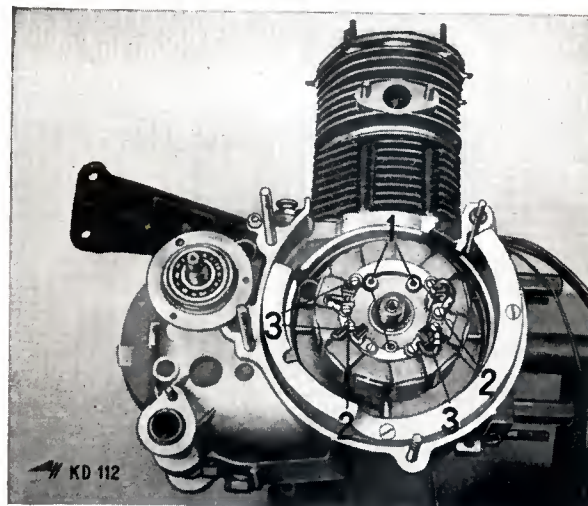
When changing the contact breaker cam, undo washer 39/2 and take off the cam. Care must be taken that the mark "O" on the governor support agrees with the mark "O" on the cam when reassembling. This only applies to type 407 B-O. With types 408 B-O/408 B-1/408 B-2/407 B-1 there are no marks.

6. Secure the spiral with 3 countersunk screws 15/1, place fan wheel and cover plate in position; assemble with 4 fillister head screws 13/2. Use retaining device (401/W 9) 13/1 as a counter holder.
7. Insert the rubber gasket with grease in the swing arm mounting on the fan case. Fit fan case, tightening 3 nuts (5W 14) 40/2 and 2 nuts (5W 10) 40/1, 40/3.
8. Secure gasket, felt holder, felt washer and contact breaker plate with 2 slot-headed screws. Place rubber ring in position and fit cover for contact breaker. Using 3 fillister head screws, fit flange 37/4 for cooling air pipe. Place gasket on fan housing and fit speedometer drive 40/4 with coupling piece.

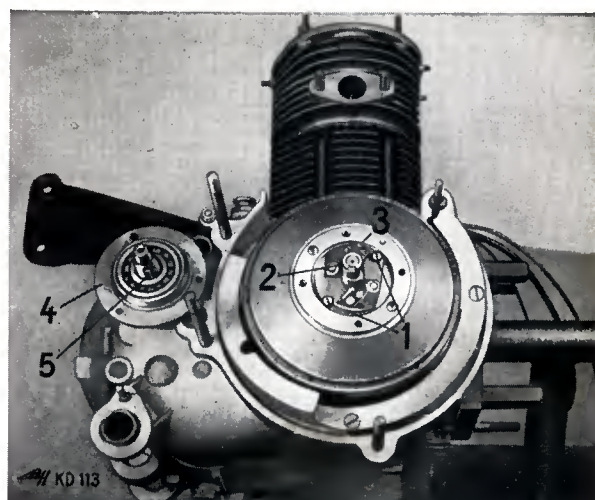
* Only type 407 B-O/408 B-O.

** Only type 407 B-O/408 B-O.

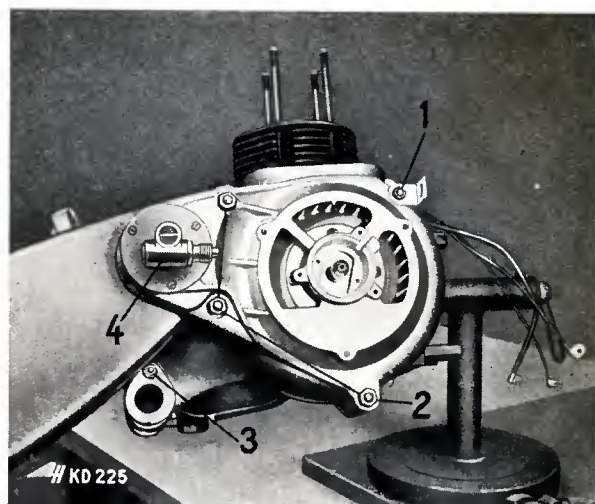
*** Only type 407 B-O/408 B-O (crankshaft 408.202/700 use 5 mkg).



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Cleaning and Testing the Piston

Please note :

When re-using the old piston, clean the ring slots and remove all traces of oil carbon from the piston head. When reassembling, see that the piston is given the same direction of course as before. If fitting a new piston and gudgeon pin, see that the colour markings coincide. The coloured dots are to be found (a) on the inside of the gudgeon pin boss on the piston, and (b) on the end face of the gudgeon pin. When assembling, insert the piston rings in such a way that when they are in position, the maker's trade mark always faces the piston head.

1. To test the piston rings for gap, place one ring 41/1 at a time in the foot of the cylinder and press flat with the stem of the piston. Using a leaf gauge 41/2, measure the gap of each individual piston ring. It may be between 0.25 and 0.40 mm. If the gap is greater than this, test the cylinder with piston.
2. To measure the height play of the piston rings, apply a leaf gauge 42/1 between piston ring and ring groove. The following table shows the individual admissible tolerances for the height play of the piston rings :

Ring Groove	Minimum	Maximum
I	0.060 mm	0.090 mm
II	0.035 mm	0.070 mm
III	0.025 mm	0.060 mm

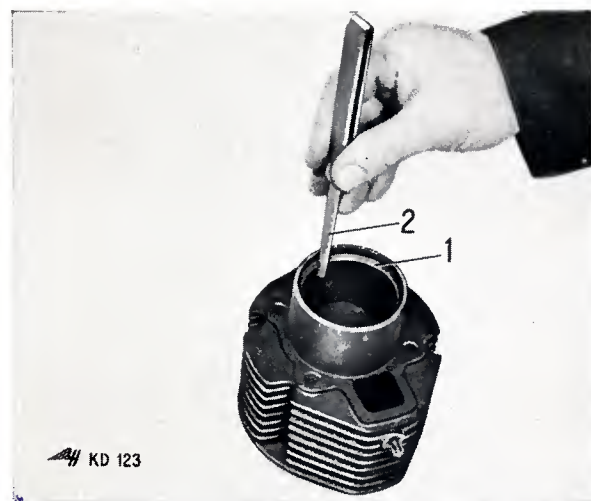
Testing the Cylinder

In order to assess accurately the amount of wear on the cylinder, a cylinder measuring instrument is necessary.

1. Clean cylinder.
Insert cylinder measuring instrument 43/1 in the bore of the cylinder so that the feeler and the guide pin 43/2 slide on the bearing surfaces of the cylinder.
2. Measure the cylinder bearing surface at at least three points : at top dead centre, in the middle and approximately 10 mm from the foot of the cylinder. If the amount of wear is in excess of 0.15 mm as compared with the original size, it is advisable to change both cylinder and piston.
3. The following table gives the installation dimensions, the cylinder unit being set opposite the recess needed for the push rods.

	Group	Cylinder, dia. in mm	Piston, dia. in mm
Engine Type 407 B-O/ 407 B-1	1	60.00—60.01	59.94
	2	60.01—60.02	59.95
	3	60.02—60.03	59.96
	4	60.03—60.04	59.97
Engine Type 408 B-O	1	65.00—65.01	64.94
	2	65.01—65.02	64.95
	3	65.02—65.03	64.96
	4	65.03—65.04	64.97
Engine Type 408 B-1/ 408 B-2	1	64.00—64.01	63.94
	2	64.01—64.02	63.95
	3	64.02—64.03	63.96
	4	64.03—64.04	63.97

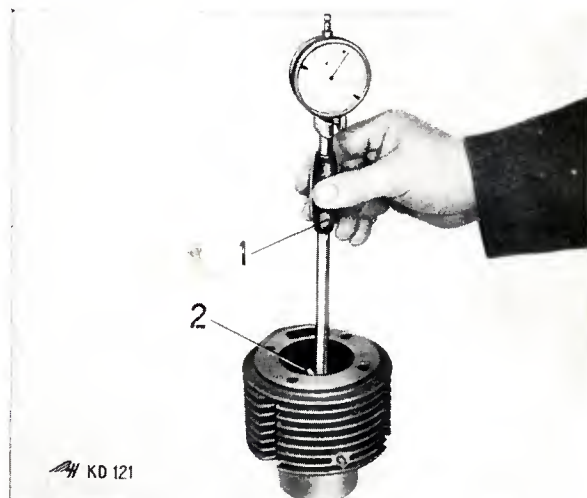
For the oversizes 60.5 and 61 mm in the case of **Engine Type 407 B-O/407 B-1**, or 65.5 and 66 mm in the case of **Engine Type 408 B-O**, and 64.5 and 65 mm in the case of **Engine Type 408 B-1/408 B-2**, the group divisions apply accordingly.



41



42



43

Dismantling and Reassembling the Cylinder Head

1. Place cylinder head in dismantling and retaining device (See Fig. 44); remove clamp halves, spring plate with springs and valves.

2. Clean cylinder head and place in retaining device (See Fig. 45). Secure cylinder head with bolt 45/5. With a brace and cutter tool 45/4, use cutter :

45/2, 29 mm diam., 77.5°, to smooth the channel.

40/3, 32 mm diam., 45°, to cut the valve seating.

40/1, 32 mm diam., 30°, to cut the width of the seating.

Width of valve seating : Inlet valve 1.1—1.2 mm.

Exhaust valve 1.5 mm.

3. Grind the valves with a fine grinding paste. After grinding in, clean valves and cylinder head thoroughly. Touch up the valve seatings and check against photograph.

4. Insert the valves in cylinder head; measure initial spring tension with a depth gauge, taking the measurement from the end face of the valve stem to the tightened bed of the bottom spring retainer on the cylinder head. This measurement should be :

	407 B-O/407 B-1	408 B-O/408 B-1/408 B-2
Inlet valve	31.0 to 31.8 mm	32.0 to 32.8 mm
Exhaust valve	31.5 to 32.3 mm	32.5 to 33.3 mm

These dimensions must be strictly complied with. If there should be any deviation, this must be offset by interposing shims (0.2, 0.5 and 1 mm thickness) between cylinder head and bottom spring retainer.

5. Place cylinder head in assembly arrangement (See Fig. 44) and assemble.

Please note :

In the case of **Engine Type 408 B-O/408 B-1/408 B-2**, the inner and outer valve springs (marked in red) face the lower plate spring with the narrow gap of the windings.

It is recommended that the valve sealing be checked. Pour petrol into the channel concerned and see from the inside of the cylinder head whether or not the valve seatings are tight.

If the valve guides and seating rings are worn out, use an "exchange" cylinder head.

Adjusting the valves

The valves can only be adjusted whilst the engine is cold.

1. Set the piston at top dead centre position. Both valves must be closed. Adjust the valves as shown in Fig. 46.

The valve clearances are :

Inlet valve 46/1 0.15 mm

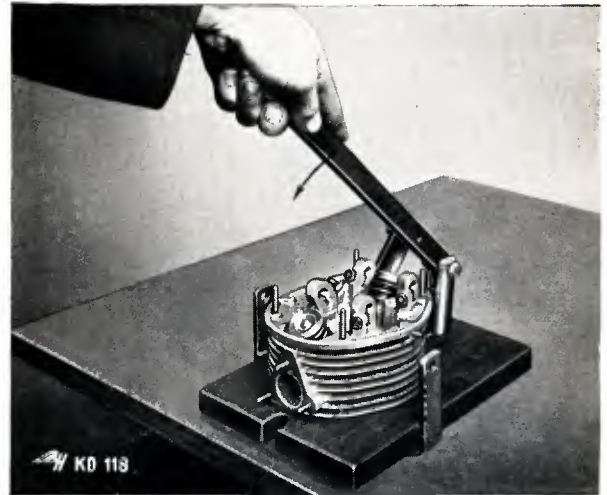
Exhaust valve 46/2 0.20 mm

After adjustment, lock the set screws with nuts.

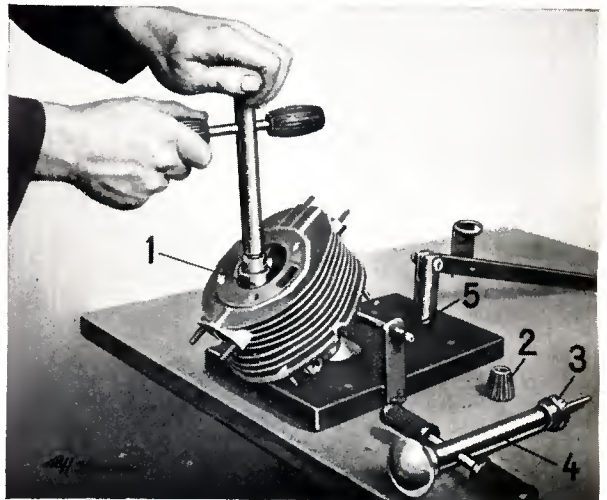
2. With 2 mm valve clearance, measured on a cold engine, the valve timing is as follows :

	407 B-O/407 B-1	408 B-O/408 B-1/408 B-2
Inlet Valve Start at	12°30' after t.d.c.	18°30' after t.d.c.
Inlet Valve End at	32°30' after b.d.c.	22°30' after b.d.c.
Exhaust Valve Start at	27°30' before b.d.c.	17°30' before b.d.c.
Exhaust Valve End at	7°30' before t.d.c.	13°30' before t.d.c.

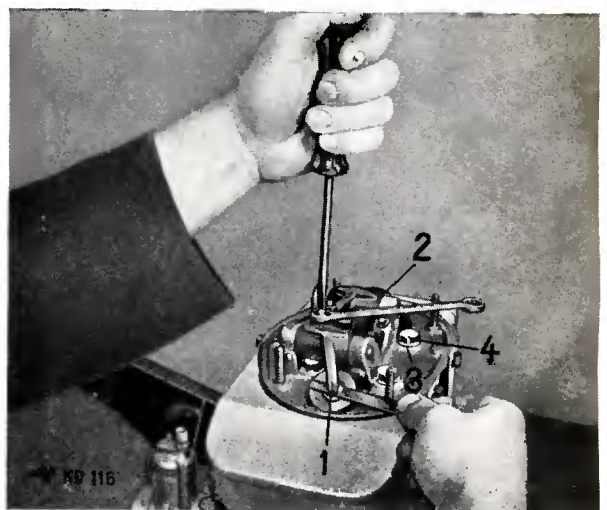
Tolerance : + or - 1°.



44



45



46

Adjusting the Ignition

Please note :

The gap between contact breaker points should be : 0.35—0.45 mm.

The adjustment is made whilst on retarded ignition (centrifugal weights not swung out). It amounts to : —

0.3 to 0.5 mm before t.d.c., measured with timing tool (408/W 10) or 8° to 10° before t.d.c.

Advance ignition takes place with the following setting :

6.5 to 7 mm before t.d.c., or 33° to 35° before t.d.c. automatically, due to centrifugal governor.

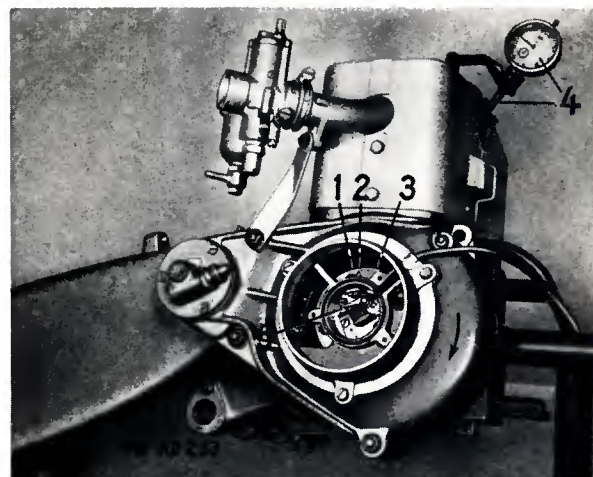
For coarse adjustment purposes, three lines are marked on the fan wheel and an integrally cast arrow is provided on the fan housing.

Mark : 47/1 o.T. = top dead centre
47/2 S.P. = retarded ignition
47/3 F.P. = advanced ignition

Attention. Before screwing in the timing tool (408/W 10), clean the oil carbon from the piston head with a blunt object, because carbon deposits can make measurements inaccurate.

1. Fix timing tool (408/W 10) 47/4 with dial on the cylinder head cover or cylinder head.
2. Set the contact breaker gap 47/5 to 0.4 mm when the contact breaker cam is in its topmost position.
3. Turn the fan wheel right round in the direction of rotation of the engine, marking the top dead centre with the figure "O" on the meter dial (maximum pointer deflection).
4. Turn the fan wheel against rotation of the engine. Switch on the ignition, connect pilot light to terminal 1 of the ignition coil and to earth.
5. Turn the fan wheel in the direction of rotation of the engine. If the ignition is properly set, the pilot light will light up when the position of the piston is 40/100 mm before top dead centre. If this adjustment is not attained, bring the piston into a position 40/100 mm before t.d.c., undo contact breaker plate and turn until the points part.
6. Turning the contact breaker plate against the direction of rotation of the engine gives **advanced** ignition, whilst turning it in the direction of rotation of the engine gives retarded ignition.

Always make sure that the position 40/100 mm before t.d.c. is reached when turning in the direction of rotation of the engine, as otherwise the bearing clearances can cause inaccuracy of measurement.

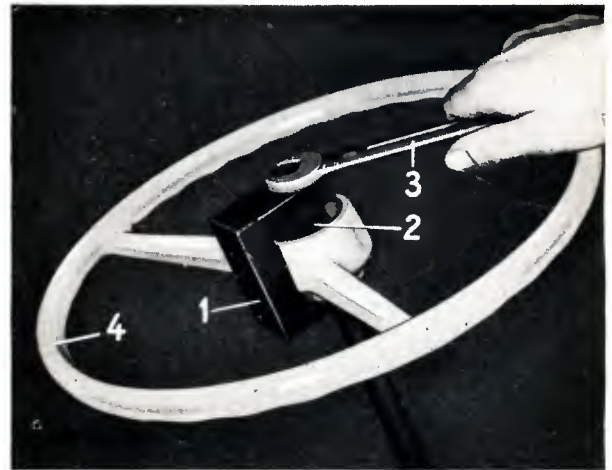


47

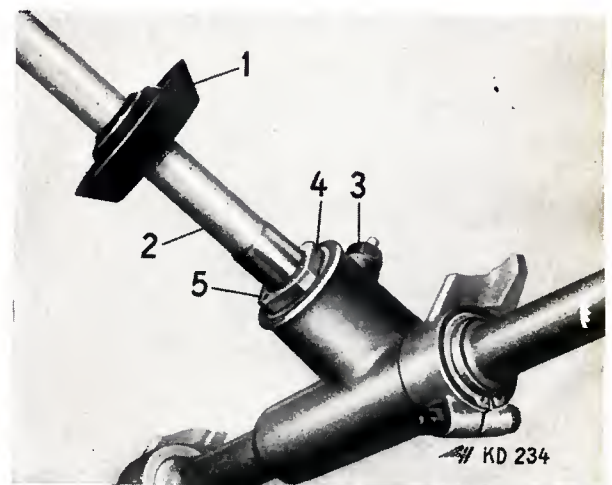
Chassis

Dismantling the Steering

1. Take steering cap off steering wheel. Bend up retainer and unscrew nut (SW 24). Apply extractor (150/W 1) 48/1, using a cushioning piece 48/2. Take off steering wheel 48/4, using spanner (SW 19) 48/3 as a counter holder. Remove plate springs from steering column.
2. Remove cover box and steering guard from floor of coachwork. Disconnect accelerator and clutch control cables and push rod of foot brake lever.
3. Remove rubber plugs on the floor (hidden by rubber mat). Remove cotter pin and crown nut (SW 14) from the steering rod. Remove adjusting bolts from the forked piece through the opening provided for this purpose.
4. Remove 4 cotter pins and 4 nuts (SW 14) from the steering bracket 50/5 and pull the steering wheel out downwards.
5. Take off rubber cap 49/1, remove wire washer from set screw 49/3 and twist out set screw. Dismantle steering column 49/2 with eccentric bush 49/4. (Watch out for shims).
6. Undo 2 fastening strips, take off bellows connection and dismantle rack.



48



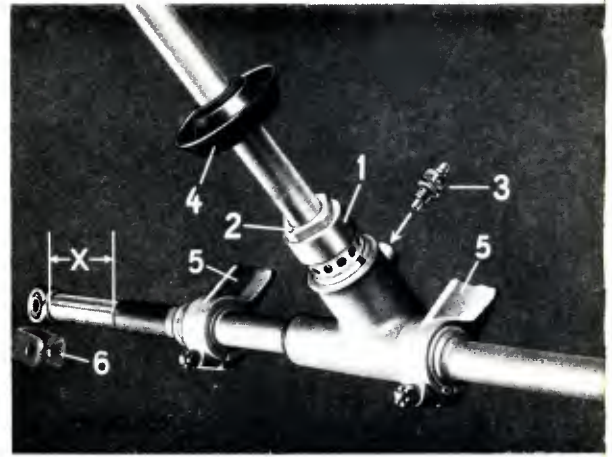
49

Assembling and Adjusting the Steering

1. Place the rack (greased) in the rack guide, until measurement 92 mm + or - 1 mm 50/X is reached.
2. Into the steering housing (centring pin) 1 fix abutting washer and fit steering column with toothed wheel and eccentric bush 50/1. Take care that, when assembling, the Vee slot in the steering column faces the direction of travel and that mark 50/2 (49/5) on the square end faces the rack side.
3. Adjust eccentric bush 50/1 (49/4) with spanner (SW 27). There must be no play between rack and pinion; it must, however, be possible to move the steering assembly towards both sides and to manipulate it without clamps.
4. Screw set screw 50/3 into the steering housing, taking care that the pin engages in a hole in the eccentric bush designed to take it. If there is any axial play between eccentric bush and steering column, then this can be eliminated by washers, placed between the end face of the pinion and the steering housing. The dimensions of these shims are 0.5 mm, 0.8 mm, 1.3 mm, 1.4 mm, 1.5 mm, 1.6 mm and 1.7 mm. Secure the set screw with binding wire and fit rubber cap 50/4.
5. Push the rubber bellows arrangement over the rack and rack guide and secure with binding strips. The air exhaust hole in the bellows points upwards.
6. Fit the steering and assemble. Sequence 4, 3, 2, 1 in "dismantling the steering" (See Page 28).

Please note :

When connecting the steering rod with the rack by means of the adjusting screw, the Vee groove in the steering column must face the direction of travel. If this position is not achieved, then undo the lock nut and shift the fork head 50/6 on the steering rod and tighten the locknut.



50

Adjusting the Toe-in

1. Run the cabin cruiser on to a flat surface. Move the steering wheel until the front wheels are pointing straight forward.
2. Using the track adjuster (150.2001/L 3) 51/1, measure from wheel flange 51/2 to wheel flange 51/2 (in front of axle), then turn both wheels through 180° and measure the gap (behind the axle). The toe-in should be 3-5 mm. If necessary, shift the track rod (right hand side) 52/3, undoing the cotter pin and unscrewing the hexagonal-headed nut (SW 14). Undo lock nut (SW 19) 52/1 from the fork head piece and withdraw the adjuster pin. Move the fork head piece (M 14 x 1.75) 52/2 of the track rod until the toe-in is 3-5 mm. Replace adjuster screw, tighten lock nut and fit cotter pin in crown nut.



51

Removing and Replacing King Pins

1. Take off front wheel and screw pressure grease fitting (SW 9) out of the king pin.
2. Open retainer 53/2 and take off hexagonal-headed screw 53/1.
3. Into the threaded portion for the threaded grease fitting, screw the spindle of the king pin extractor (150.2001/W 2) 53/3 and extract the king pin. To fit same, reverse the procedure.

Please note :

Oil, never grease the king pins, and only lubricate after assembly!

If there are any tolerances between the facing surfaces of the axle head and the end faces of the stub axle, then insert shims 54/1, which are of the following thicknesses :

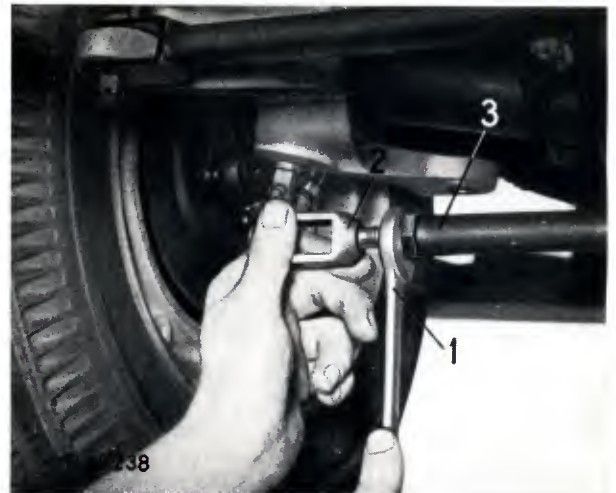
Group 1 :

1.850 mm, 1.875 mm, 1.900 mm, 1.925 mm, 1.950 mm, 1.975 mm,
2.000 mm, 2.025 mm, 2.050 mm, 2.075 mm, 2.100 mm, 2.125 mm,
2.150 mm, 2.175 mm, 2.200 mm, 2.225 mm, 2.250 mm, 2.275 mm,
2.300 mm, 2.325 mm, 2.350 mm, 2.375 mm, 2.400 mm.

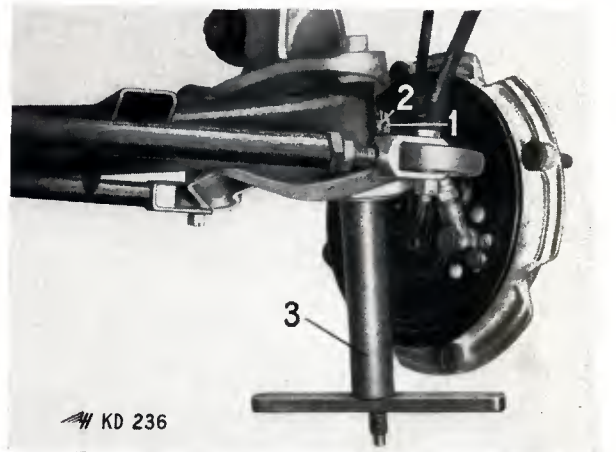
Group 2 :

2.450 mm, 2.475 mm, 2.500 mm.

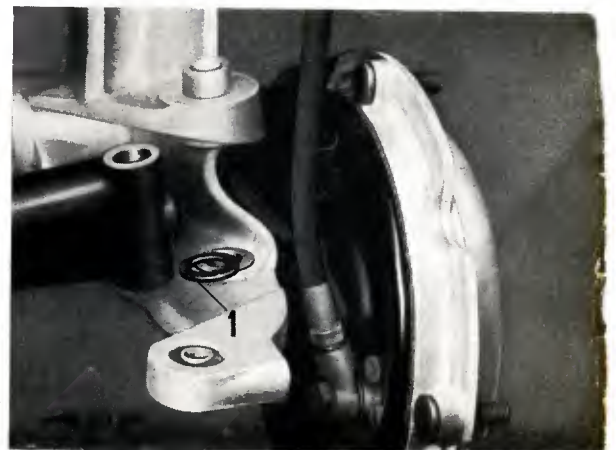
No detectable play should exist between axle head and stub axle.



52



53



54

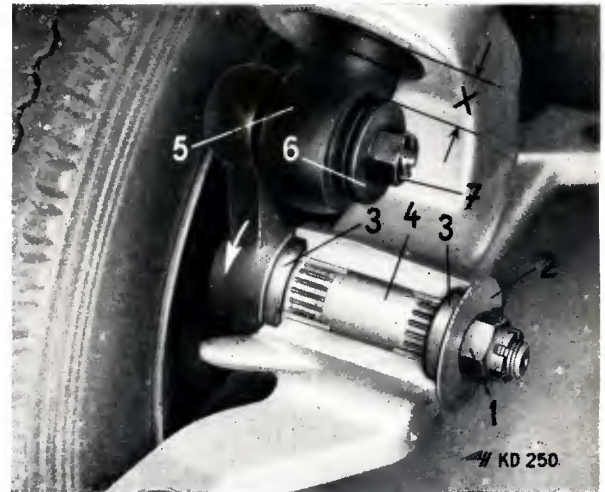
Removing and Replacing the Axle Cranks

Removal :

1. Take off front wheel.
2. Remove 2 cotter pins and crown nut 55/7 (SW 17) and crown nut 55/1 (SW 19). Remove washer 55/6 and ring 55/2.
3. Withdraw the axle crank from stub axle and shock absorber.

Replacement :

1. Push needle bearing 55/4 (grease) on to crank spindle. Fit washer 55/3, insert axle crank in stub axle and shock absorber 55/5. Fit washer 55/3 and ring 55/2, fix axle crank with crown nut and apply cotter pins.
2. If there is any axial play between the axle stub and axle crank, remove this by changing 55/2 or by fitting a thicker ring. The sizes of ring are : 4.0 mm, 4.25 mm, 4.5 mm, 4.75 mm.
3. Move the axle crank in the direction of the arrow and compress shock absorber 55/5 until the measurement 35 mm is achieved between stub axle and crank axle (as shown in Fig. 55/X). Use hardwood wedges 35 mm square.
4. Fit washer 55/6 and secure crown nut 55/7, applying cotter pins (remove hardwood wedges).



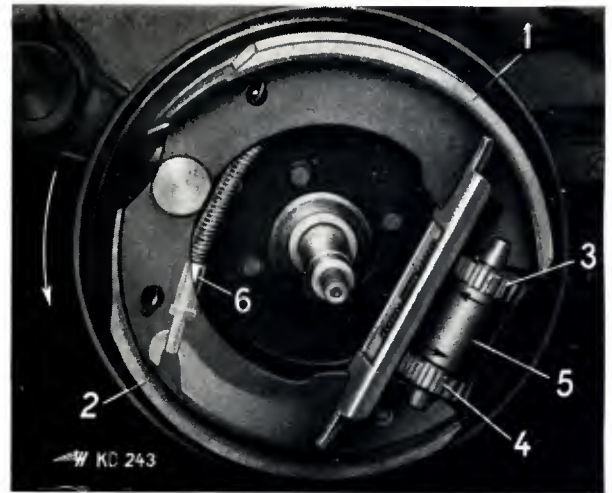
55

Adjusting the Brakes

1. Jack the cabin cruiser up high.
2. Remove the two nylon plugs on the brake anchor plate. Through this opening and using a screw driver, turn the adjuster cap 56/3 on the wheel brake cylinder 56/5 in the direction of the arrow and by this means adjust the approaching brake shoe 56/1 until the wheel hub is difficult to turn. Then twist the adjuster cap 56/3 in the direction opposite to that of the arrow, until the hub can be turned without any sound of grinding. The other brake shoe 56/2 is adjusted accordingly with the adjuster cap 56/4.

Caution :

Adjust the approach brake shoe first, then the other.



56

Exhausting the Air from the Brakes

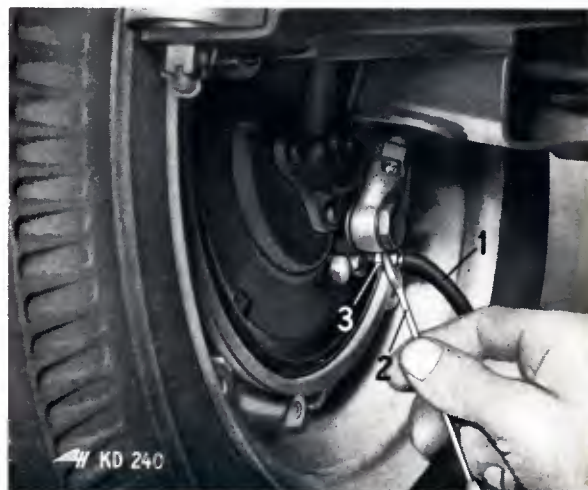
1. Open the screwed plug 57/1 (60/14) of the main brake cylinder. If the level of the liquid is too low, top up with "ATE Blue Original Brake Fluid" 57/2 as far as the first turn of thread on the container 60/2. Replace screwed cap 57/1 (60/14).
2. Take off dust protector cap from air bleed valve (right hand side). Fit air bleed pipe 58/1 (59/2) and drop the end of the pipe into a container 59/3 half filled with brake fluid. The level of liquid must come higher than the end of the pipe.
3. Open the air bleed valve 58/3 (59/1), using spanner (SW 7).
4. Depress brake pedal sharply and release it slowly. Repeat this process until the brake fluid leaves the end of the pipe without showing any bubbles.
5. Close air bleed valve 58/3 (59/1); take off the pipe and replace the dust protector cap. This air bleeding process is carried out in the same way on the other wheel.
6. Check the level of the brake fluid and if need be top up as far as the 1st turn of the thread.

Please note :

Close the air bleed valve only when the brake pedal is fully depressed. During the air bleed process, watch the brake fluid level in the container 60/2. The compensator holes 60/15 must always be covered with fluid. Always filter pumped out fluid before re-using (use a filter paper). Unfiltered brake fluid can contain foreign bodies, which, if they find their way into the system, can lead to failure of the brakes.



57



58



59

Dismantling and Reassembling the Main Brake Cylinder

1. Seal off brake pipe from connecting pipe 60/12 and remove main brake cylinder.
2. Open screwed plugs 60/14 and empty tank 60/2.
3. Clamp main brake cylinder 60/1 (use aluminium shoes and unscrew fork piece 60/9 and nut. Take off rubber cap 60/8.
4. Undo screwed plug 60/3 (watch out for rubber washer) and remove piston 60/4 with piston rod, filling sleeve 60/5 (primary sleeve), plate spring, spring 60/6 and secondary sleeve with plate spring 60/7 from the brake cylinder 60/1.
5. Unscrew hollow screw 60/13 and take off connector 60/12 (gaskets).
6. Undo connecting pipe 60/11. Take off Seeger ring and dismantle bottom valve 60/10.

Reverse the procedure to assemble.

Please note :

All parts of the hydraulic brake should be cleaned with spirit only!

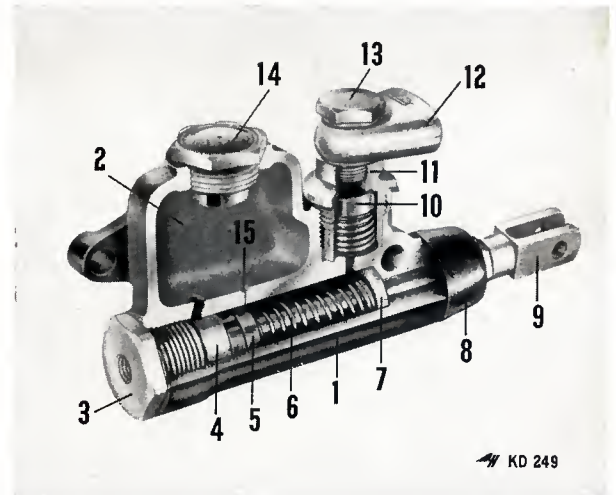
If the parts (such as sleeves and bottom valve) receive even the slightest damage, replace them.

For maintenance and when assembling, only use "ATE Brake Cylinder Paste."

Important !

The hole in the screwed cap 60/14 must always be opened; this also applies to the compensating hole 60/15 (breathing hole) of 0.7 mm diameter. Both holes should be checked with a 0.5 mm diameter wire before final assembly.

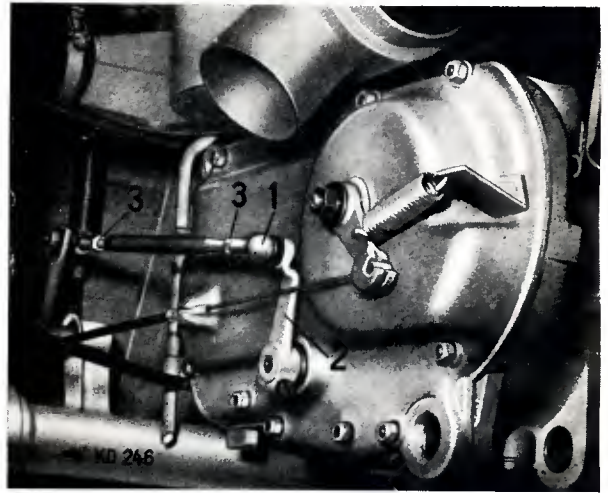
When the brake is not in use, the filling sleeve (primary sleeve) must not cover the compensator arm.



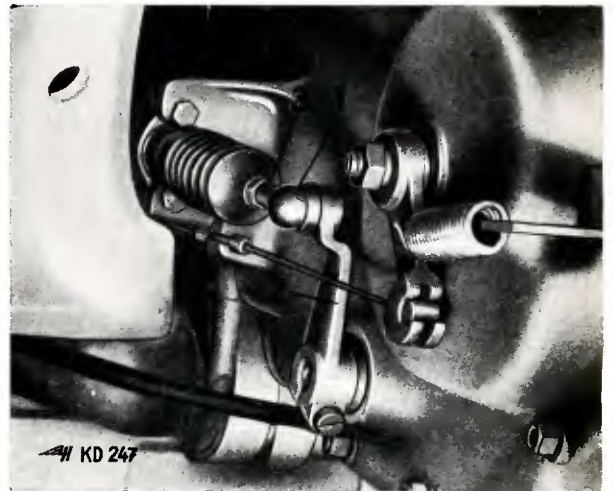
60

Adjusting the Gear Shift Arrangement

1. Set the gear shift lever (inside) to position O. Raise the tail cowl and secure.
2. Remove the safety bracket on the ball socket 61/1 (62/1) and depress the gear selector arrangement (on engine types 408 B-O/408 B-1, also 408 B-2/407 B-1 : flexible ball control) on the gear shift lever 61/2 (62/2).
3. Turn the rear wheel, depressing gear shift lever 61/2 (62/2) and bring it again to the position O. In this position the ball socket 61/1 (62/1) (grease) should come up without the gear shift lever 61/2 (62/2) shifting. If need be, undo lock nut 61/3 (62/3) and adjust the ball socket accordingly.
4. Check the gear shift setting, replace safety clip.



61



62

Fitting Glazing

1. Try the pane for fit. The gap between bodywork and pane must be 3-5 mm all round. If Plexiglass is being used, the necessary gap can, if need be, be made by grinding down or filing the pane (in a longitudinal direction only); where safety glass is used, the metal sheeting of the bodywork must be correspondingly modified.
2. Insert moulded rubber fixing strips 63/1 in the bodywork and wipe the groove to take the pane with sealing cement.
3. Place the pane in the moulded rubber fixing section 63/1, using tool 1/9 for glazing.
4. Apply plastic crack-filler 63/2 through the hole in the tool. Hold tool 63/3 at right angles to the groove (moulded fixing strip), turned through 90° and apply the plastic crack filler in a regular, even movement.

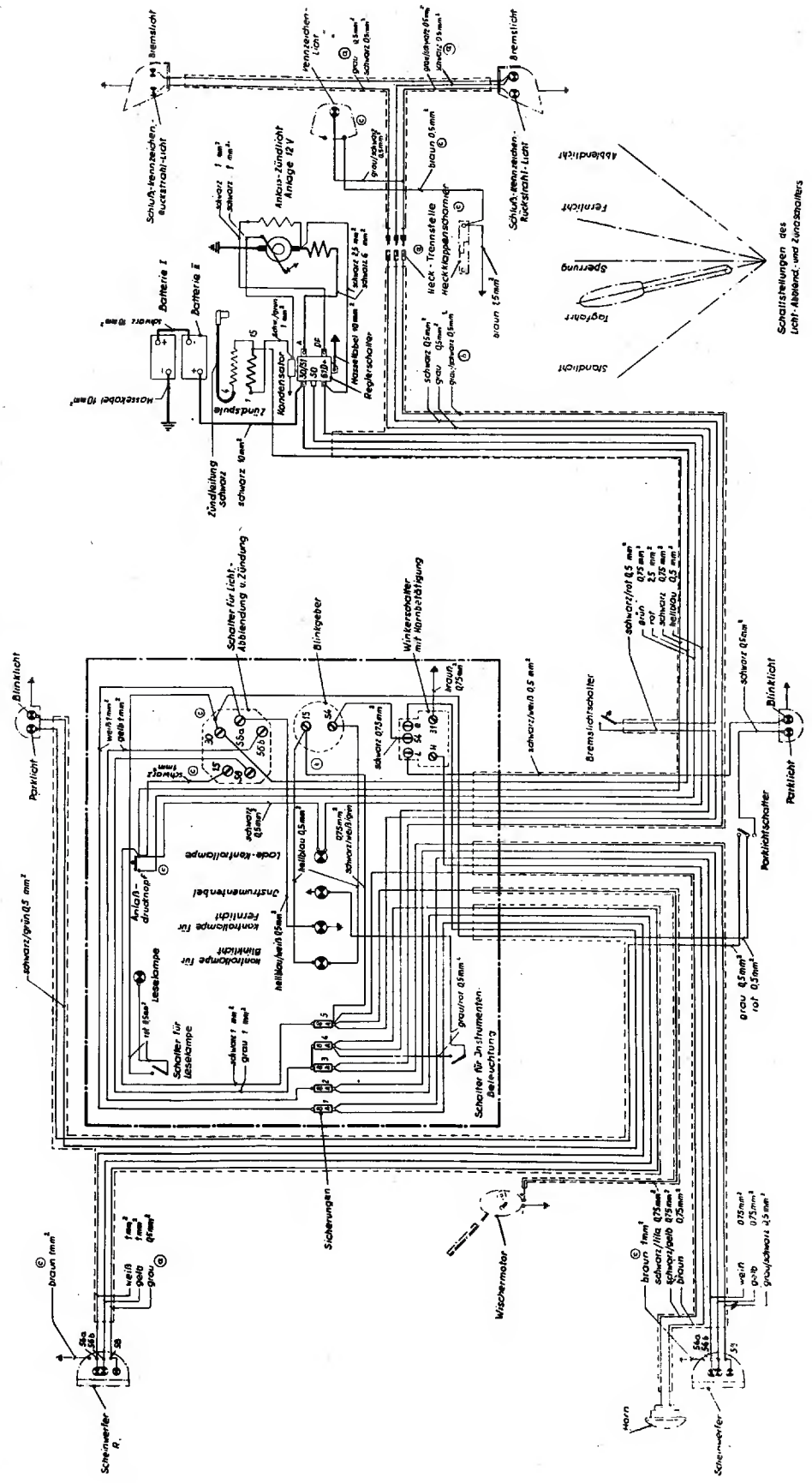
Please note :

At joints, the crack-filler must overlap by about 15 mm. The beginning of the crack-filler is pressed down with a pin at the end of the tool so that the overlapping end of the crack-filler can be inlaid under pressure.



63

WIRING DIAGRAM FOR "HEINKEL-KABINE" TYPE 150



Key to diagram on next page

KEY TO WIRING DIAGRAM FOR "HEINKEL-KABINE" TYPE 150

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Wiring diagram for "HEINKEL-KABINE" Type 150 2. Headlamp, right 3. Brown 1 sq. mm 4. White 1 sq. mm, yellow 1 sq. mm, grey 0.5 sq. mm 5. Black/green 0.5 sq. mm 6. Parking light 7. Blinker light 8. White, 1 sq. mm
Yellow, 1 sq. mm 9. Red, 0.5 sq. mm 9a. Switch for reading lamp 10. Reading lamp 11. Starter button 12. Black, 1 sq. mm 13. Grey, 1 sq. mm 14. Fuses 15. Windscreen wiper motor 16. Horn 17. Headlamp, left 18. Brown, 1 sq. mm
Black/lilac, 0.75 sq. mm
Black/yellow, 0.75 sq. mm
brown, 0.75 sq. mm 19. White, 0.25 sq. mm
Yellow 0.25 sq. mm
Grey/black, 0.5 sq. mm 20. Grey, 0.5 sq. mm
Red, 0.5 sq. mm 21. Switch for dashboard light 22. Sky-blue/white, 0.5 sq. mm 23. Telltale light for blinker light 24. Telltale light for headlamp 24a. Instrument lever 25. Charging pilot light 26. Black, 0.5 sq. mm 27. Sky-blue, 0.5 sq. mm 28. 0.75 sq. mm black/white/grey 29. Black, 0.75 sq. mm 30. Blinker 31. Black, 1 sq. mm 32. Switch for dipper light and ignition 33. Trafficator switch and horn control 34. Black/white, 0.5 sq. mm | <ol style="list-style-type: none"> 35. Braking light switch 36. Black/red, 0.5 sq. mm
Green, 0.25 sq. mm
Red, 2.5 sq. mm
Black, 0.75 sq. mm
Sky-blue, 0.5 sq. mm 37. Parking light switch 38. Parking light 39. Blinker light 40. Brown, 0.75 sq. mm 41. Earthing lead, 10 sq. mm 42. Battery I
Battery II 43. Braking, rear and licence plate light 44. Braking light 45. Ignition lead, black 46. Black, 10 sq. mm 47. Ignition coil 48. Black/green, 1 sq. mm 49. Condenser 50. Governor switch 51. Black, 2.5 sq. mm
Black, 6 sq. mm 52. 12 volt starter magneto unit 53. Black, 1 sq. mm
Black, 1 sq. mm 54. Registration plate light 55. Grey, 0.5 sq. mm
Black, 0.5 sq. mm 56. Grey/black, 0.5 sq. mm
black, 0.5 sq. mm 57. Tail break
Tail cowl hinge 58. Black, 0.5 sq. mm
Grey, 0.75 sq. mm
Grey/black, 0.5 sq. mm 59. Brown, 1.5 sq. mm 60. Parking light 61. Daytime travel 62. Isolate 63. Headlight 64. Dipper light 65. Switch positions on the light, dipper and ignition switch 66. Brown, 0.5 sq. mm 67. Grey/black, 0.5 sq. mm |
|--|--|

KEY TO WIRING DIAGRAM FOR "HEINKEL-KABINE" TYPE 153/154

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Wiring diagram for "HEINKEL-KABINE" Type 154 2. Headlamp, right 3. Brown, 1 sq. mm 4. White, 1 sq. mm, yellow 1 sq. mm, grey 0.5 sq. mm 5. Black/green, 0.5 sq. mm 6. Parking light 7. Blinker light 8. White, 1 sq. mm 9. Red, 0.5 sq. mm 9a. Switch for reading lamp 10. Reading lamp 11. Starter button 12. Black, 1 sq. mm 13. Grey, 1 sq. mm 14. Fuses 15. Windscreen wiper motor 16. Horn 17. Headlamp, left 18. Brown, 1 sq. mm
Lilac, 0.75 sq. mm
Black/yellow, 0.75 sq. mm
Brown, 0.75 sq. mm 19. White, 0.25 sq. mm
Yellow 0.25 sq. mm
Grey/black, 0.5 sq. mm 20. Grey, 0.5 sq. mm
Red, 0.5 sq. mm 21. Switch for dashboard light 22. Sky-blue/white, 0.5 sq. mm 23. Telltale light for blinker light 24. Telltale light for headlamp 25. Charging pilot light 26. Black, 0.5 sq. mm 27. Sky-blue, 0.5 sq. mm 28. 0.75 sq. mm black/white/grey 29. Black, 0.75 sq. mm 30. Blinker 31. Black, 1 sq. mm 32. Switch for dipper light and ignition 33. Trafficator switch and horn control | <ol style="list-style-type: none"> 34. Black/white, 0.5 sq. mm 35. Braking light switch 36. Black/red, 0.5 sq. mm
Green, 0.25 sq. mm
Red, 2.5 sq. mm
Black, 0.75 sq. mm
Sky-blue, 0.5 sq. mm 37. Parking light switch 38. Parking light 39. Blinker light 40. Brown, 0.75 sq. mm 41. Earthing lead, 10 sq. mm 42. Battery 43. Tail light 44. Braking light 45. Ignition lead, black 46. Black, 10 sq. mm 47. Ignition coil 48. Black/green, 1 sq. mm 49. Condenser 50. Governor switch 51. Black, 2.5 sq. mm
Black, 6 sq. mm 52. 12 volt starter magneto unit 53. Black, 1 sq. mm
Black, 1 sq. mm 54. Registration plate light 55. Grey, 0.75 sq. mm
Black, 0.5 sq. mm 56. Grey/black, 0.5 sq. mm
black, 0.5 sq. mm 57. Tail break
• Tail cowl hinge 58. Black, 0.5 sq. mm
Grey, 0.75 sq. mm
Grey/black, 0.5 sq. mm 59. Brown, 1.5 sq. mm 60. Parking light 61. Daytime travel 62. Isolate 63. Headlight 64. Dipper light 65. Switch positions on the light, dipper and ignition switch |
|--|---|

Assembly No.	Operation	Time Reqd. for Actual Operation (hrs.)	Additional Jobs Necessary	Total Time (hrs.)
	Chassis			
F 1	Change the bodywork	ca. 45.00	—	ca. 45.00
F 2	Seal off body floor	0.50	—	0.50
F 3	Fit new bitumenised felt	1.00	—	1.00
F 4	Change doors	1.00	F 5, F 6, F 7, F 8, E 5	3.00
F 5	Change door lock	0.50	—	0.50
F 6	Remove and fit fork and eyebolts	0.50	—	0.50
F 7	Change telescopic legs	0.25	—	0.25
F 8	Change front window	0.50	—	0.50
F 9	Fit new tail cowl	0.25	F 10, F 14	1.25
F 10	Change hinge	0.25	F 21	1.00
F 11	Remove hinged roof and fit new one	0.50	—	0.50
F 12	Change moulded rubber strip for hinged roof	0.50	F 11	1.00
F 13	Remove old and fit new front bumper	1.00	—	1.00
F 14	Remove old and fit new rear bumper	0.75	—	0.75
F 15	Remove old and fit new side window (large)	0.50	—	0.50
F 16	Remove old and fit new side window (small)	0.50	—	0.50
F 17	Remove old and fit new rear window pane	0.50	—	0.50
F 18	Change swivel window pane	0.50	—	0.50
F 19	Change swivel window frame	0.50	—	0.50
F 20	Remove old and fit new moulded rubber strip	0.50	—	0.50
F 21	Remove old and fit new fuel tank	0.75	—	0.75
F 22	Remove old and fit new inner covering	0.50	—	0.50
F 23	Change decorative strips	0.25	—	0.25
F 24	Remove and replace front wheel suspension	0.50	F 25, F 26, F 27	2.50
F 25	Remove and fit axle crank	0.75	—	0.75
F 26	Remove and fit stub axle	0.75	F 25	1.50
F 27	Change king pins	0.50	—	0.50
F 28	Change sprung leg (front)	0.50	F 25, F 26	2.00
F 29	Change sprung leg (rear)	0.50	—	0.50
F 30	Change front wheel springs	0.50	F 25, F 26	2.00
F 31	Remove and refit cooling pipe	1.00	—	1.00
F 32	Fit heating unit	2.50	—	2.50
F 33	Lubricate vehicle	0.50	—	0.50
	Controls			
B 1	Remove and fit steering	1.50	—	1.50
B 2	Change bellows connection	0.50	—	0.50
B 3	Dismantle steering and reassemble	0.50	—	0.50
B 4	Adjust steering	0.25	—	0.25
B 5	Adjust toe-in	0.50	—	0.50
B 6	Remove and replace pedals	1.50	—	1.50
B 7	Change throttle and control cable	0.25	B 13	0.50
B 8	Change clutch control cable	0.25	B 14	0.50
B 9	Change gear shift control cable	0.50	B 15	0.75
B 10	Change gear selector arrangement	0.25	B 15	0.50
B 11	Change intermediate shaft	0.50	B 15	0.75
B 12	Change hand brake control cable	0.25	R 8	0.50
B 13	Adjust throttle control	0.25	—	0.25
B 14	Adjust clutch	0.25	—	0.25
B 15	Adjust gear shift	0.25	—	0.25
	Wheels and Brakes			
R 1	Change tyres	0.25	—	0.25
R 2	Change front wheel mounting	0.50	—	0.50
R 3	Change rear wheel protector plate	0.50	—	0.50
R 4	Change front wheel brake shoes	0.25	R 6, R 7	0.75
R 5	Change rear wheel brake shoes	0.50	R 8	0.75
R 6	Adjust front wheel brake	0.25	—	0.25
R 7	Remove air from front wheel brake	0.25	—	0.25
R 8	Adjust rear wheel brake	0.25	—	0.25

Assembly No.	Operation	Time Reqd. for Actual Operation (hrs.)	Additional Jobs Necessary	Total Time (hrs.)
R 9	Remove and fit main brake cylinder	0.50	R 7	0.75
R 10	Dismantle and assemble main brake cylinder	0.75	—	0.75
R 11	Remove and fit wheel brake cylinder	0.25	R 4, R 7	0.75
R 12	Dismantle and fit wheel brake cylinder	0.25	—	0.25
R 13	Remove and fit brake pipe	0.25	R 7	0.50
R 14	Remove and fit brake lead	0.25	R 7	0.50
R 15	Remove and fit braking light switch	0.25	R 7	0.50
Electrical Installation				
E 1	Remove and fit battery	0.25	—	0.25
E 2	Remove and fit ignition switch	0.50	E 1	0.75
E 3	Remove and fit dipper switch	0.25	—	0.25
E 4	Change dipper signal	0.25	—	0.25
E 5	Remove and fit windscreen wiper	0.25	—	0.25
E 6	Change head lamp insert	0.50	—	0.50
E 7	Adjust head lamps	0.25	—	0.25
E 8	Remove and fit braking light	0.25	—	0.25
E 9	Remove and fit registration plate light	0.25	—	0.25
E 10	Change horn	0.25	—	0.25
E 11	Change governor	0.50	—	0.50
E 12	Change condenser	0.25	E 11	0.75
E 13	Remove and fit ignition coil	0.50	—	0.50
E 14	Remove and fit bundle of cables	1.50	F 21, R 15, E 1, E 5, E 6 E 10, E 11	4.25
E 15	Remove and fit speedometer and clock	0.25	—	0.25
E 16	Fit radio	3.50	—	3.50

Guide Times for Repair Work

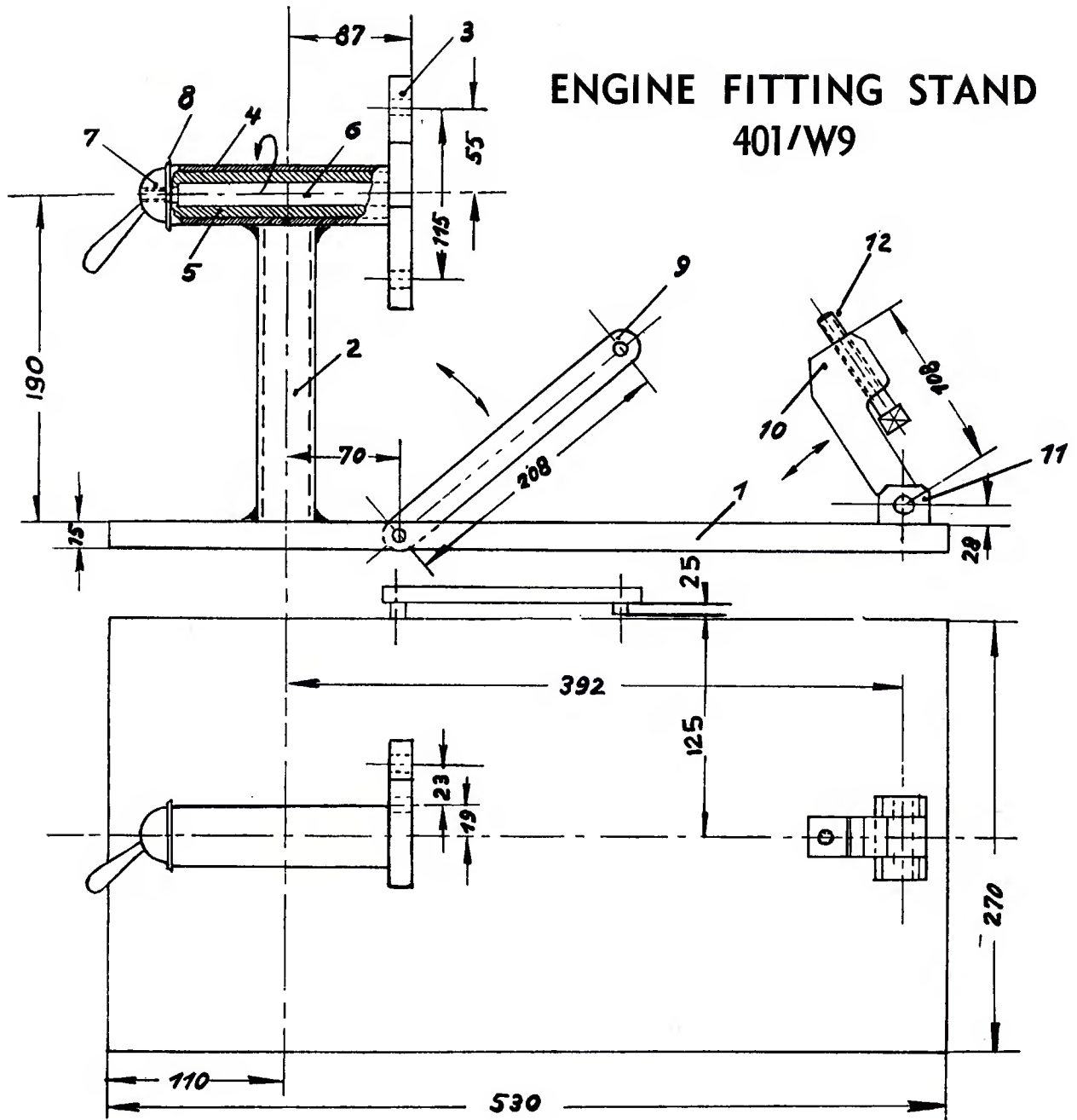
The guide times apply when the special tools (Fig. 1, Page 7) are used and are expressed in hours and decimal parts of hours :

e.g. 0.25 hrs. = $\frac{1}{4}$ hour
 0.50 hrs. = $\frac{1}{2}$ hour
 0.75 hrs. = $\frac{3}{4}$ hour
 1.00 hrs. = 1 hour

The amount of labour required for any cleaning is **not** included.

Assembly No.	Operation	Time Req'd. for Actual Operation (hrs.)	Additional Jobs Necessary	Total Time (hrs.)
Engine				
M 1	Remove and fit engine, trial run	2.25	—	2.25
M 2	Strip down and reassemble engine (with adjustments)	8.50	M 1	10.75
M 3	Test and, if necessary, change cylinder head	TYPE 150	M 5	1.75
		TYPE 154		2.25
M 4	Cut valve seatings; grind valves	TYPE 150	M 3, M 5	3.00
		TYPE 154		3.50
M 5	Adjust valves	0.25	—	0.25
M 6	Remove and fit cylinder and piston	TYPE 150	M 3, M 5	2.50
		TYPE 154		3.00
M 7	Remove and fit gudgeon pin bushing	TYPE 150	M 3, M 5, M 6	3.25
		TYPE 154		3.75
		TYPE 150		3.00
M 8	Seal cylinder head and cylinder	0.50	M 3, M 5, M 6	3.50
M 9	Remove and fit crank assembly and bearings	1.00	M 1, M 5, M 6, K 1, Z 1, Z 2	6.50
M 10	Attend to and, if necessary, change camshaft, timing sprockets and drag arm	1.00	M 1, M 5, M 6, K 1	5.50
M 11	Remove and fit gear mechanism	1.25	M 1, M 5, M 6, K 1, Z 2, S 1	7.00
M 12	Seal crankcase	1.25	M 1, M 5, M 6, K 1	5.25
M 13	Oil change and flush out	0.50	—	0.50
Clutch				
K 1	Remove and fit clutch	TYPE 150	B 14	1.50
		TYPE 154	M 1, B 14	3.75
		TYPE 150	K 1, B 14	2.00
K 2	Change chain and chain wheels	TYPE 154	M 1, K 1, B 14	4.25
		TYPE 150	B 14	1.00
K 3	Seal clutch cover plate	0.75	M 1, B 14	3.25
Ignition and Lighting Installation				
Z 1	Remove, fit, or possibly change dynamo	0.75	Z 2, F 31	2.00
Z 2	Adjust ignition timing	0.25	F 31	1.25
Z 3	Remove and fit contact breaker points; adjust same	1.25	—	1.25
Z 4	Change carbons, check collector	0.25	Z 1, Z 2, F 31	2.25
Z 5	Seal dynamo	0.25	Z 1, Z 2, F 31	2.25
Carburettor				
V 1	Remove, clean, adjust and replace carburettor	0.50	—	0.50
Swing Arm				
S 1	Remove and replace swing arm	1.00	Z 2, F 31	2.25
S 2	Change chain and chain wheels (sidecar transmission)	0.50	Z 2, S 1, F 31	2.75
		TYPE 150	Z 2, S 1, F 31	2.50
S 3	Change driving shaft and mounting	1.25	Z 2, S 1, F 31	3.50
S 4	Seal swing arm (radial gasket)	1.25	—	1.25
S 5	Change oil	0.25	—	0.25

ENGINE FITTING STAND 401/W9



Part	Name
1	Base plate
2	Tubular upright
3	Fixing plate
4	Tube
5	Shank
6	Bolt
7	Ball handle M 12
8	Washer
9	Retaining arm
10	Guide piece
11	Block
12	Bolt M 14

All dimensions given on the drawing are millimetres

