PUCH

MOFA
MOPED
MOKICK
SMALL MOTOR CYCLE

REPAIR MANUAL

1st Edition

Foreword

This repair manual is a guide to enable service workshops and service engineers to carry out all maintenance and overhaul jobs correctly and efficiently.

Please ensure that the manual and all subsequent supplements are kept within easy reach of all workshop personnel.

Correct servicing requires the proper equipment including all special workshop tools as detailed in our lists of special tools. And, of course, we are always pleased to receive your suggestions for improvements and modifications.

We sincereley hope that this manual will prove of invaluable assistance both for the workshop and customer alike.

STEYR-DAIMLER-PUCH AG
Graz Works
Service Department

Introduction

Although it is impossible to differentiate between individual models because of the many types available, we have arranged the material in groups for ease of reference. A detailed description of the basic design is given at the beginning of every main group.

Colour strips identify main groups for easy identification and sub-groups are denoted by letters in alphabetical order printed at the top of each page. Furthermore, every page of a sub-group is numbered and carries a short heading to assist in finding a particular job.

The descriptions left, right, front or rear are invariably based on the operational direction of the machine, as they would appear to a rider seated normally.

Supplements will be issued as and when necessary to keep the manual up to date.

Full use of the manual cannot be made without the service bulletins, issued from time to time, which give the latest information on design modifications and improvements and quote additional repair hints.

Methods regarded as standard practice by trained engineers are not detailed in the manual.

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Engine

Frame

Electrical Equipment

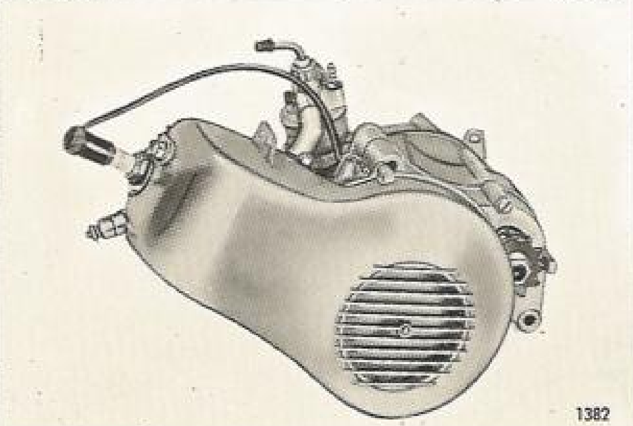
Various

ENGINE

Contents

X 30-ENGINE

50 cc | 0.8 to 1.5 hp | Twoo-speed gear box



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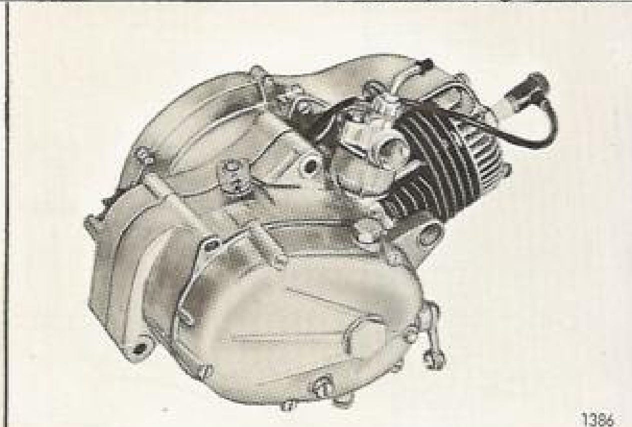

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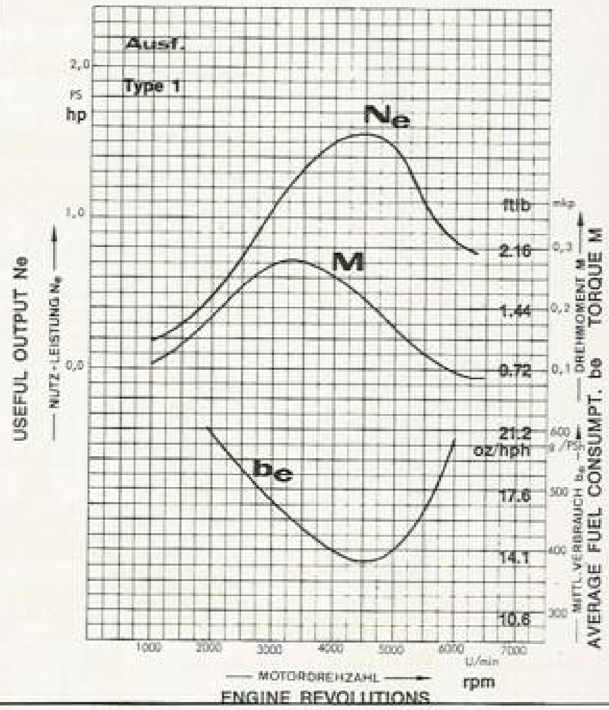
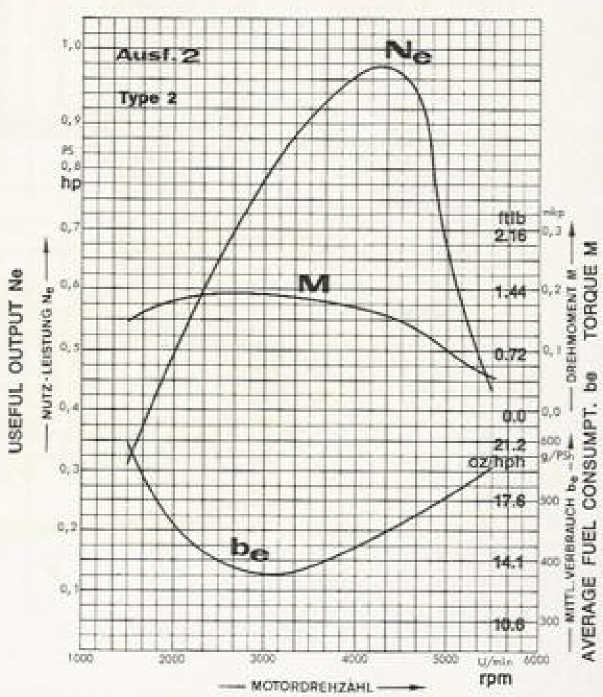
ENGINE

Maximum output	
Type 1:	1.5 hp at 4600 rpm
Type 2:	0.97 hp at 4250 rpm
Type 3:	0.8 hp at 3700 rpm
Maximum torque	
Type 1:	1.95 ftlb (0.27 mkp) at 3700 rpm
Type 2:	1.35 ftlb (0.187 mkp) at 2700 rpm
Type 3:	1.56 ftlb (0.215 mkp) at 2000 rpm
Compression ratio	
Type 1:	10.5 : 1
Type 2:	10.5 : 1
Type 3:	10.5 : 1
Number of cylinders	One
Bore x stroke	1.49 x 1.69 in (38 x 43 mm)
Displacement	48.8 cc
Cylinder material	Special cast iron
Cylinder head	Light alloy
Crankshaft	Steel
Main bearings	Two ball bearings
Crankcase	Light alloy, split
Scavenge system	Loop scavenging
Inlet and exhaust	Ports
Port control	Piston
Lubrication	Two-stroke mixture, 25 : 1
Cooling	Radial fan
Weight	18.7 lb (8.5 kg)
Air filter	Oil film combined with induction silencer
Carburettor	Bing 1/11
Carburettor type	Piston valve controlled
Lighting/Ignition	Six-volt flywheel magneto

TRANSMISSION

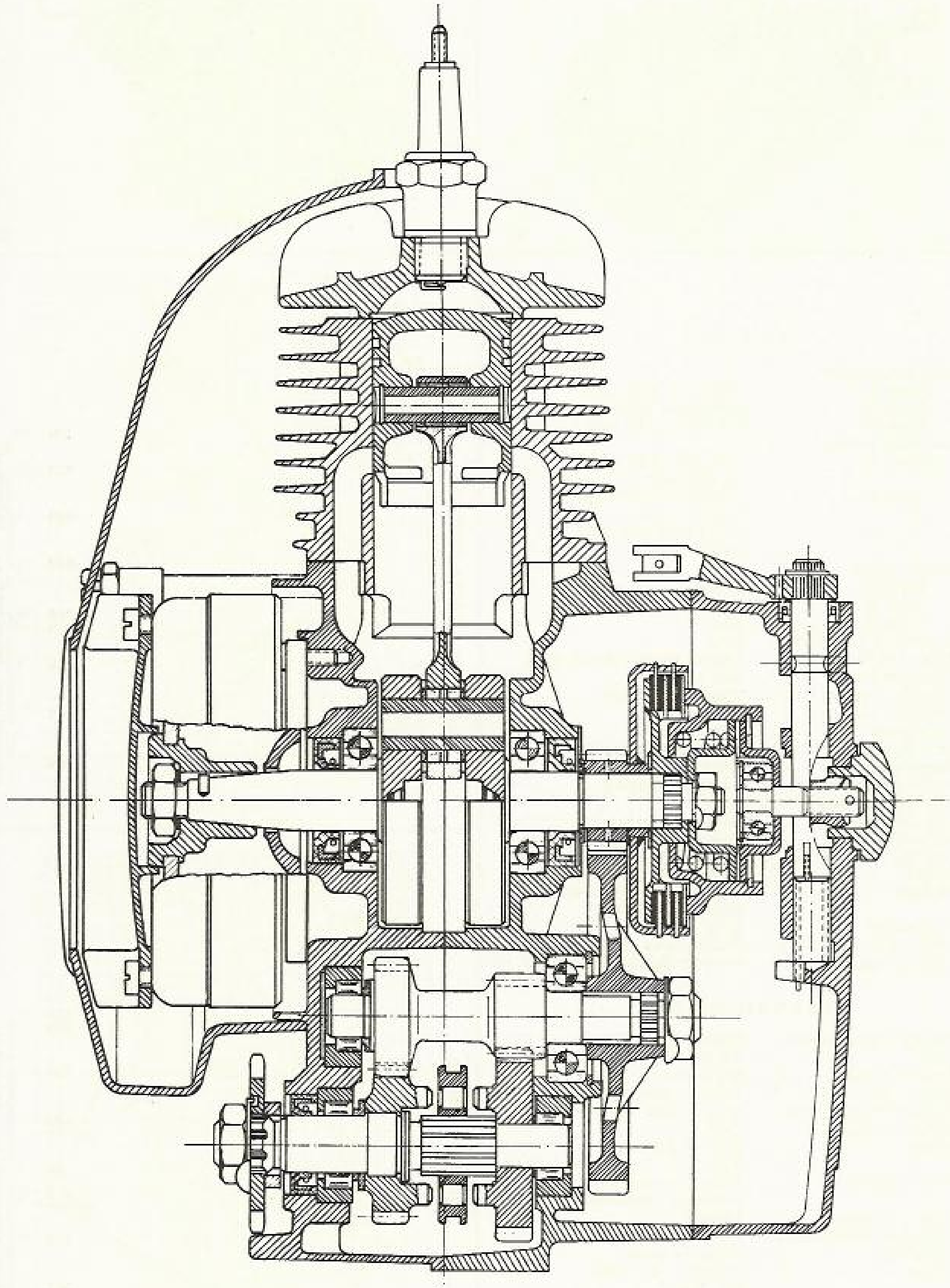
Primary transmission	Helical gears
Ratio	4.0 or 3.63 : 1
Type of clutch	Multi-disc
Type of gear box	normal, claw controlled
Position of gear box	In unit with engine
Number of speeds	Two
Ratios	Bottom 2.8 : 1 Top 1.44 : 1
Gear control	Rotary control on left-hand handlebar
Type of control	Manual
Secondary transmission	Chain, 1/2" x 3/16"
Sprockets	10 or 11 teeth
Starter	Pedals, with chain 1/2" x 1/8"





X 30-ENGINE

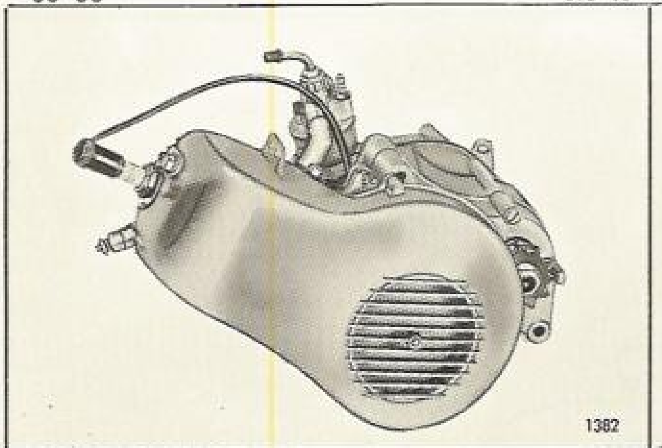
50 cc | 0.8 to 1.5 hp | Two-speed gear box



1st Edition

X 30A-ENGINE

50 cc | 0.8 to 1.5 hp | Automatic gear box



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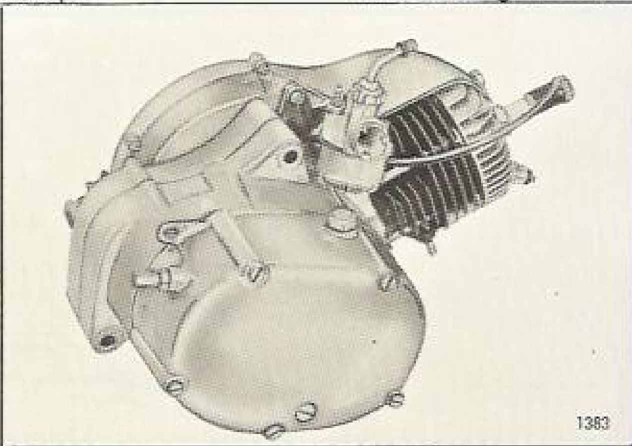

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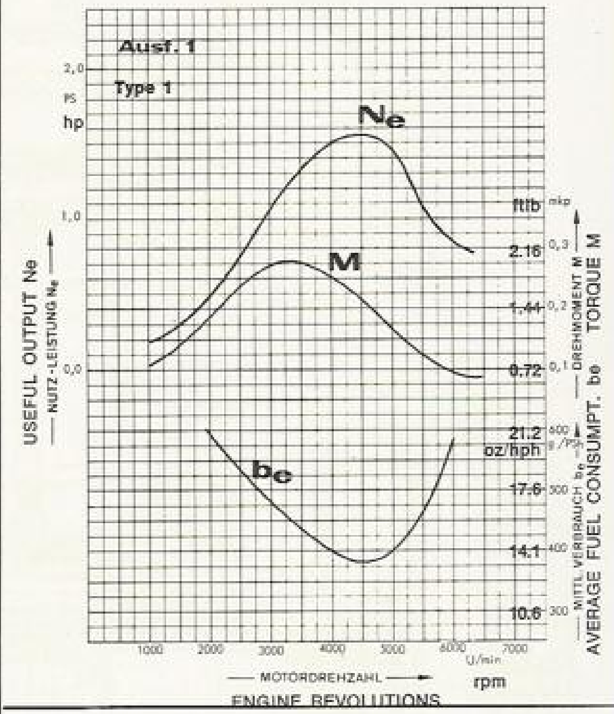
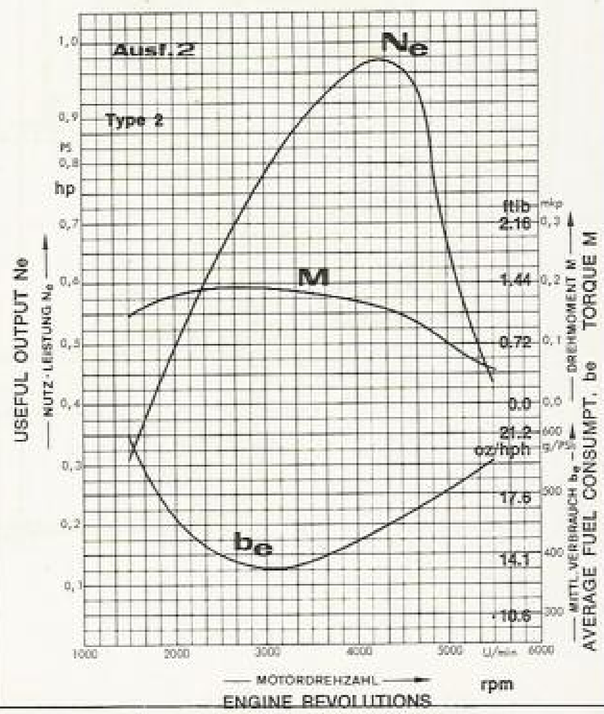
ENGINE

Maximum output	
Type 1:	1.5 hp at 4600 rpm
Type 2:	0.97 hp at 4250 rpm
Type 3:	0.8 hp at 3700 rpm
Maximum torque	
Type 1:	1.95 ftlb (0.27 mkp) at 3700 rpm
Type 2:	1.35 ftlb (0.187 mkp) at 2700 rpm
Type 3:	1.56 ftlb (0.215 mkp) at 2000 rpm
Compression ratio	
Type 1:	10.5 : 1
Type 2:	10.5 : 1
Type 3:	10.5 : 1
Number of cylinders	One
Bore x stroke	1.49 x 1.69 in (38 x 43 mm)
Displacement	48.8 cc
Cylinder material	Special cast iron
Cylinder head	Light alloy
Crankshaft	Steel
Main bearings	Two ball bearings
Crankcase	Light alloy, split
Scavenge system	Loop scavenging
Inlet and exhaust	Ports
Control of ports	Piston
Lubrication	Two-stroke mixture, 25 : 1
Cooling	Radial fan
Weight	20.9 lb (9.5 kg)
Air filter	Oil film combined with induction silencer
Carburettor	Bing 1/11
Carburettor type	Piston valve controlled
Lighting / Ignition	Six-volt flywheel magneto

TRANSMISSION

Primary transmission	Helical gears
Ratio	Bottom 3.059 : 1 Top 1.875 : 1
Clutch	Two separate centrifugal clutches
Gear box	Automatic
Position of gear box	In unit with engine
Number of speeds	Two
Ratio (layhaft/mainshaft)	3.273 : 1
Secondary Transmission	Chain, 1/2" x 3/16"
Sprockets	10 or 11 teeth
Starter	Pedals and chain, 1/2" x 1/8"



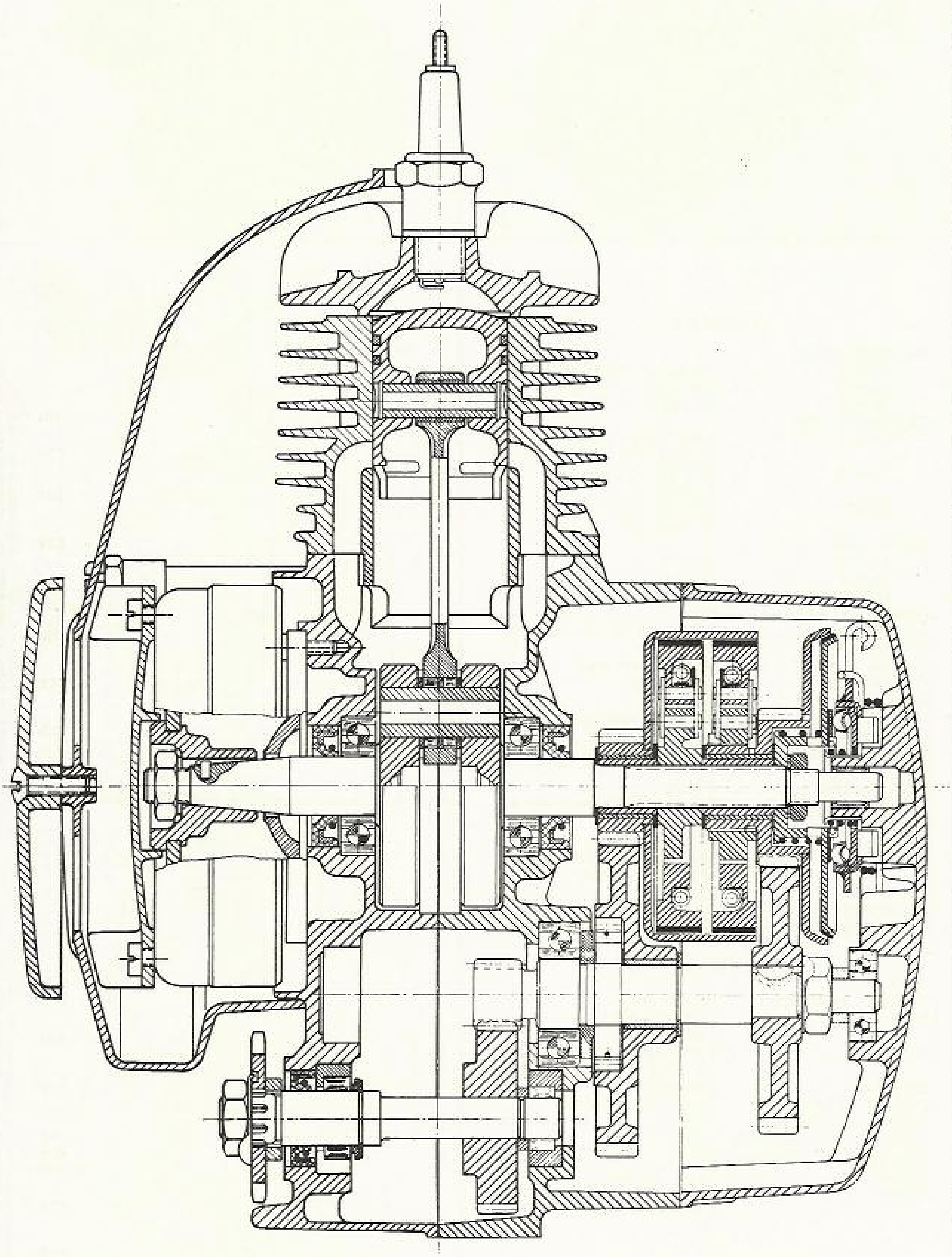


X 30A-ENGINE

50 cc

0.8 to 1.5 hp

Automatic gear box



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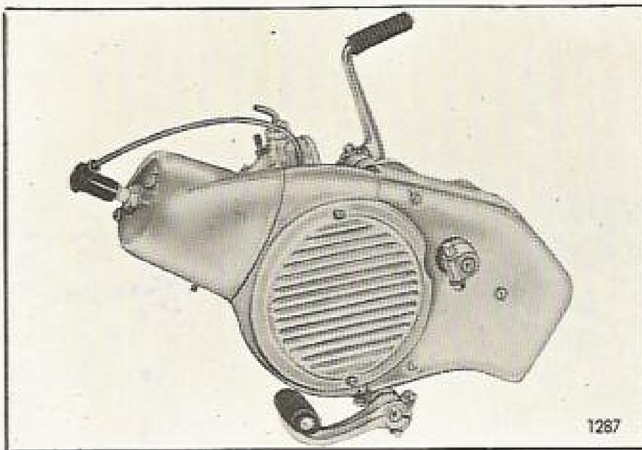
MSV-ENGINE

50 cc | 0.8 to 2.4 hp | Two-speed gear box



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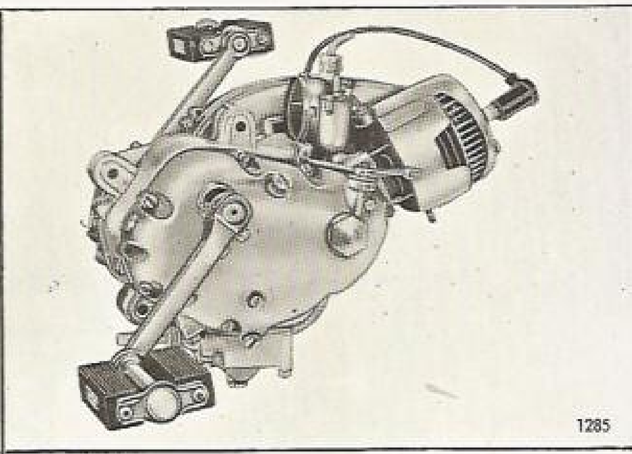

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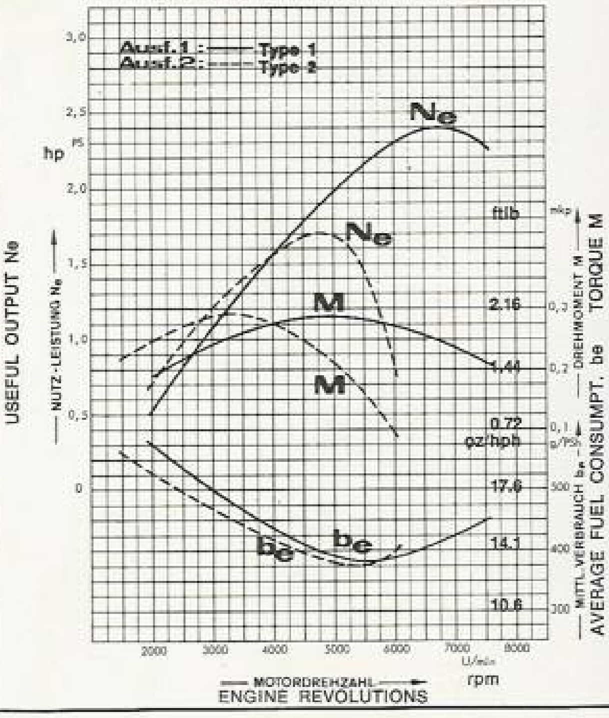
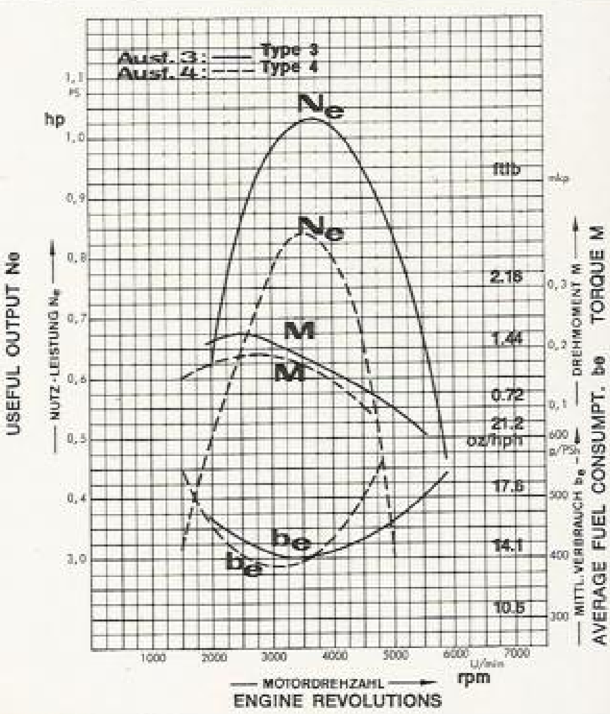
ENGINE

Maximum output	
Type 1:	2.4 hp at 6700 rpm
Type 2:	1.7 hp at 4700 rpm
Type 3:	1.03 hp at 3750 rpm
Type 4:	0.84 hp at 3500 rpm
Maximum torque	
Type 1:	2.05 ftlb (0.283 mkp) at 5000 rpm
Type 2:	2.03 ftlb (0.28 mkp) at 3400 rpm
Type 3:	1.59 ftlb (0.22 mkp) at 2500 rpm
Type 4:	1.37 ftlb (0.19 mkp) at 2750 rpm
Compression ratio	
Type 1:	10.5 : 1
Type 2:	8.5 : 1
Type 3:	6.5 : 1
Type 4:	10.5 : 1
Number of cylinders	One
Bore x stroke	1.49 x 1.69 in (38 x 43 mm)
Displacement	48.8 cc
Cylinder material . . .	Light alloy
Crankshaft	Steel
Main bearings	Two ball bearings
Crankcase	Light alloy, split
Scavenge system . . .	Loop scavenging
Inlet and Exhaust . .	Ports
Control of ports . . .	Piston
Lubrication	Two stroke mixture, 25 : 1
Cooling	Radial fan
Weight	23.2 lb (10.5 kg)
Air filter	Oil film, combined with induction silencer
Carburettor	Bing 1/12, 1/9.5
Carburettor type . . .	Piston valve controlled
Light/Ignition	Six-volt flywheel magneto

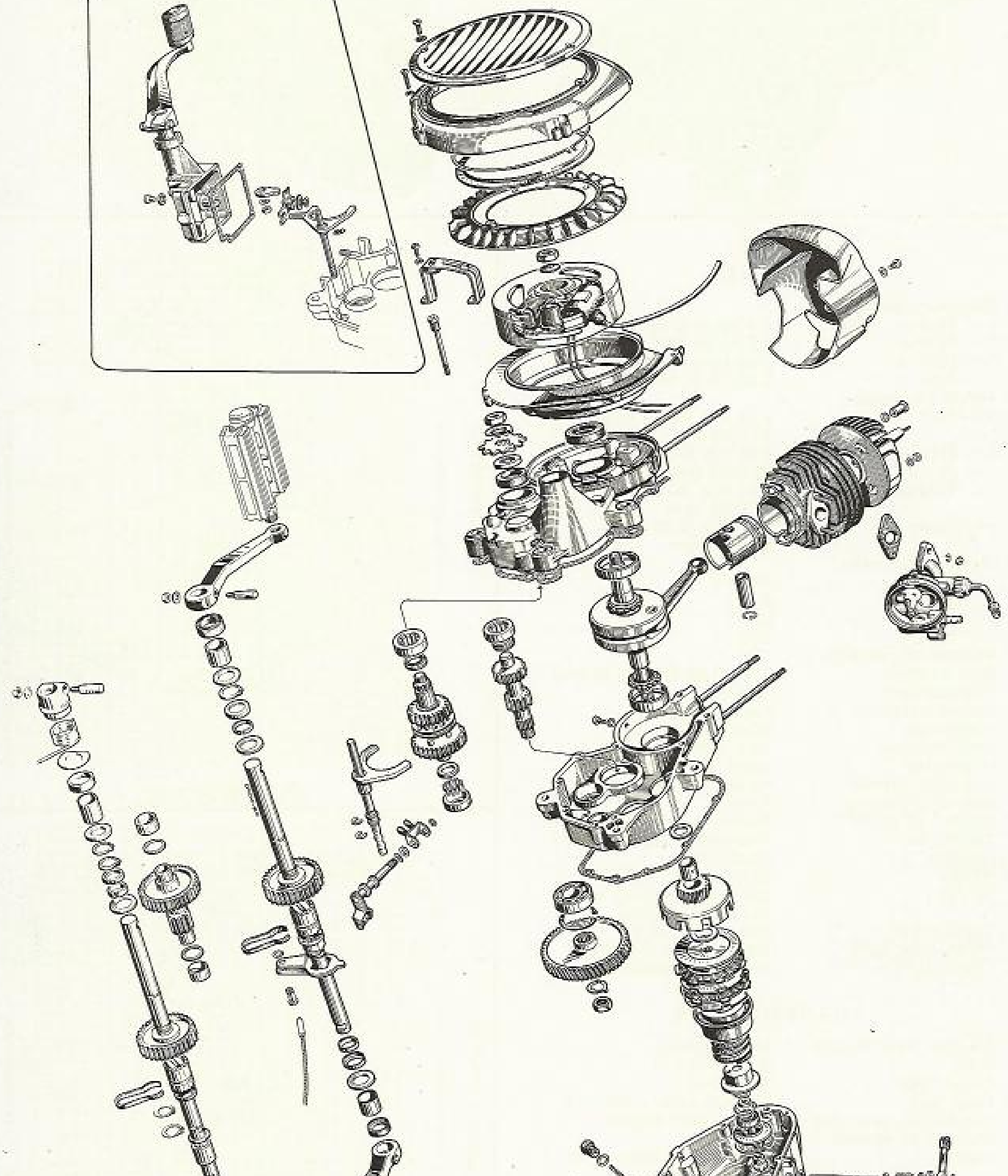
TRANSMISSION

Primary transmission	Helical gears
Ratio	3.63 or 4.0 : 1
Clutch type	Multi-disc
Gear box	Normal, claw controlled
Position of gear box	In unit with engine
Number of speeds . .	Two
Ratios	Bottom: 2.8, 2.54 or 2.16 : 1
	Top 1.44 : 1
Gear control	Rotary control on left handlebar or left-hand mounted foot pedal
Type of control . . .	Manual shifted or foot operated
Secondary transmission	Chain 1/2" x 3/16"
Sprockets	10, 11, 12 or 13 teeth
Starter	Kickstarter or pedals





MSV-ENGINE



1st Edition

MSA-ENGINE

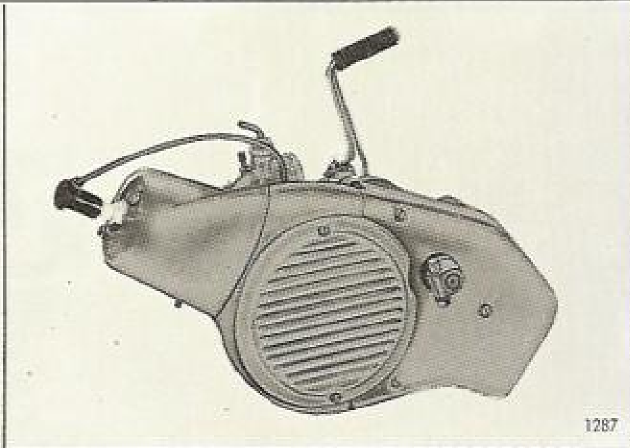
50 cc — 1.5 to 2.6 hp — Automatic gear box

ENGINE

Maximum output	
Type 1:	2.1 hp at 4900 rpm
Type 2:	1.5 hp at 5000 rpm
Type 3:	2.6 hp at 4900 rpm
Type 4:	1.7 hp at 4700 rpm
Maximum torque	
Type 1:	2.39 ftlb (0.33 mkp) at 4000 rpm
Type 2:	1.81 ftlb (0.25 mkp) at 3300 rpm
Type 3:	2.97 ftlb (0.41 mkp) at 3500 rpm
Type 4:	2.03 ftlb (0.28 mkp) at 3400 rpm
Compression ratio	
Type 1:	10.5 : 1
Type 2:	6.5 : 1
Type 3:	11.5 : 1
Type 4:	10.5 : 1
Number of cylinders	One
Bore x stroke	1.49 x 1.69 in (38 x 43 mm)
Displacement	48.8 cc
Cylinder material	Special cast iron
Cylinder head	Light alloy
Crankshaft	Steel
Main bearings	Three ball bearings
Crankcase	Light alloy, sectioned
Scavenge system	Loop scavenging
Inlet and exhaust	Ports
Port control	Piston
Lubrication	Two-stroke mixture, 25 : 1
Cooling	Radial fan
Weight	24.3 lb (11 kg)
Air filter	Oil film combined with induction silencer
Carburettor	Bing 1/12, 1/14
Carburettor type	Piston valve controlled
Lighting / Ignition	Six-volt flywheel magneto

TRANSMISSION

Primary transmission	Helical gears
Ratio	Bottom 3.059 : 1 Top 1.653 : 1
Clutch	Two separate centrifugal clutches
Gear box type	Stepped gears
Position of gear box	In unit with engine
Number of speeds	Two
Ratio (layshaft/mainshaft)	3.273 : 1
Gear control	Automatic
Secondary transmission	Chain 1/2" x 3/16" 1/2" x 3/16" x 7.75
Chain wheels	10, 11, 12 or 13 teeth
Starter	Kickstarter or pedals



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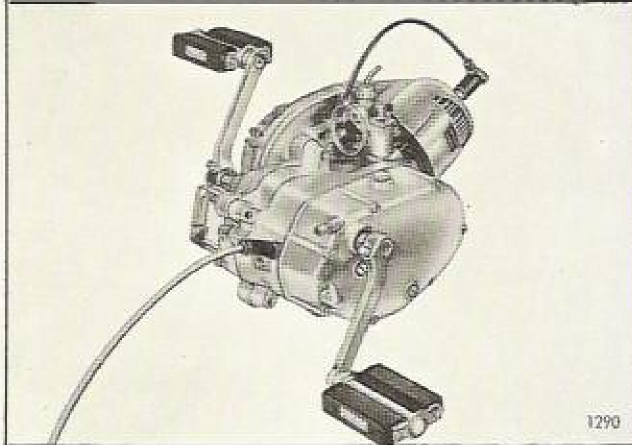

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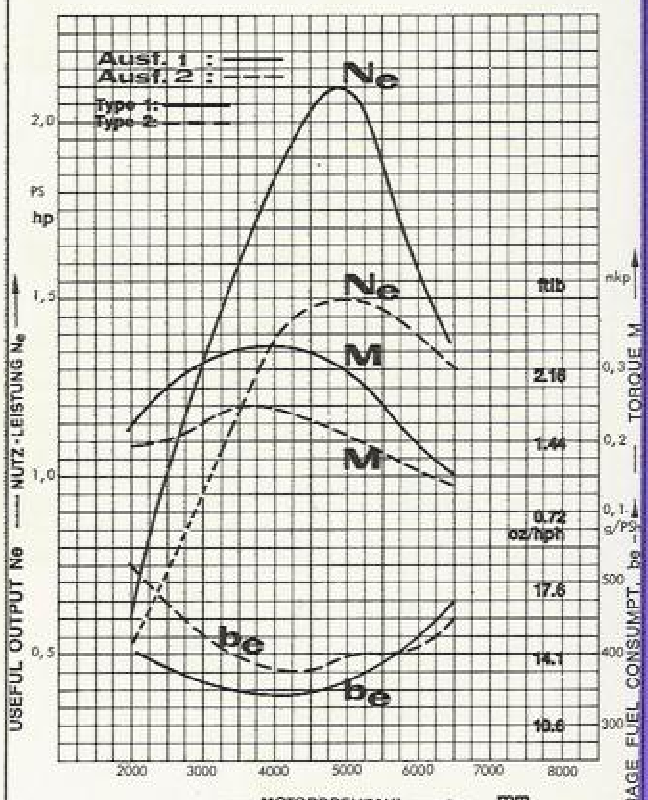


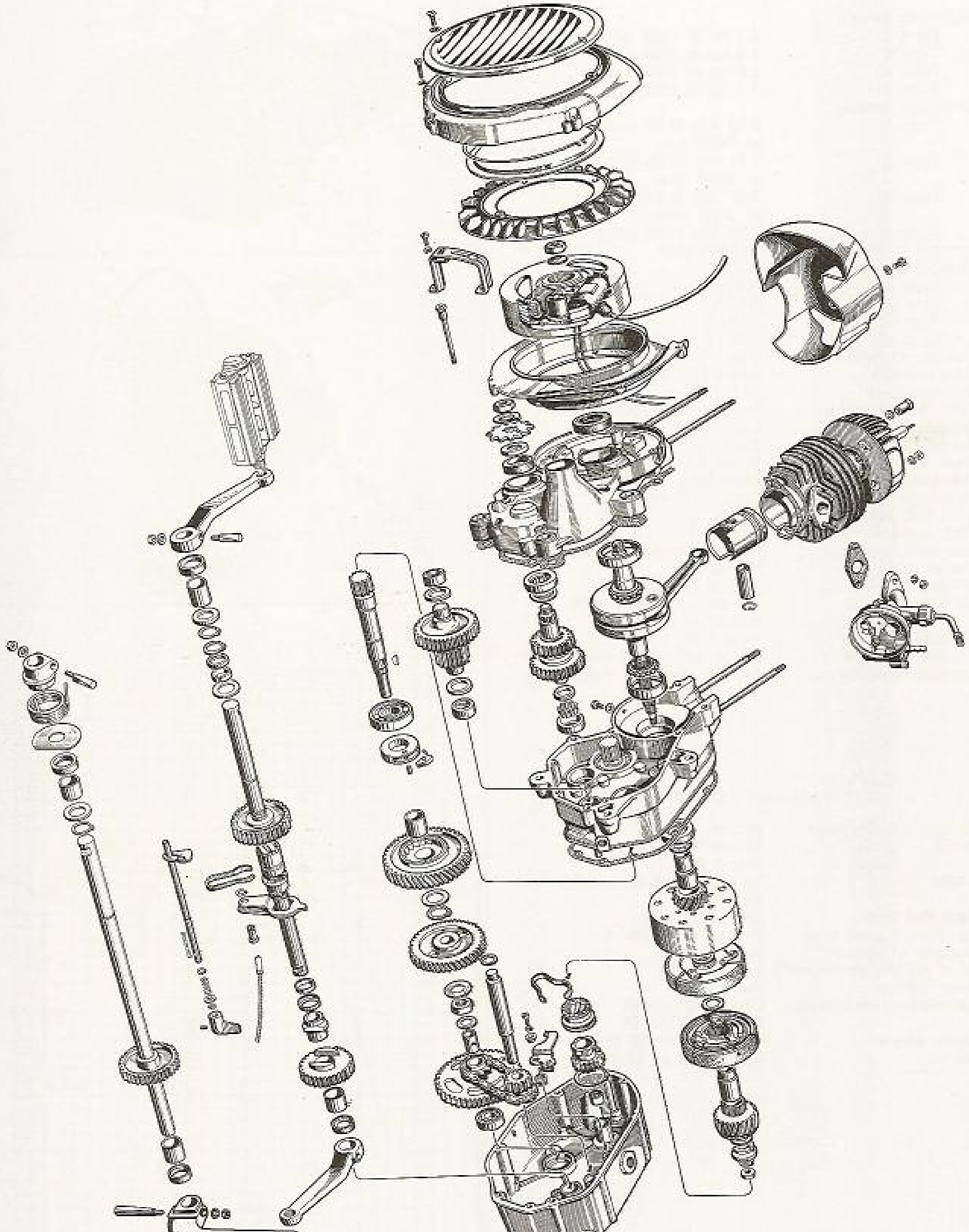
1st Edition

MSA-ENGINE

50 cc

1.5 to 2.6 hp

Automatic gear box



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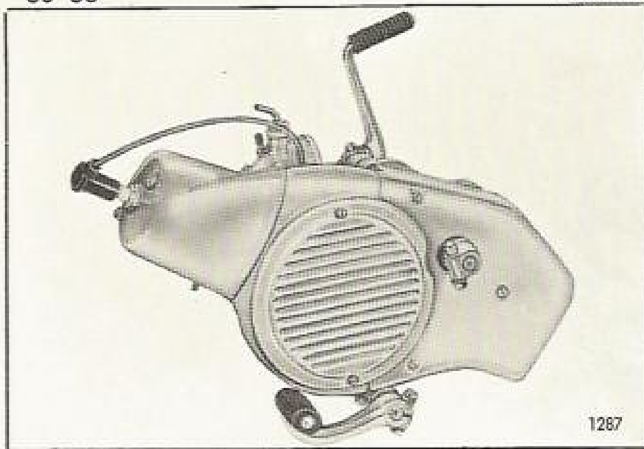
VSD-ENGINE

50 cc | 1.03 to 2.4 hp | Three-speed gear box



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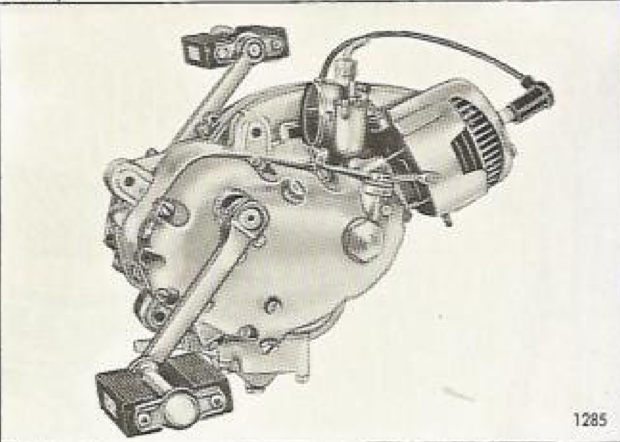

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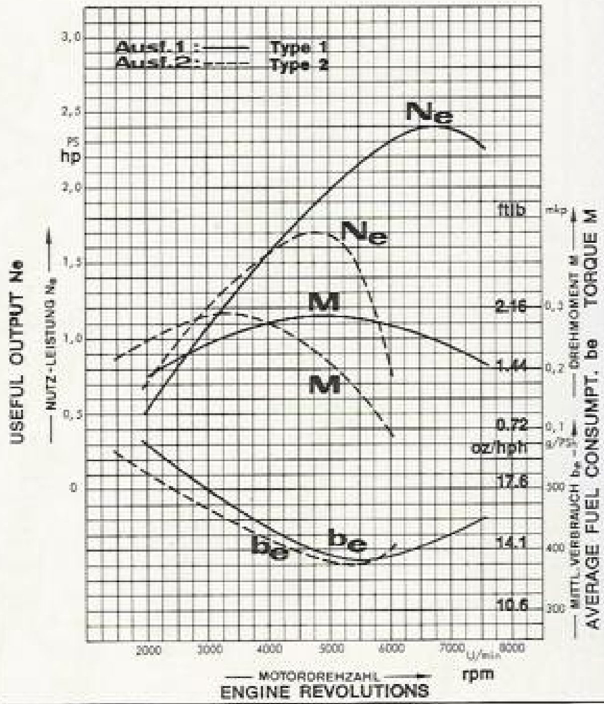
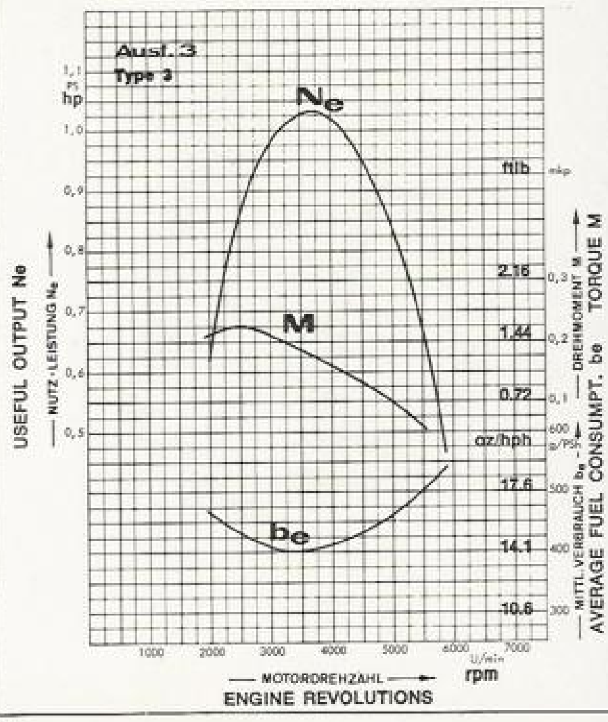


ENGINE

Maximum output	
Type 1:	2.4 hp at 6700 rpm
Type 2.	1.7 hp at 4700 rpm
Type 3:	1.03 hp at 3750 rpm
Type 4:	1.8 hp at 4600 rpm
Maximum torque	
Type 1:	2.05 ftlb (0.283 mkp) at 5000 rpm
Type 2:	2.03 ftlb (0.28 mkp) at 3400 rpm
Type 3:	1.59 ftlb (0.22 mkp) at 2500 rpm
Type 4:	2.10 ftlb (0.29 mkp) at 3750 rpm
Compression ratio	
Type 1:	10.5 : 1
Type 2:	8.5 : 1
Type 3:	6.5 : 1
Type 4:	8.5 : 1
Number of cylinders	One
Bore x stroke	1.49 x 1.69 in (38 x 43 mm)
Displacement	48.8 cc
Cylinder material	Special cast iron
Cylinder head	Light alloy
Crankshaft	Steel
Main bearings	Three ball bearings
Crankcase	Light alloy, split
Scavenge system	Loop scavenging
Inlet and exhaust	Ports
Control of ports	Piston
Lubrication	Two-stroke mixture, 25 : 1
Cooling	Radial fan
Weight	26.5 lb (12 kg)
Air filter	oil film, combined with induction silencer
Carburettor	Bing 1/12
Carburettor type	Piston valve controlled
Lighting / Ignition	Six-volt flywheel magneto

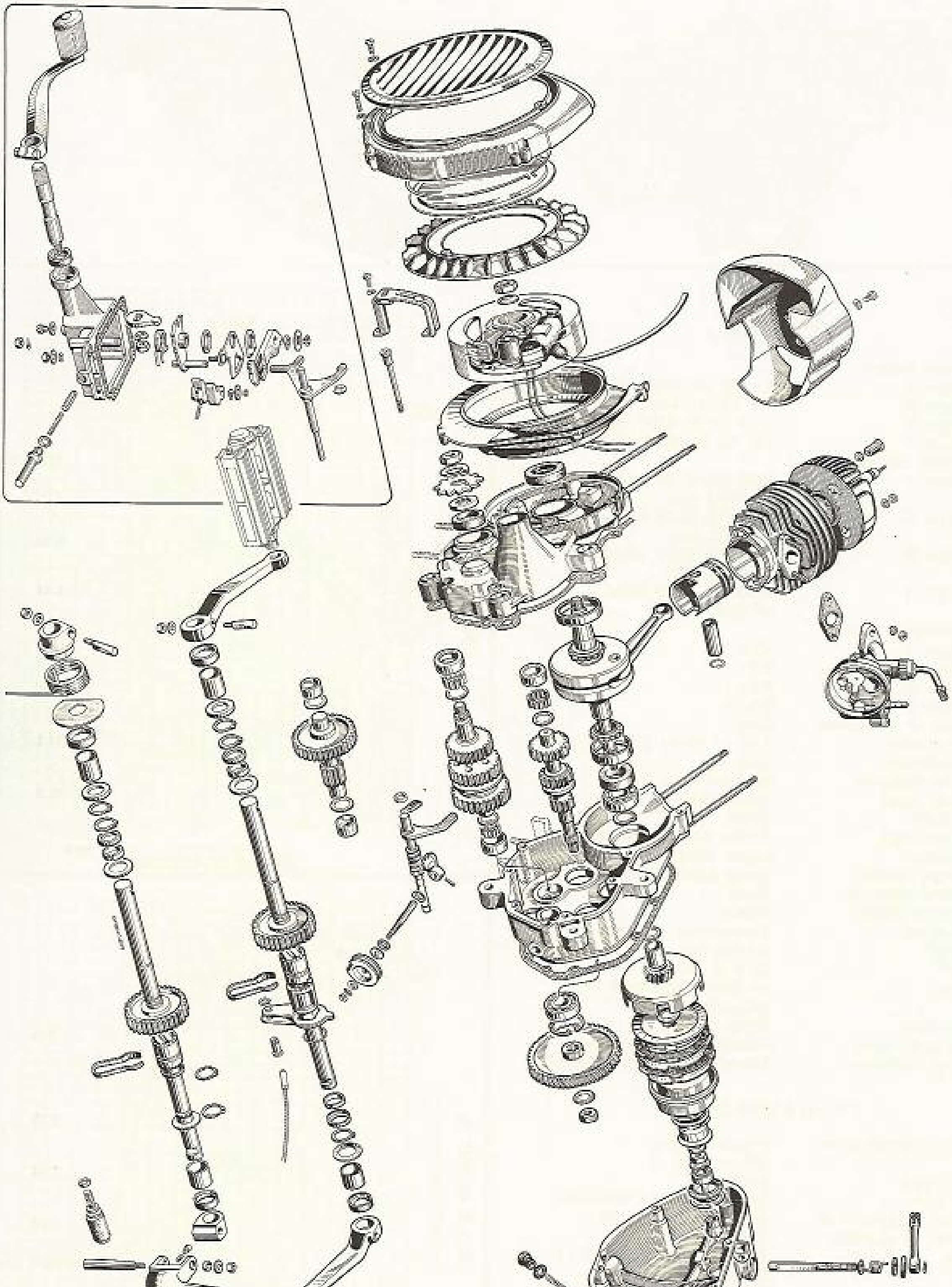
TRANSMISSION

Primary transmission	Helical gears
Ratio	4.0 or 3.63 : 1
Clutch type	Multi-disc
Gear box	Normal, claw controlled
Position of gear box	In unit with engine
Number of speeds	Three
Ratios	Bottom 3.636 or 3.25 : 1 Second 2.0 : 1 Top 1.68, 1.263 or 1.20 : 1
Gear control position	Rotary control on left handlebar or foot pedal on left-hand side of engine
Secondary transmission	Chain, 1/2" x 3/16" or 1/2" x 3/16" x 7.75
Sprockets	10, 11, 12 or 13 teeth
Starter	Kickstarter or pedals



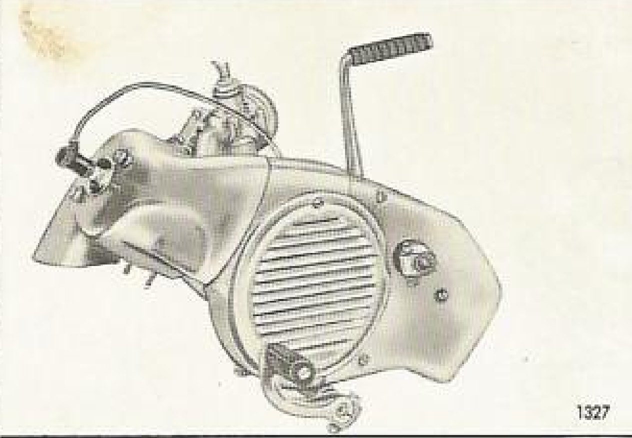
VSD-ENGINE

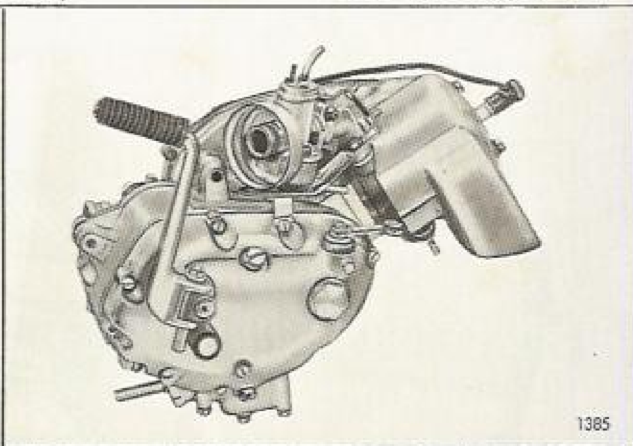
50 cc | 1.03 to 2.4 hp | Three-speed gear box



R-ENGINE

50 and 60 cc — 2.0 to 4.2 hp — Three-speed gear box





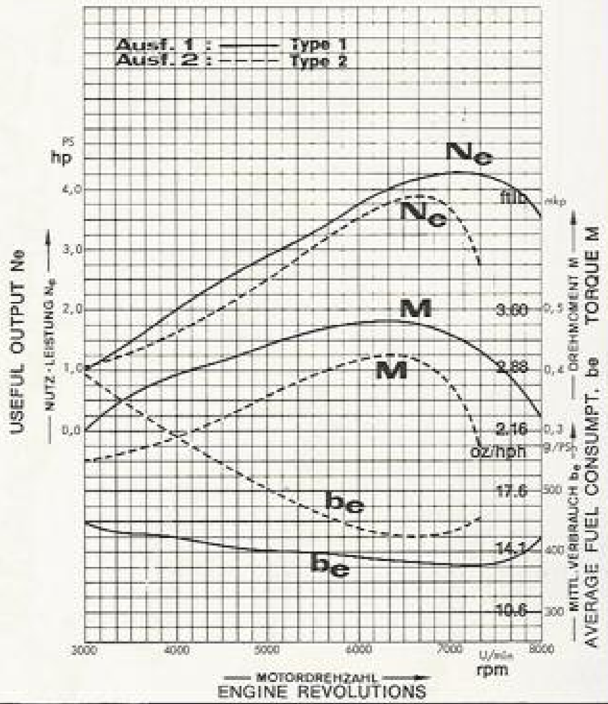
ENGINE

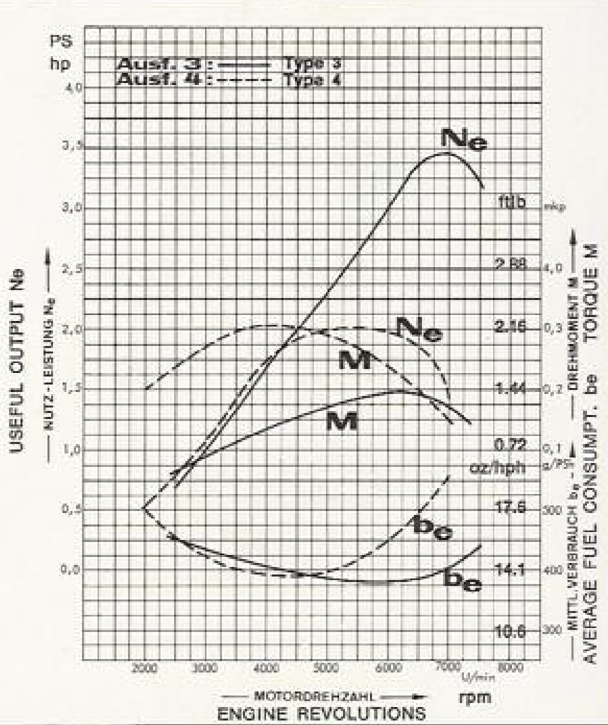
Maximum output	
Type 1:	4.2 hp at 7200 rpm *
Type 2:	3.8 hp at 6700 rpm *
Type 3:	3.46 hp at 7000 rpm
Type 4:	2.0 hp at 5500 rpm
Maximum torque	
Type 1:	3.47 ftlb (0.48 mkp) at 6200 rpm *
Type 2:	3.04 ftlb (0.42 mkp) at 6300 rpm *
Type 3:	2.68 ftlb (0.37 mkp) at 6300 rpm
Type 4:	2.24 ftlb (0.31 mkp) at 4000 rpm
Compression ratio	
Type 1:	10.5 : 1 *
Type 2:	10.5 : 1 *
Type 3:	10.5 : 1
*Type 4:	10.5 : 1
Number of cylinders	One
Cylinder bore	1.49 in (38 mm), 1.65 in (42 mm) *
Piston stroke	1.69 in (43 mm)
Displacement	48.8 cc, 59.6 cc *
Cylinder material . . .	Special cast iron
Cylinder head . . .	Light alloy
Crankshaft	Steel
Main bearings . . .	Three ball bearings
Crankcase	Light alloy, split
Scavenge system . .	Loop scavenge
Inlet and Exhaust . .	Ports
Control of ports . . .	Piston
Lubrication	Two-stroke mixture, 25 : 1
Cooling	Radial fan
Weight	27.5 lb (12.5 kg)
Air filter	Oil film combined with induction silencer
Carburettor	Bing 1/17; 1/14 for type 4
Carburettor type . . .	Piston valve controlled
Lighting / Ignition . . .	Six-volt flywheel magneto

TRANSMISSION

Primary transmission	Helical gears
Ratio	3.0, 3.63 or 4.0 : 1
Clutch type	Multi-disc
Gear box type . .	Normal, claw controlled
Position of gear box	In unit with engine
Number of speeds . .	Three
Ratios	Bottom 3.636 or 3.25 : 1 Second 2.0 : 1 Top 1.263, 1.68 or 1.20 : 1
Gear control	Rotary control on left handlebar or foot pedal on left-hand side of engine
Secondary transmission	Chain, 1/2" x 3/16" x 7.75
Sprockets	11, 12 or 13 teeth
Starter	Kickstarter or pedals

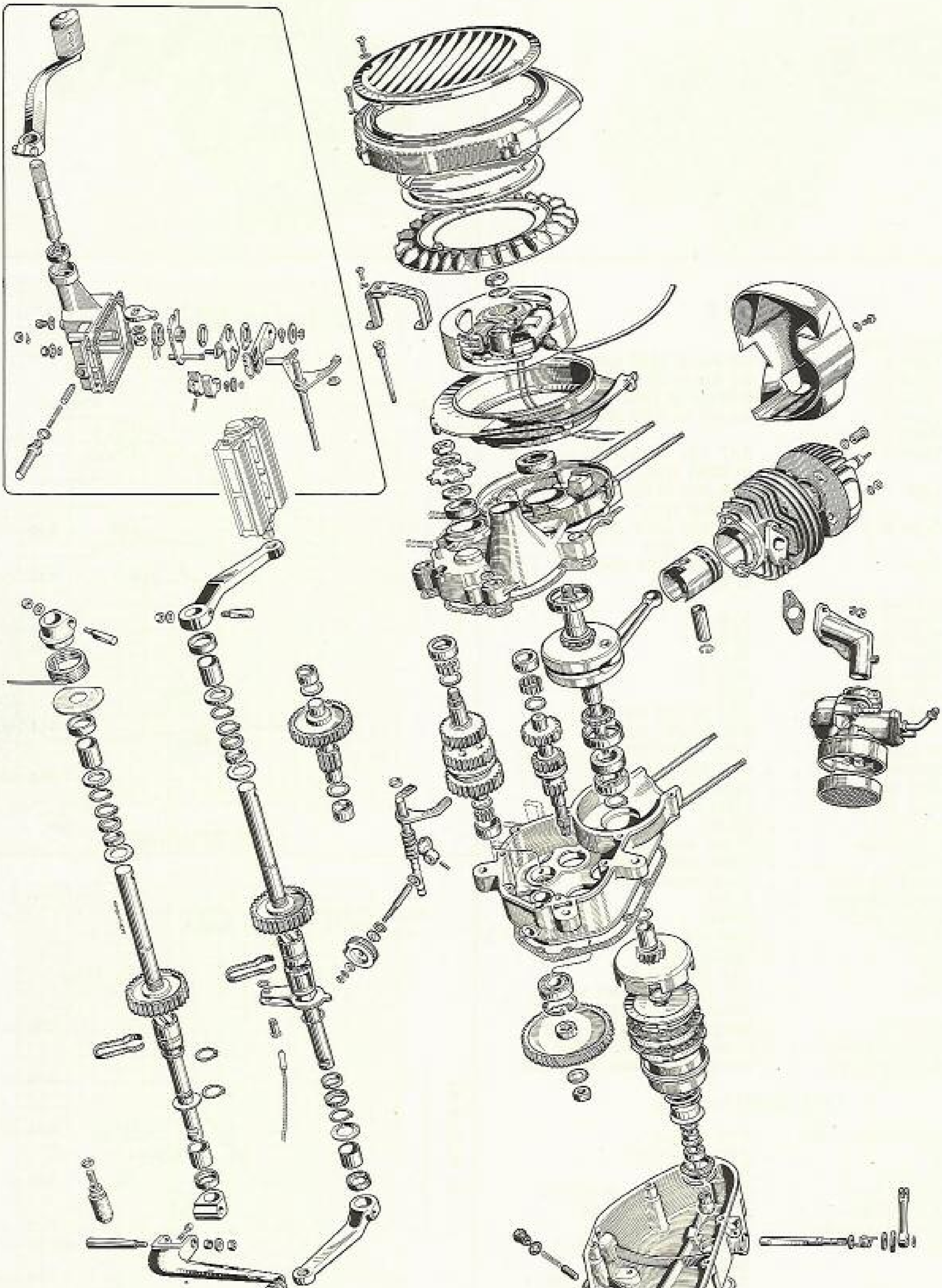
* Indicate 60 cc models





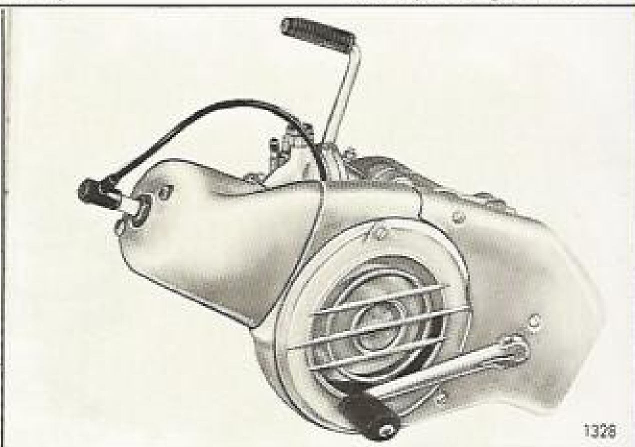
R-ENGINE

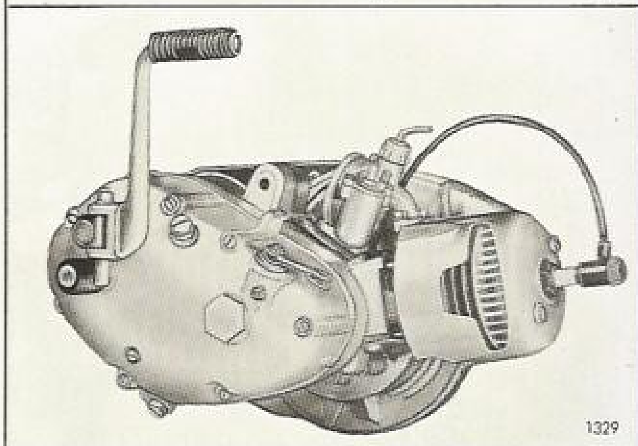
50 and 60 cc | 2.0 to 4.2 hp | Three-speed gear box



V-ENGINE

50 cc | 1.03 to 2.6 hp | Four-speed gear box





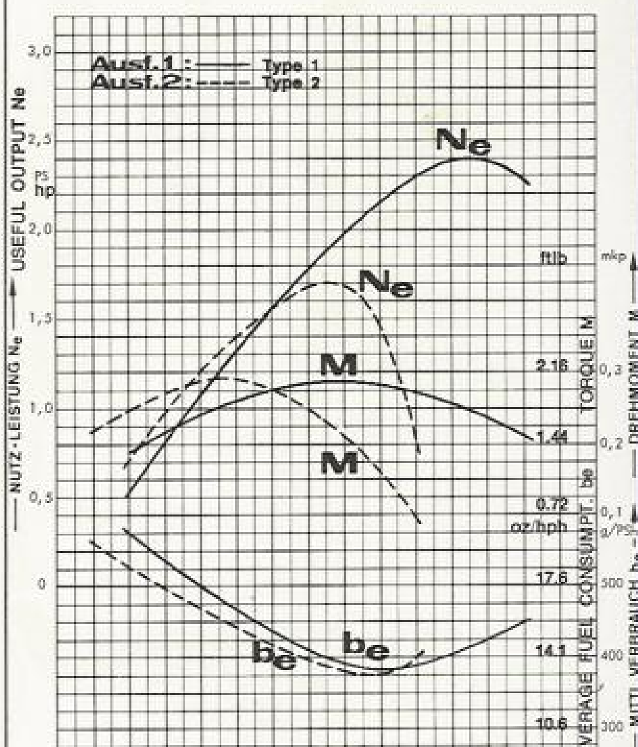
ENGINE

Maximum output	
Type 1:	2.4 hp at 6700 rpm
Type 2:	1.7 hp at 4700 rpm
Type 3:	2.6 hp at 5000 rpm
Type 4:	1.8 hp at 4600 rpm
Type 5:	1.03 hp at 3750 rpm *
Maximum torque	
Type 1:	2.05 ftlb (0.283 mkp) at 5000 rpm
Type 2:	2.03 ftlb (0.28 mkp) at 3400 rpm
Type 3:	2.88 ftlb (0.4 mkp) at 3500 rpm
Type 4:	2.10 ftlb (0.29 mkp) at 3750 rpm
Type 5:	1.74 ftlb (0.24 mkp) at 2500 rpm *
Compression ratio	
Type 1:	10.5 : 1
Type 2:	8.5 : 1
Type 3:	11.5 : 1
Type 4:	8.5 : 1
Type 5:	6.5 : 1 *
Number of cylinders	One
Bore x stroke	1.49 x 1.69 in (38 x 43 mm)
Piston displacement	48.8 cc
Cylinder material . .	Special cast-iron
Cylinder head	Light alloy
Crankshaft	Steel
Engine bearings . . .	Three ball-bearings
Crankcase	Light alloy, split
Scavenge system . .	Loop scavenge
Inlet and exhaust . .	Ports
Control of ports . . .	Piston
Lubrication	Two-stroke mixture, 25 : 1
Cooling	Radial fan
Weight	26.9 lb (12.2 kg)
Air filter	Oil film combined with induction silencer
Carburettor	Bing 1/12, 1/14
Carburettor principle	Controlled by piston valve
Lighting / Ignition . .	Six-volt flywheel magneto

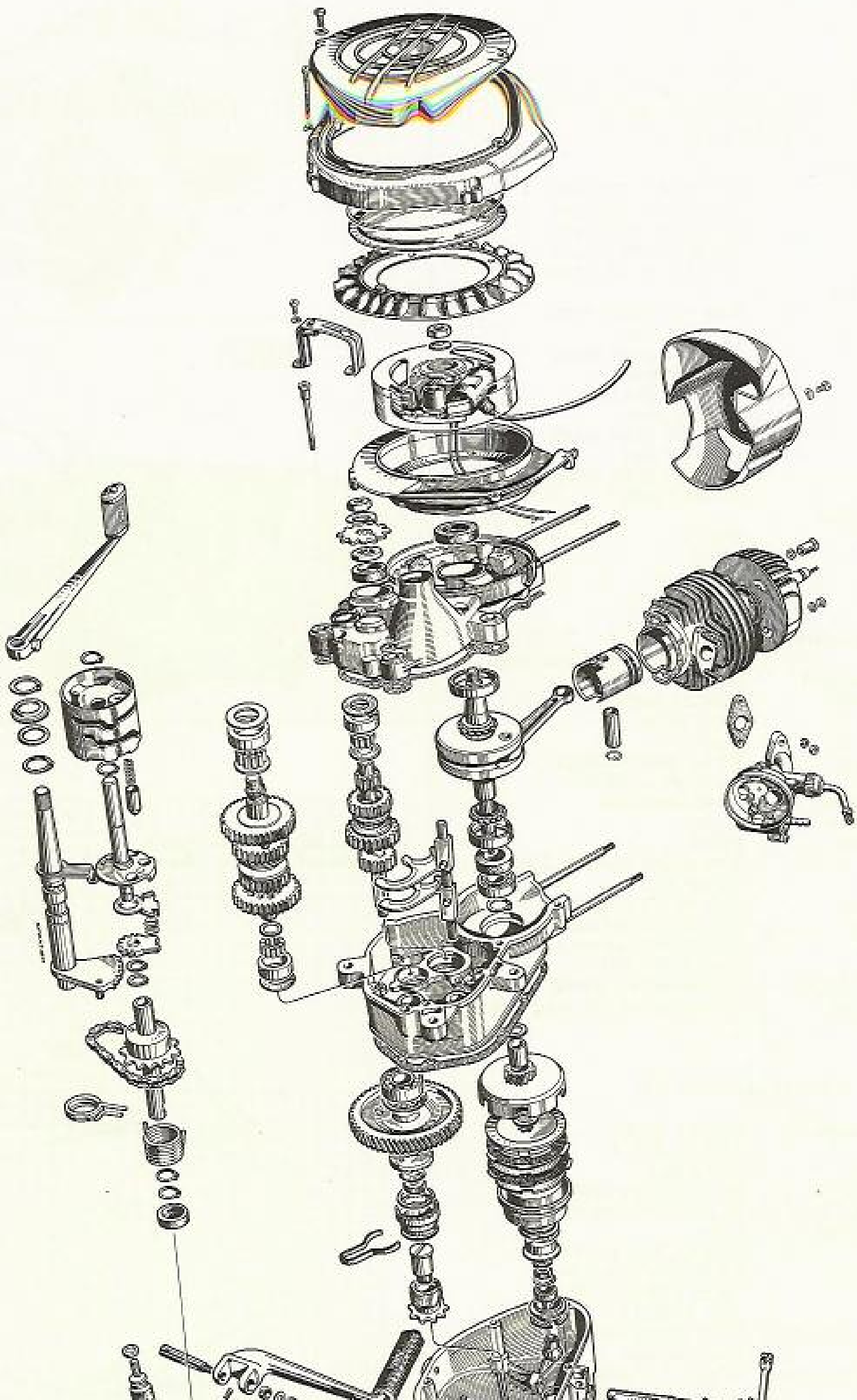
TRANSMISSION

Primary transmission	Helical gears
Ratio	3.63 or 4.0 : 1
Type of clutch . . .	Multi-disc
Type of gear box . .	Normal, claw-controlled
Position of gear box	In unit with engine
Number of speeds . .	Four
Ratios	Bottom 3.63 or 3.55 : 1 Second 2.0 or 1.94 : 1 Third 1.38 : 1, 1.26 : 1 Top 1.00 : 1
Position of gear control	Foot pedal/left-hand side
Gear control	Foot change
Secondary transmission	Chain, 1/2" x 3/16" x 7.75
Sprockets	10, 11, 12 or 13 teeth.
Starter	Kickstarter

* Without the fourth speed



V-ENGINE



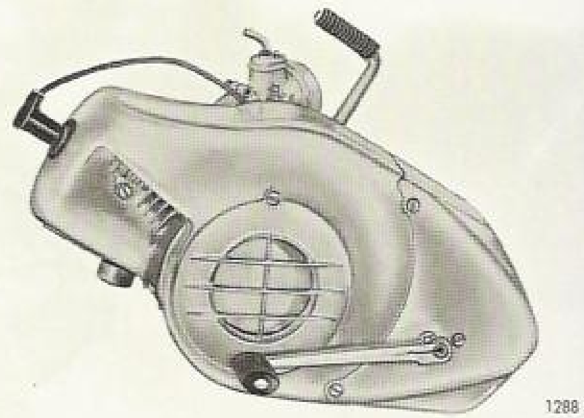
1st Edition

M-ENGINE

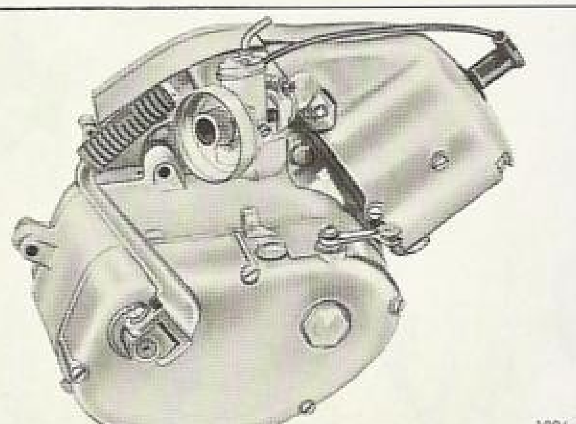
50 cc | 4.8 hp | Four-speed gear box

ENGINE

Maximum output . . .	4.8 hp at 6800 rpm
Maximum torque . . .	3.84 ftlb (0.53 mkp) at 6700 rpm
Compression ratio . .	11 : 1
Number of cylinders .	One
Bore x stroke	1.49 x 1.73 in (38 x 44 mm)
Piston displacement .	49.8 cc
Cylinder material . . .	Light alloy, bore aluminium plated
Cylinder head	Light alloy
Crankshaft	Steel
Engine bearings . . .	Three ball bearings
Crankcase	Light alloy, split
Scavenge system . . .	Loop scavenge
Inlet and exhaust . . .	Ports
Control of ports . . .	Piston
Lubrication	Two-stroke mixture
Cooling	Radial fan
Weight	31.9 lb (14.5 kg)
Air filter	Oil film combined with iduction silencer
Carburettor	Bing 1/17
Carburettor principle .	Controlled by piston valve
Lighting/Ignition . . .	Six-volt flywheel magneto



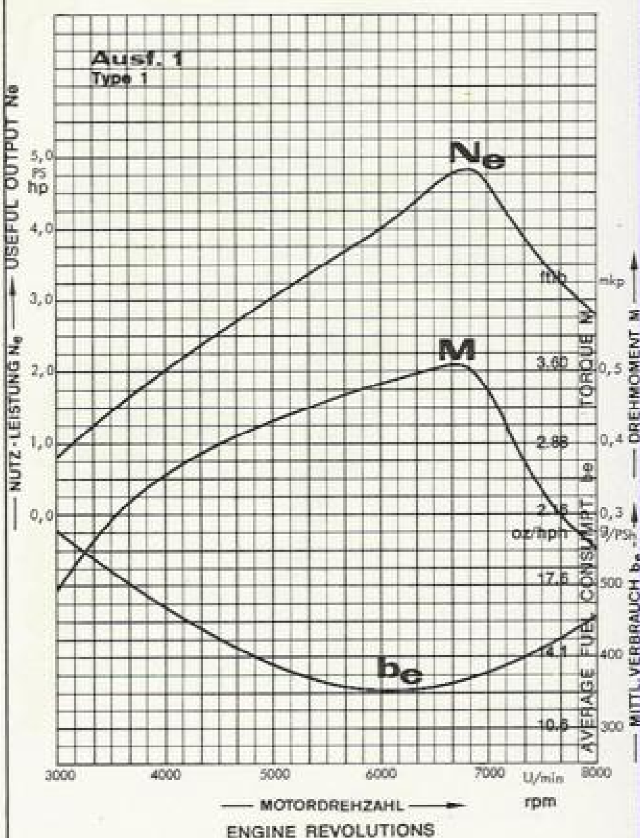
1288



1286

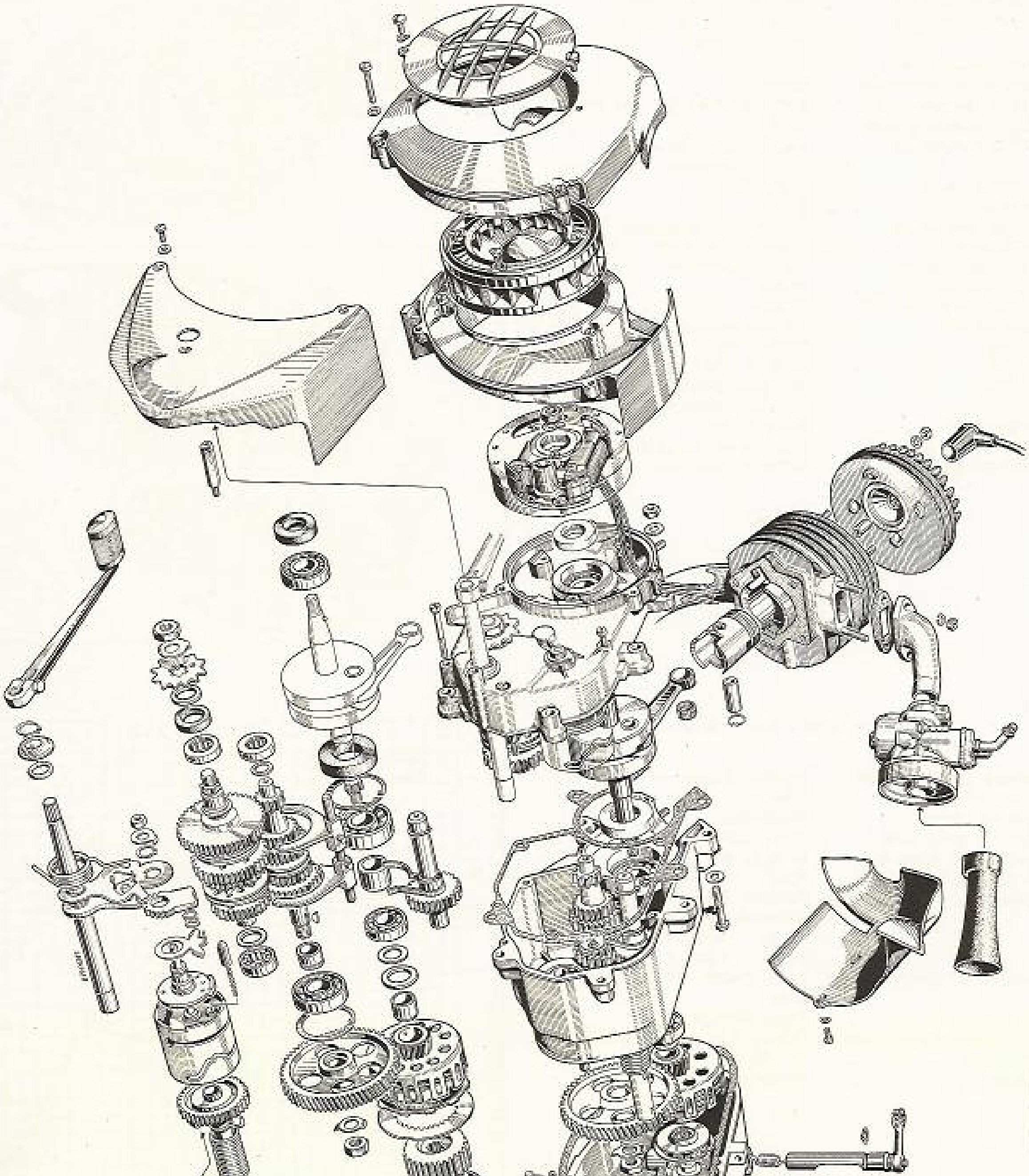
TRANSMISSION

Primary transmission .	Helical gears
Ratio	3.04 : 1
Type of clutch	Multi-disc
Type of gear box . .	Claw controlled
Position of gear box .	In unit with engine
Number of speeds . .	Four
Ratios	Bottom 3.69 : 1
	Second 1.95 : 1
	Third 1.30 : 1
	Top 1.00 : 1
Position of gear control	Foot pedal on left-hand side
Gear control	Foot change
Secondary transmission	Chain, 1/2" x 3/16" x 7.75
Sprockets	11, 12 or 13 teeth
Starter	Kickstarter



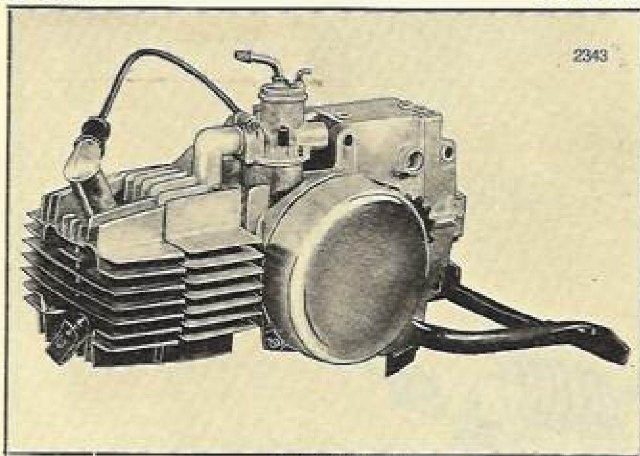
M-ENGINE

50 cc | 4.8 hp | Four-speed gear box

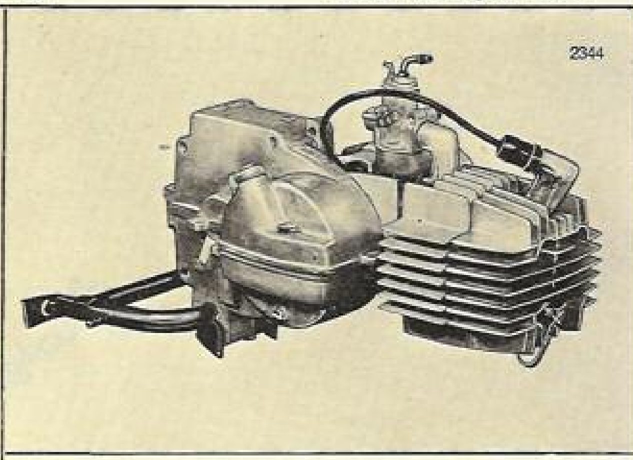


MAXI-ENGINE

50 ccm | 0.8 to 2.2 hp | Automatic gear box



2343



2344

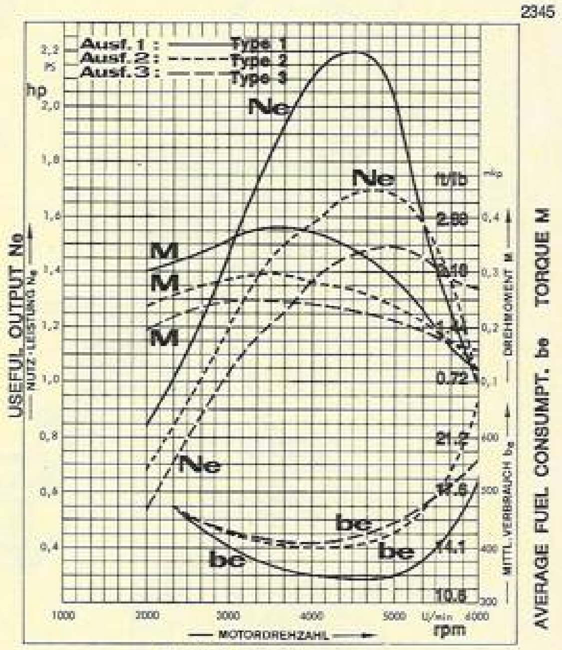
ENGINE

Max. output	
Type 1:	2.20 hp at 4500 rpm
Type 2:	1.70 hp at 4800 rpm
Type 3:	1.49 hp at 5000 rpm
Type 4:	1.25 hp at 4000 rpm
Type 5:	0.95 hp at 4000 rpm
Type 6:	0.80 hp at 3800 rpm
Type 7:	1.09 hp at 3500 rpm
Max. torque	
Type 1:	2.75 ft/lb (0.38 mkp) at 3600 rpm
Type 2:	2.17 ft/lb (0.30 mkp) at 3500 rpm
Type 3:	1.81 ft/lb (0.25 mkp) at 3250 rpm
Type 4:	2.10 ft/lb (0.29 mkp) at 2000 rpm
Type 5:	1.52 ft/lb (0.21 mkp) at 3000 rpm
Type 6:	1.23 ft/lb (0.17 mkp) at 3000 rpm
Type 7:	1.88 ft/lb (0.26 mkp) at 2500 rpm
Compression ratio	
Type 1:	9.0 : 1
Type 2:	9.0 : 1
Type 3:	7.5 : 1
Type 4:	9.0 : 1
Type 5:	9.8 : 1
Type 6:	9.8 : 1
Type 7:	9.8 : 1
Number of cylinders	1
Bore / Stroke	1.49 x 1.69 in (38 x 43 mm)
Capacity	48.8 cc
Cylinder material	Light alloy bore chromium plated
Cylinder head	Light alloy
Crankshaft	Steel
Main bearings	Two ball bearings
Crankcase	Light alloy, plit
Scavenge system	Loop scavenging
Inlets and outlets	Ports
Control of inlet and outlet	Piston
Lubrication	Two-stroke mixture, 25 : 1
Cooling	Air
Weight	17.64 lb (8 kg)
Air filter	Oil film combined with induction silencer
Carburettor	Bing 1/12 or Bing 1/14
Carburettor type	Piston valve controlled
Lighting / ignition	Six-volt flywheel magneto

TRANSMISSION

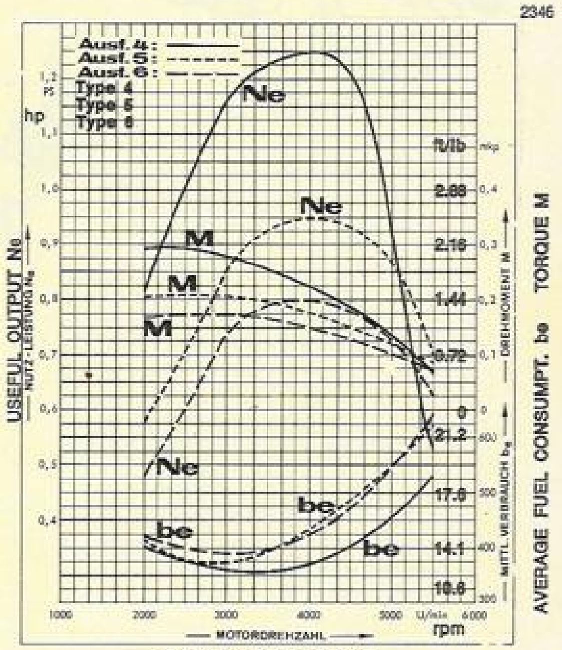
Primary transmission	Helical toothed gears
Ratio	i = 5.05 : 1
Type of clutch	Centrifugal
Type of gear box	Automatically controlled single speed
Position of gear box	In unit with engine
Gear selection	Automatic
Number of speeds	1
Secondary transmission	Chain 1/2" x 3/16"
Sprockets	12, 13 to 16 teeth
Starter	Pedals and chain 1/2" x 1/8"

2345



ENGINE REVOLUTIONS

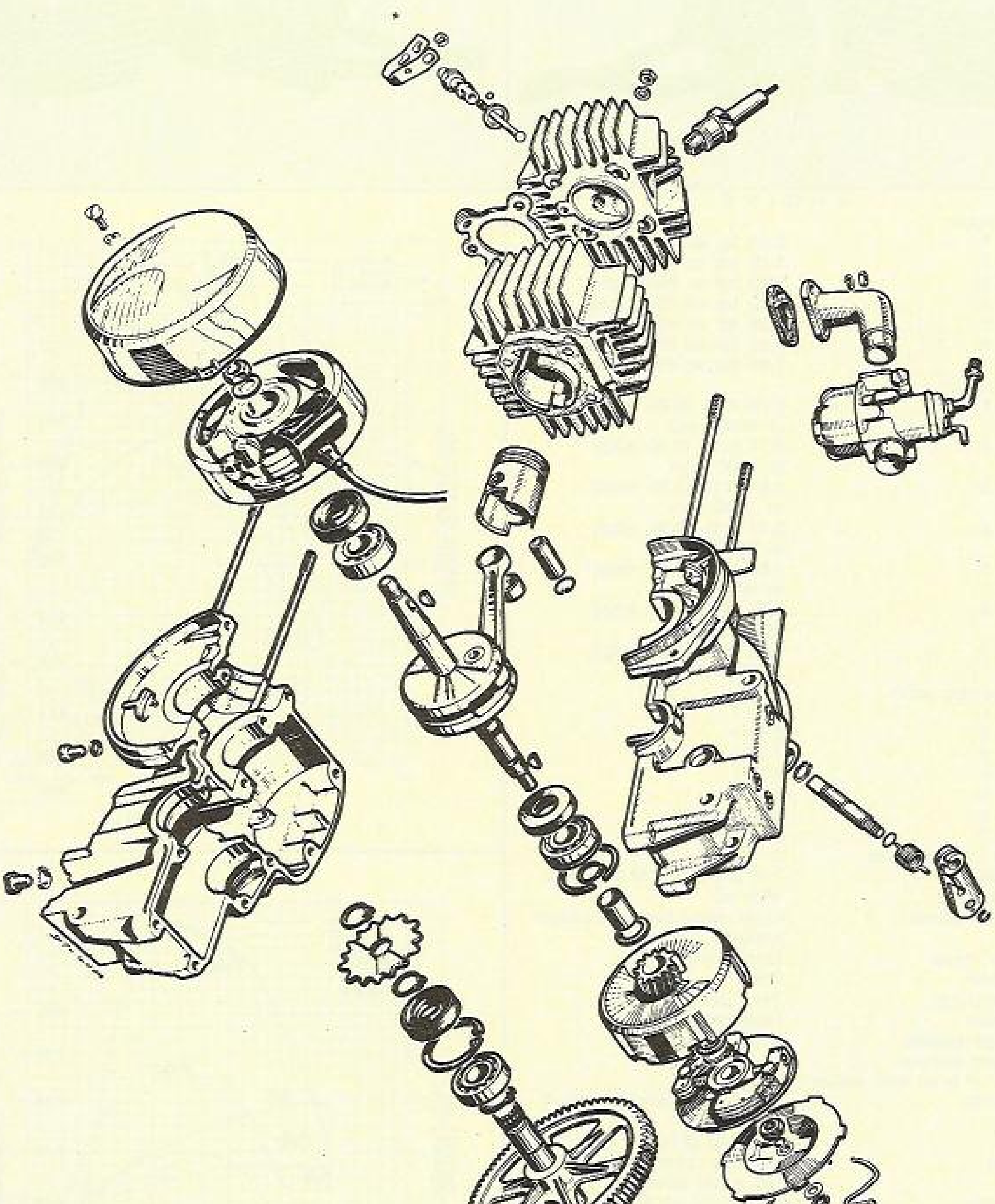
2346



ENGINE REVOLUTIONS

Maxi-engine

50 ccm | 0.8 to 2.2 hp | Automatic gear box



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1st Edition

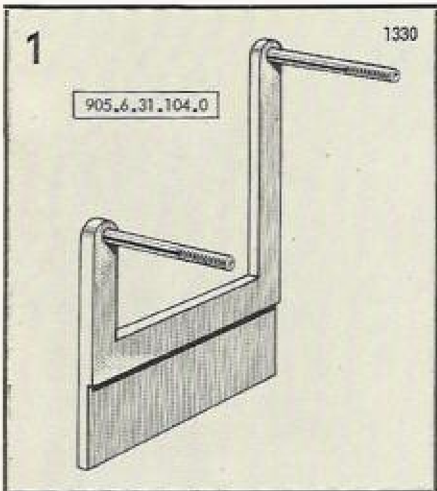
List of special tools

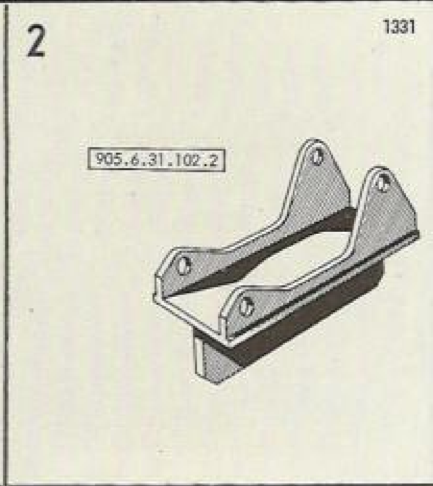
Figure	DESCRIPTION	Part number	ENGINE TYPES							
			X 30	X 30 A	MSV	MSA	VSD	R	V	M
1	Engine bracket	905.6.31.104.0	x	x						
2	Engine bracket	905.6.31.102.2			x	x	x	x	x	x
3	Flywheel extractor	050.7012	x	x	x	x	x	x	x	x
4	Locking plate for flywheel	320.1.70.014.2	x	x						
5	Locking bar for flywheel	905.6.36.103.2			x	x	x	x	x	x
6	Socket spanner for cylinder	905.6.35.101.1								x
7	Guide for gudgeon pin assembly	905.6.31.103.1								x
8	Reaming and centering unit (Hunger Puch 000.0)	obtain locally	x	x	x	x	x	x	x	
9	Pressing-in device for connecting rod bush dia. 10 mm	905.6.33.101.0	x	x	x	x	x	x	x	
9	Pressing-in device for connecting rod bush dia. 15 mm	905.6.33.102.0						x		
10	Locking device for primary gearwheel	360.1.70.014.1	x		x		x	x		
11	Locking device for primary gearwheel	320.1.70.017.2		x						
12	Locking device for primary gearwheel	350.3.10.600.0/W1				x				
13	Locking device for primary gearwheel	905.6.36.104.2							x	
14	Locking device for primary gearwheel	905.6.36.102.1								x
15	Clutch spanner	905.6.31.105.0	x		x		x	x	x	x
16	Clutch-drum extractor	905.0.24.101.0		x		x				
17	Main-bearing play tester	350.1.70.013.0	x	x	x	x	x	x	x	
18	Bearing extractor	905.0.24.102.0	x	x	x	x	x	x	x	
19	Bearing extractor	905.6.34.101.0								x
20	Gauge	050.1.1032/L44	x	x	x	x	x	x	x	
20	Depth gauge	905.6.32.103.0	x	x	x	x	x	x	x	
21	Press bar for main bearings	350.1.70.012.0	x	x	x	x	x	x	x	
22	Press bar for main bearings	905.6.33.103.1								x
23	Press table	320.1.70.012.2	x	x	x	x	x	x	x	x
24	Puller for bearing ring (KUKKO 22/1 with KUKKO 21/3 or 21/4)	obtain locally	x	x	x	x	x	x	x	x
25	Needle-bearing extractor	905.0.14.005.0		x		x				
26	Press-tool for needle bearing	905.6.33.104.1		x		x				
27	Extractor for cover disc	320.1.70.019.0		x						
28	Assembling pin for gear shaft	331.1.00.000.0/W21	x	x	x	x	x	x	x	x
29	Sprocket holder, 10-teeth	320.1.70.015.2	x	x						

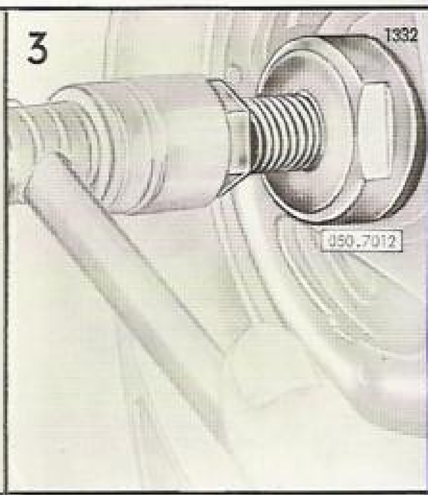
List of special tools

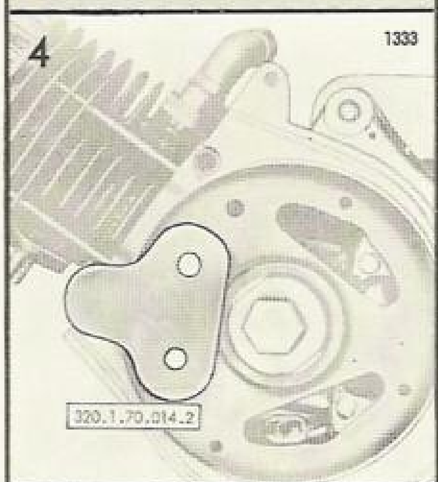
Figure	DESCRIPTION	Part number	ENGINE TYPES							
			X 30	X 30 A	MSV	MSA	VSD	R	V	M
29	Sprocket holder, 11-teeth	320.1.70.016.2	x	x						
30	Sprocket holder	905.0.36.101.2			x	x	x	x	x	x
31	Dial gauge holder for ignition timing	905.6.32.101.0	x	x	x	x	x	x	x	x
	Dial gauge	obtain locally	x	x	x	x	x	x	x	x
32	Timing tester	obtain locally	x	x	x	x	x	x	x	x
	Depth gauge	obtain locally		x		x				
	Bore gauge	obtain locally	x	x	x	x	x	x	x	x
	Feeler gauge	obtain locally	x	x	x	x	x	x	x	x
	Micrometer	obtain locally	x	x	x	x	x	x	x	x
	Torque spanner	obtain locally	x	x	x	x	x	x	x	x
	Assembly board	make yourself	x	x	x	x	x	x	x	x

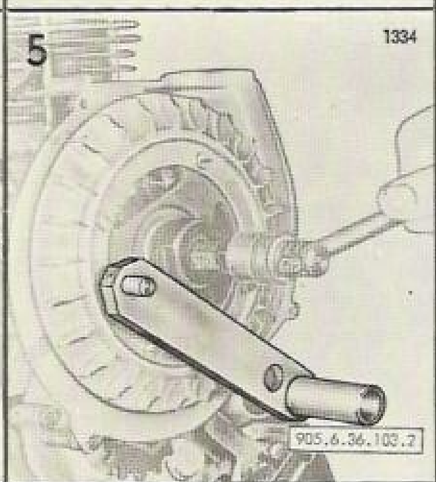
Special tools

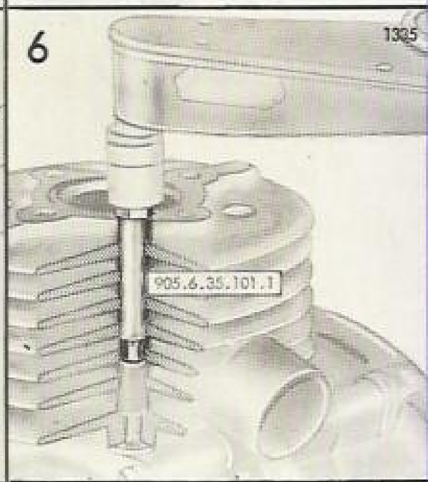


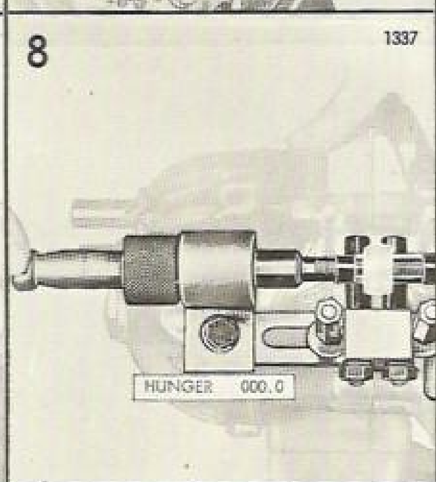


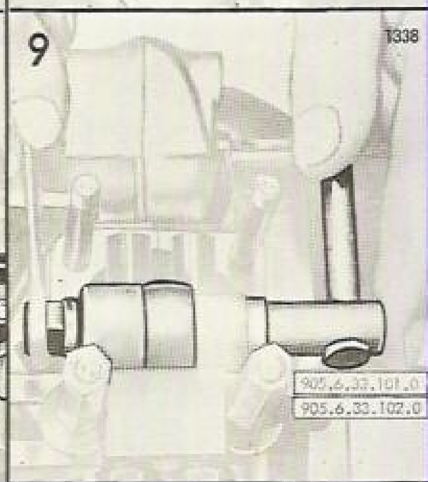


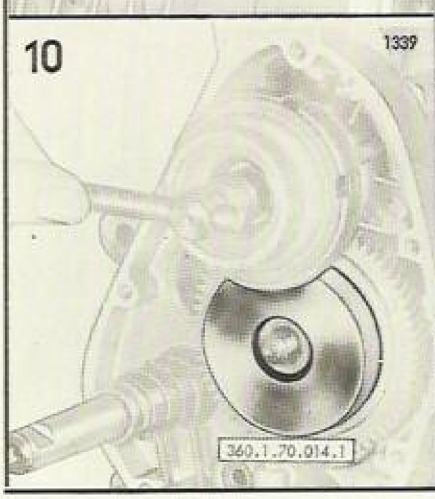


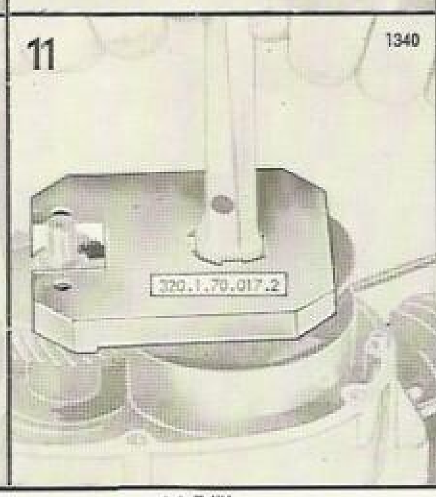




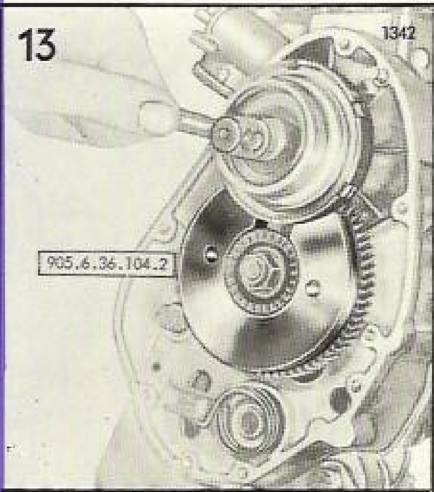


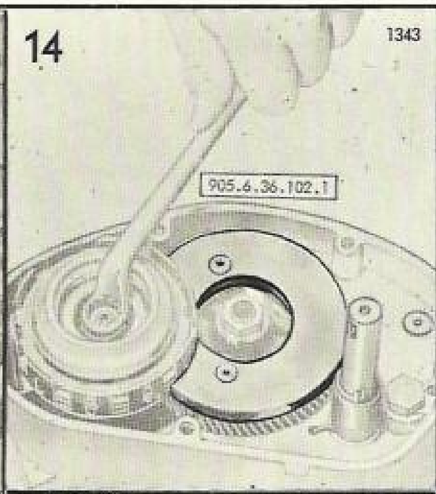


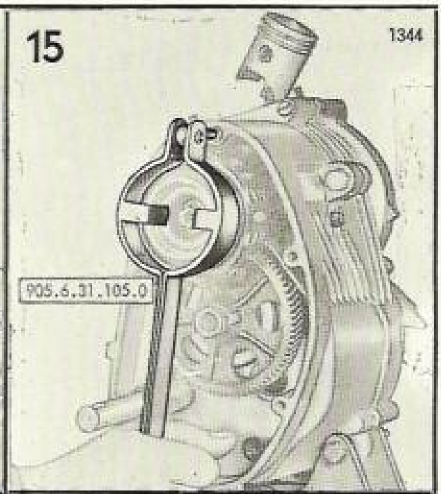


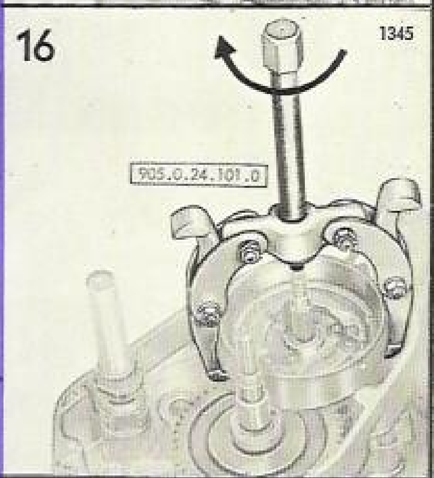


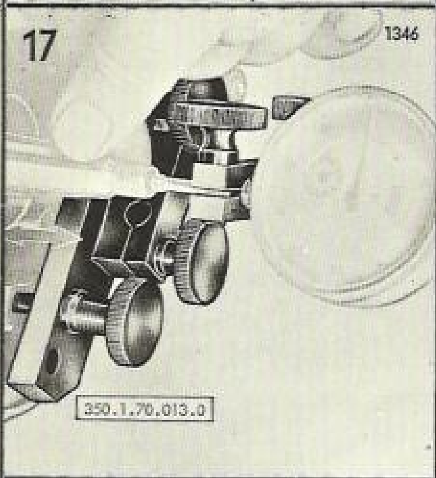
Special tools

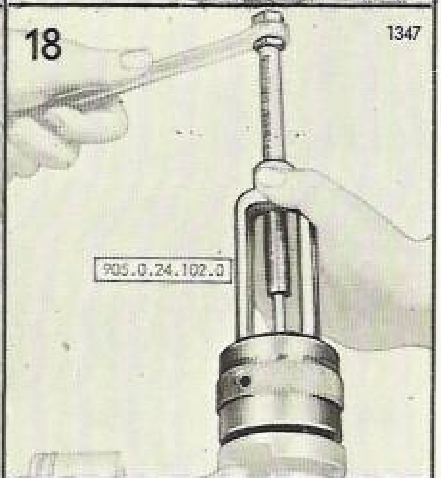


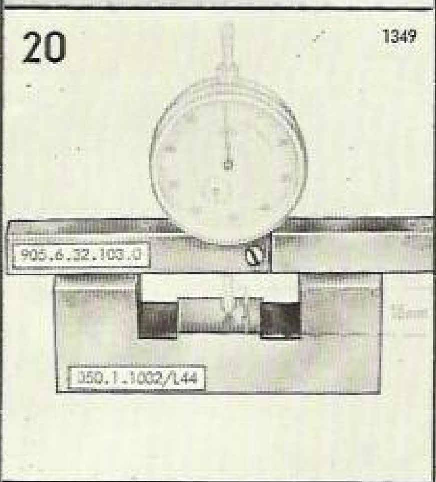


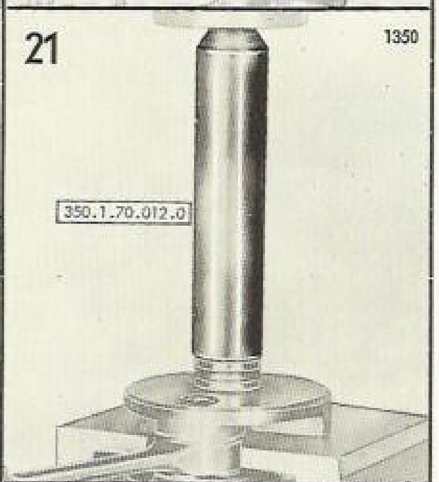


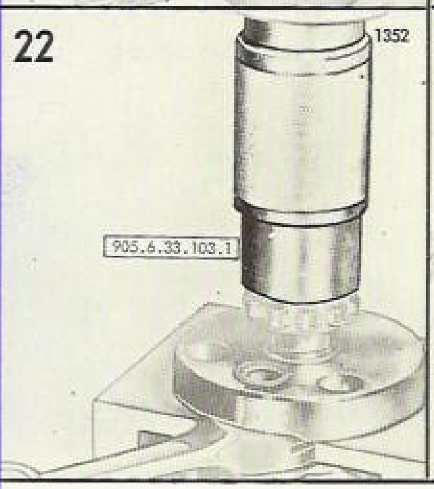


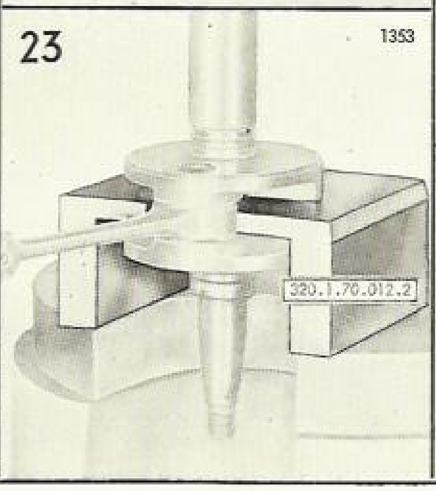


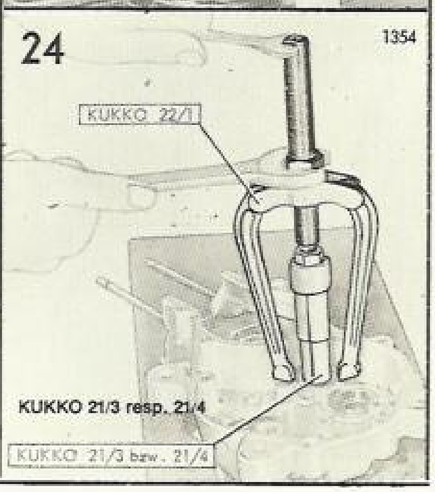








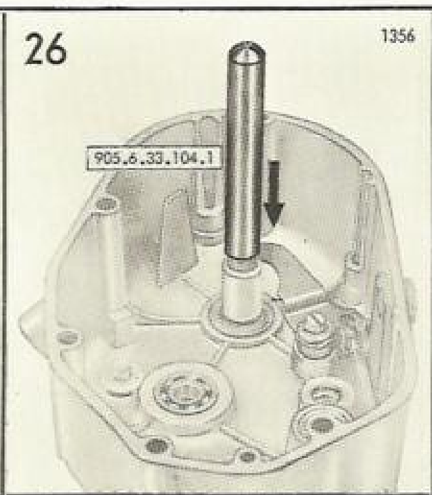




Special tools

25

26



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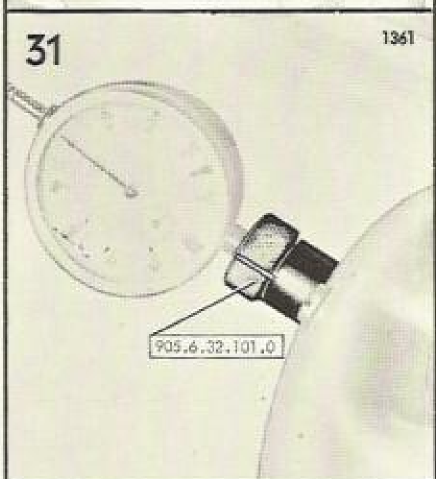

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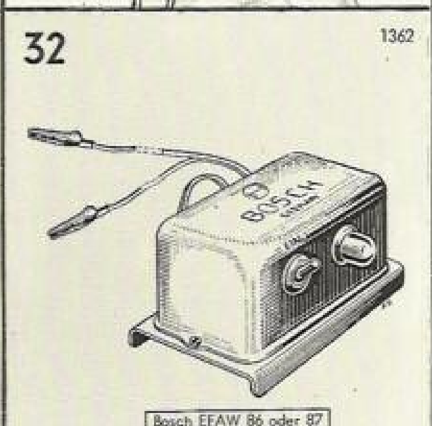


Bosch EFAW 86 or 87

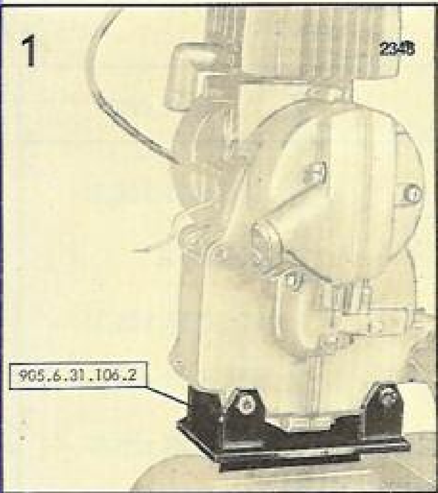
Special tools, Maxi engine

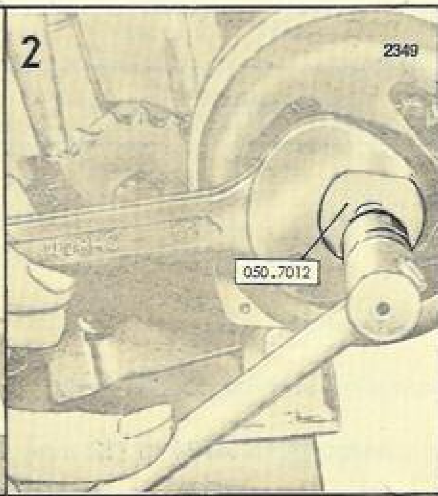
Fig.	Description	Part No.
1	Engine holder	905.6.31.106.2
2	Flywheel extractor	050.7012
3	Locking device for flywheel	905.0.36.101.2
4	Reaming and centering unit for conrod bush	905.6.17.101.0
5	Press-in tool for conrod bush .4724 in (12 mm) dia	905.6.33.105.0
6	Extractor for main and gear bearings and flywheel clutch	905.6.34.102.0
7	Press sleeve for main bearing	350.1.70.012.2
8	Support	320.1.70.012.2
9	Ignition timing device	905.0.12.101.0
–	Gauge for bore	obtain locally
–	Feeler	obtain locally
–	Micrometer	obtain locally
–	Torque wrench	obtain locally

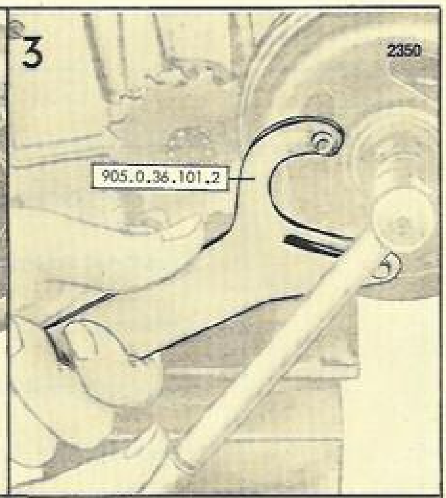
Instead of the reaming and centering unit part no. 905.6.17.101.0. (figure 4, page B 8) the units Hunger 000.0 or Hunger 005.0 (figure 8, page B 3) can be used. However, a Hunger P 11.5–12.5 reamer and a guide bush number 2 must be added.

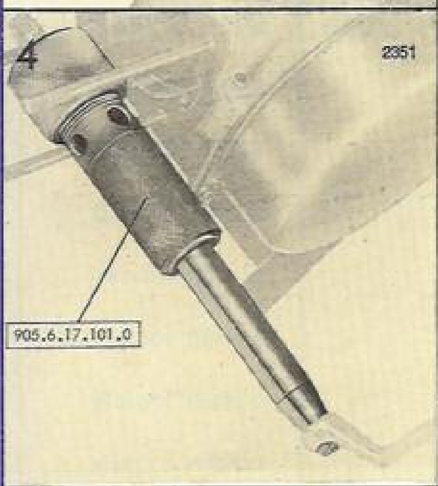
Instead of the ignition device part no. 905.0.12.101.0 any timing device having optical or sound signals can be used, e. g., Bosch EFAW 86 or 87 (see figure 32, Page B 5).

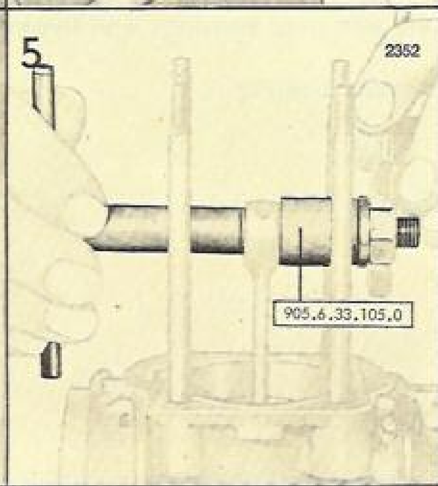
Special tools, Maxi-engine

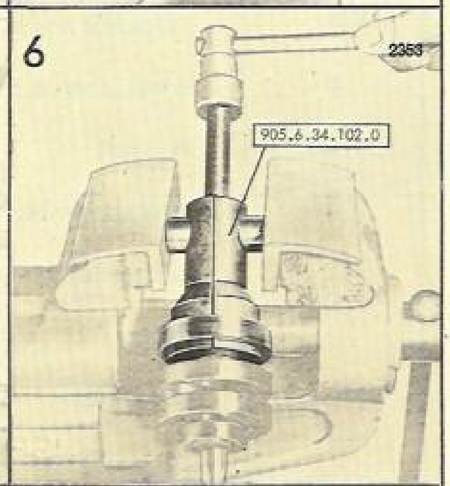


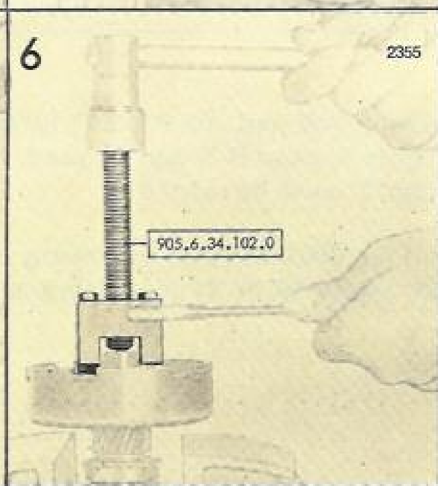


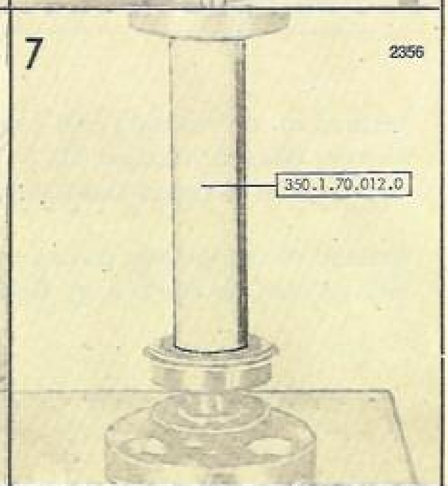


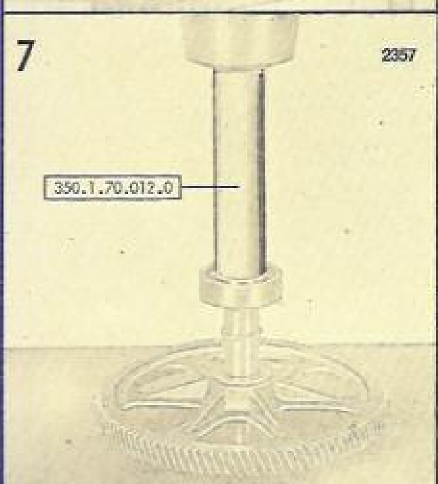


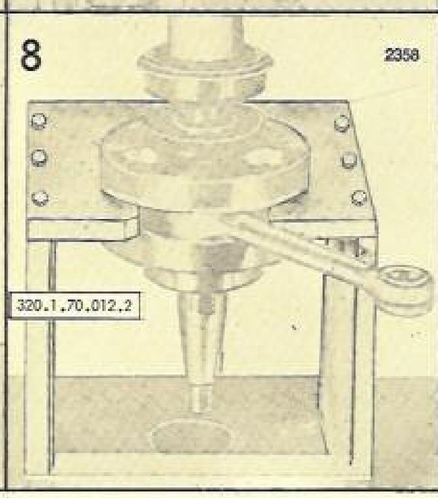


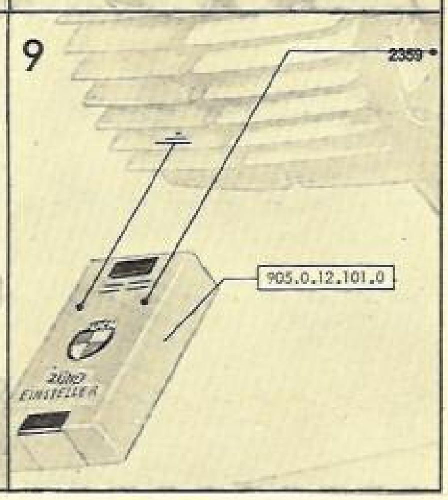






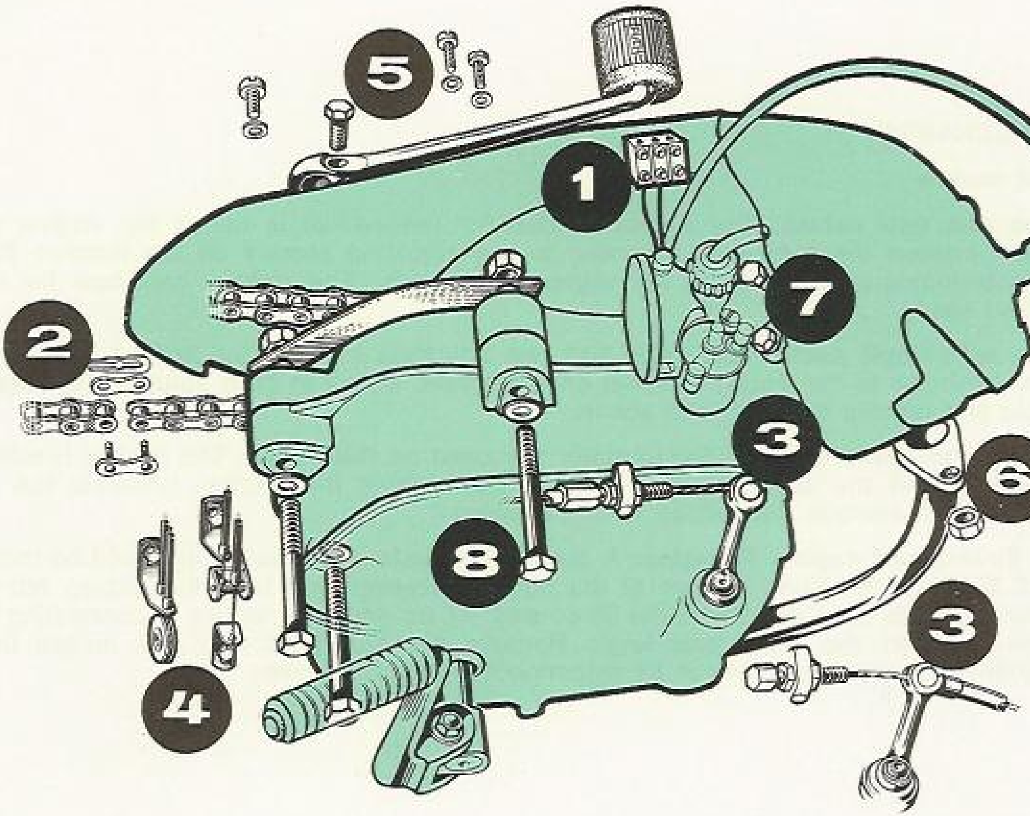






1st Edition

Hints on removing the engine



1 ELECTRICAL CONNECTIONS

Disconnect the cables from the flywheel magneto on the terminal block after removing the covers, left pedal and, on the four-speed models, the gear-control lever.

yellow	=	headlight cable
green	=	stoplight cable (horn)
blue	=	cable to terminal of ignition coil (only on models equipped with separate coil)
black	=	short circuit cable
grey	=	town light cable

2 CHAIN

Open coupling and remove chain.

3 CLUTCH OR STARTING MECHANISM

X 30, MSV, VSD, R, V or M models

Declutch and hold in the lever. Unhook the cable and remove the slotted nipple. Unscrew the counter nut from the cable adjusting screw on the housing cover and take the cable away from the housing.

Models having an adjusting screw on the handlebar gear change control do not have another adjuster. The cable may be taken out of the clutch cover after unhooking.

X 30 A and MSA models

The cable operating the starting mechanism is disconnected from the hand lever and pulled out the cable tunnel at the opening of the housing cover. Roll up the cable and leave on the engine.

Hints on removing the engine

4 HANDCHANGE

X 30 models

Type with dual cables: The anchor bracket for the cables is above the engine on the frame. Loosen the cables by screwing in the adjusting screws on the bracket. Remove the top engine bolt and press the engine downwards. The cables can now be disconnected easily.

Type with single cable: This cable has two adjusting screws, one fitted to the operating lever and one to the anchor bracket on the frame. Screw in both adjusters to loosen the cable and remove as described above.

MS/VS two-speed models: Dual cables are used on this model. The anchor brackets are positioned on the frame to the right of and behind the engine. Unscrew the anchor bracket and remove the cables from the lever.

VS three-speed engine, R-engine: A dual cable system and pulley are used on these models. Remove the fixing screws of the holding bracket and take the cables out of the roller. There is a difference on the 50 cc and 60 cc scooters where a connecting bar is fitted between the roller and lever. Remove the locking device and loosen the nut, enabling the connecting bar to be disconnected from the lever.

5 FOOTCHANGE

Remove the lever or unhook the control bar, as applicable.

6 EXHAUST

Unscrew or loosen the exhaust pipe from the cylinder and swivel the pipe downwards. The silencer fixing screws must be loosened to prevent damage to the cylinder.

7 CARBURETTOR

Remove from the engine after removing fixing screws (Bing 1/9,5; 1/12) or after loosening the clamping screw (Bing 1/11; 1/14; 1/17).

8 ENGINE FIXING SCREWS

Remove after opening the locking devices and unscrewing the nuts. Take the engine out of the frame. Detailed descriptions of access and removal of engines from the different frames are given in the frame section, colour green.

Dismantling the engine

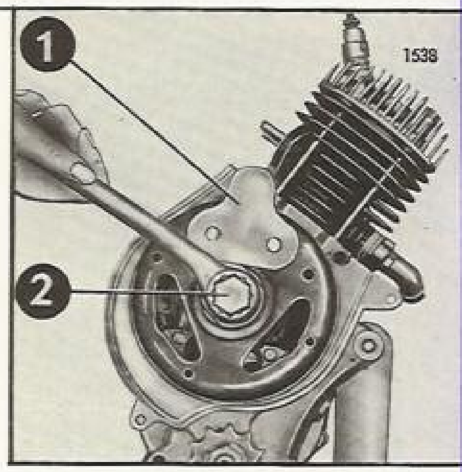


Fig. 1

Unnecessary work will be prevented by locating the fault before the engine is dismantled since most common faults are rectified without stripping the engine.

The following parts can be repaired with the engine in position in the frame:

Cylinder and piston – on all types of engines

Clutch and primary drive – on all types of engines

Centrifugal clutches including free – wheeling devices on the models X 30 and MS automatic.

Start or change mechanisms, completely on V engine and partly on MSA engine.

Gear box, except for shifting fork on all types of motor save V and M engine.

If dismantling should be necessary, clean the removed engine thoroughly, drain the oil and, if not already removed, dismantle the kick starter, foot pedal, decompressor hood and all other parts obstructing the engine-stripping procedure. The engine block is mounted to the engine bracket (see list of special tools) and clamped in a vice. The different engine types are dismantled as follows:

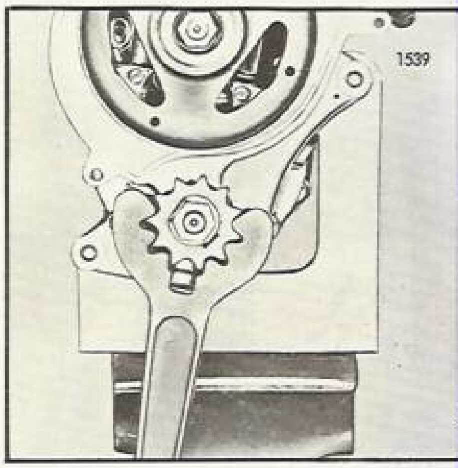


Fig. 2

X 30 - ENGINE

Unscrew sparking plug, remove plug connector and take off fan cover after unscrewing the 5 fixing screws. Dismantle fan after removing 4 fixing screws.

Fit locking plate part number 320.1.70.014.2 to flywheel (see fig. 1/1). Unscrew locking nut and pull off flywheel with extractor No. 050.7012 (see fig. 1/2). Take key out of crankshaft.

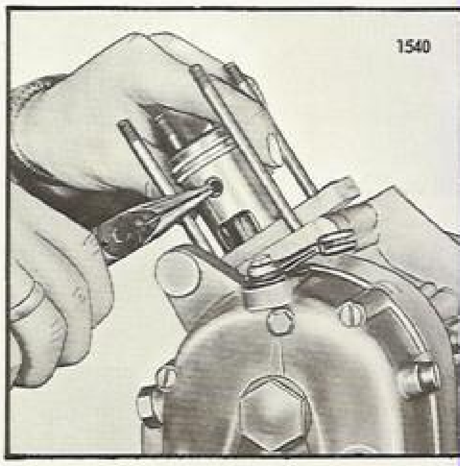
Pull electrical cables out of grommet and take off flywheel magneto baseplate after removing the three fixing screws. Insert baseplate into flywheel.

Dismantle the drive-chain sprocket. Use sprocket holder No. 320.1.70.015.2 for 10-tooth or No. 320.170.016.2 for 11-tooth sprockets in order to remove locking nut (see fig. 2).

Loosen the housing screws and turn engine and engine bracket around. Remove nuts holding the cylinder head and take off cylinder and head.

Remove gudgeon-pin circlips from piston (fig. 3), clean the bore outside of the clips with a scraper and

Fig. 3



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Dismantling the engine-type X 30

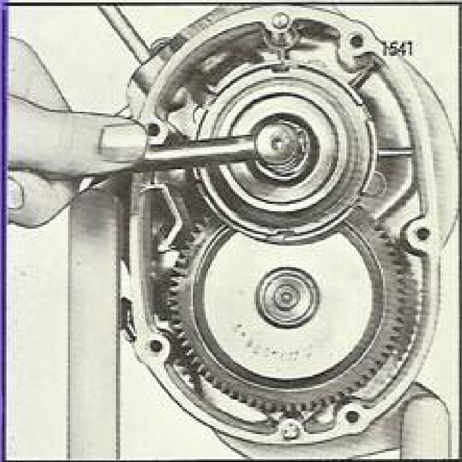


Fig. 4 ▲ Fig. 5 ▼

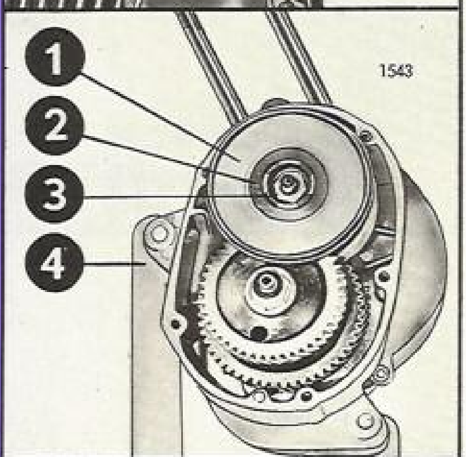
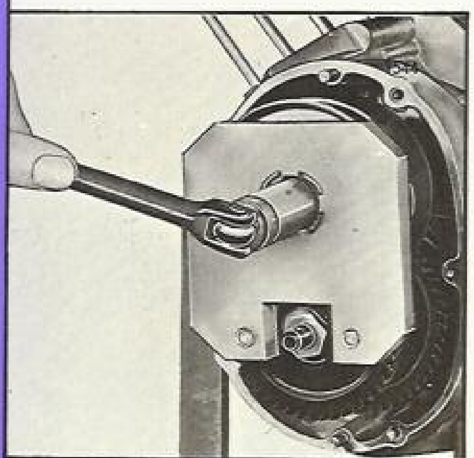


Fig. 6 ▲ Fig. 7 ▼



push out the gudgeon pin (as in fig. 22). Tap slightly if necessary. Commercially available gudgeon-pin extractors may be used, but the piston rings must be removed first (be careful not to interchange them when reassembling). Take off the piston.

Remove the clutch housing after unscrewing the centering screw on the guiding nut of the clutch bracket and after dismantling the five cover-fixing screws.

Use a mallet to loosen the cover if necessary. Move the clutch lever until the spindle releases the guiding nut and lift off the housing (as in fig. 23).

Dismantle the clutch and primary drive by removing the large circlip from the clutch bracket and lifting off the bracket. Bend up the locking plates of the fixing nuts on the crankshaft and layshaft. Fit locking disc No. 360.1.70.014.1 and loosen first the layshaft nut and then the crankshaft nut (see fig. 4). Take off the clutch assembly and primary gears and then remove the engine from the engine bracket (fig. 6/4).

Lay the engine with the clutch side on the assembly board and remove the housing screws (turn over the engine).

Remove the right-hand half of the crankshaft (clutch side), if necessary tap the layshaft with a rubber mallet. Gears and shifting mechanism and crankshaft are now accessible and may be removed.

X 30 A ENGINE

Proceed on the left-hand housing (flywheel magneto) as on the X 30 engine, but when taking off the fan cover remove the decompressor hood after loosening the clamping screw (fig. 5) together with the short decompressor cable. Cylinder and piston: same procedure as X 30 engine. Unscrew housing cover fixing screws. Loosen cover with the rubber mallet and take off together with the clutch actuating mechanism. Take off the crankshaft-locking ring (fig. 6/3) with a pair of pointed pliers or a screwdriver and lift off the driving disc (fig. 6/1) including spring and buffer disc for starting device (fig. 6/2).

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Dismantling engine-type X 30 A

Bend up the locking plates on the crankshaft and layshaft fixing nuts. Fix the primary-gear locking device No. 320.1.70.017.2, unscrew the nuts and remove the locking plates (see fig. 7). Remove the driving discs from the crankshaft and remove the second-speed gearwheel from the layshaft. Pull the clutch drum and two centrifugal clutches from the crankshaft (fig. 8) with extractor No. 905.0.24.101.0. When dismantling note the steel and bronze bushes, the disc and the shims.

Pull out the layshaft together with the first-speed gearwheel and free-wheeling unit and remove the engine from the engine bracket No. 905.6.31.104.0.

Lay the engine with the clutch downwards on the assembly board and remove the crankcase screws. Part the crankcase halves, if necessary by slightly tapping with a rubber mallet.

The gear spindle and crankshaft are now accessible and can be removed.

MSV ENGINE

Unscrew the sparking plug and remove the fan hood after removing the two fixing screws.

Models with foot control only: Remove the foot control unit after unscrewing the four fixing screws.

Unscrew the fan cover and remove the fan housing after unscrewing the fixing screws (two front, one back). Remove the wire clip holding the flywheel magneto cover and take off the cover.

Fit holding bracket No. 905.6.36.103.2 to pedal spindle (kickstarter spindle) and insert into openings in the flywheel (fig. 9). Use a pulling action only on the bracket. Remove the fixing nut, change over the bracket (fig. 10) and pull the flywheel off the crankshaft with extractor No. 050.7012. Take the key out of the end of the crankshaft. Take off the flywheel magneto baseplate, including rubber grommet, after removing the three fixing screws and replacing them in the flywheel for safe keeping. Remove the four fixing screws of the fan baseplate, take off the baseplate and chain catch. Do not loosen the two rubber stops sealing the fan baseplate, situated between the baseplate and the two housing screws nearest to the cylinder.

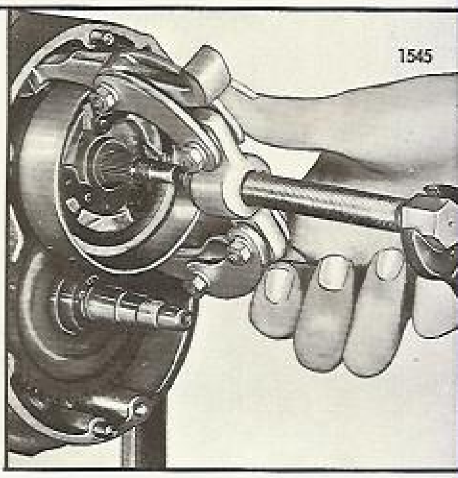
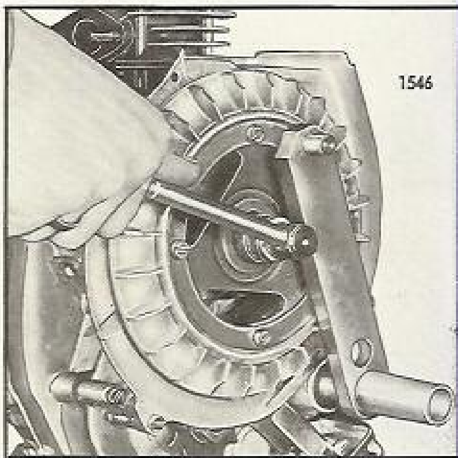


Fig. 8 ▲ Fig. 9 ▼



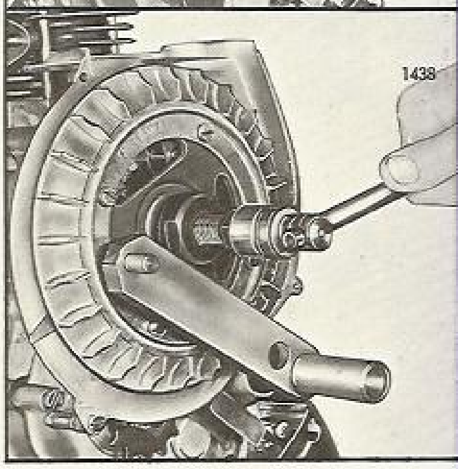
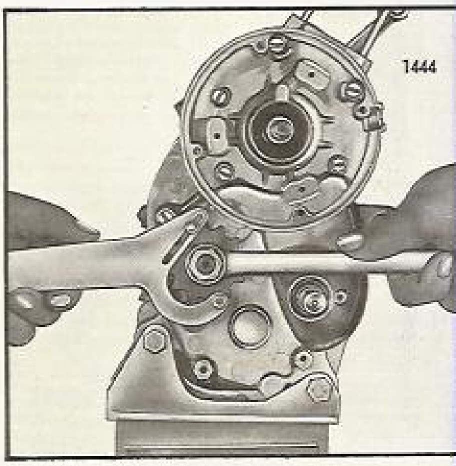


Fig. 10 ▲ Fig. 11 ▼



Dismantling the engine-type MSV

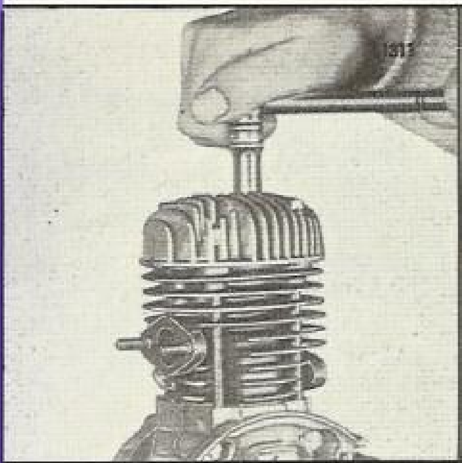
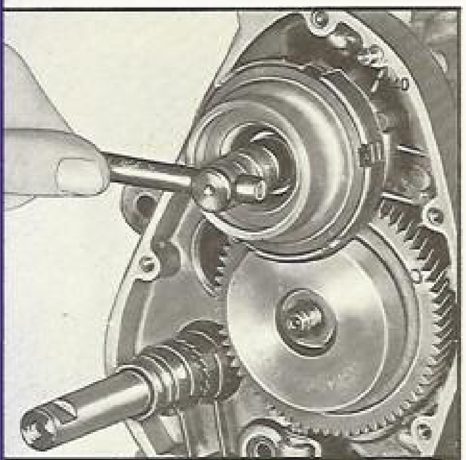


Fig. 12 ▲ Fig. 13 ▼



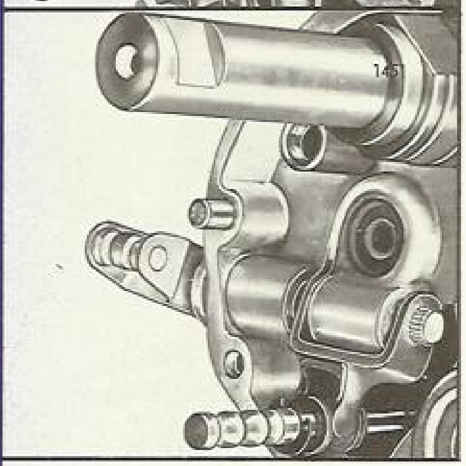
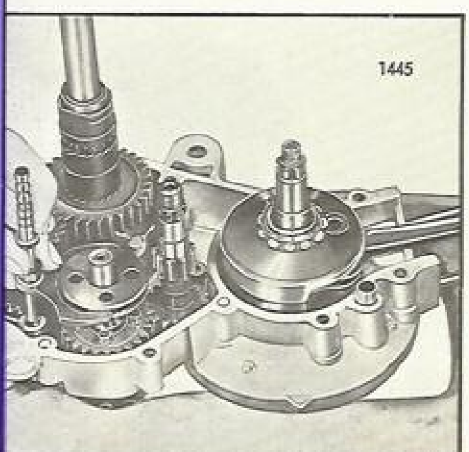


Fig. 14 ▲ Fig. 15 ▼



Remove the chain sprocket by means of sprocket holder No. 905.0.36.101.2 (fig. 11). (Apply pressure to the holder). Loosen the housing screws and turn round the engine and engine bracket No. 905.6.31.102.2.

Unscrew the cylinder-head nuts (fig. 12) and remove the cylinder and head.

Remove the gudgeon-pin circlips (as fig. 3) and clean the gudgeon-pin bore outside of the circlips with a scraper. Press out the pin (fig. 22), tapping lightly if necessary. A commercial gudgeon-pin extractor may be used but, if so, the piston rings must first be removed – care being taken to avoid interchange on assembly. Remove the piston.

To dismantle the clutch housing cover, unscrew the centering screw of the guiding nut on the clutch bracket and remove the fixing screws. Operate the clutch lever until the clutch spindle releases the guiding nut (fig. 23). On models without brake cable (brakes not operated by pedal) remove the housing cover by lightly tapping with a rubber mallet where necessary. If a brake cable is fitted, turn the pedal bearing spindle to braking position and lift up the cover approximately 1½in, tapping if necessary. The device securing the brake lever to the pedal spindle is not accessible and may be removed with a screwdriver. The housing cover can now be taken off completely.

The clutch bearing can be removed after pulling off the circlip.

Bend up the security plates on the crankshaft and layshaft. Fit gear holder No. 360.1.70.014.1 and loosen firstly the nut on the layshaft and then the nut on the crankshaft. Take off the nuts, securing plates, clutch components and layshaft gear wheel.

Pull the brake spring from the pedal bearing spindle. On models with hand gear control it is now necessary to remove the washers and ring from the control rail (fig. 14). Remove the engine bracket. Fix the engine to assembling board, clutch side facing downwards. Unscrew the housing screws and turn the engine round. Remove the right housing half (clutch side), if necessary tapping lightly with a rubber mallet.

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Dismantling the engine-type MSV

Gears control fork (fig. 15) and crankshaft are accessible after removing the right housing half and can be dismantled.

MSA ENGINE

All work on the left housing side (flywheel side) and dismantling of the cylinder, head and piston, is identical with that of the MSV engine. Remove the housing cover screws and remove the operating lever of the pedalling mechanism after unscrewing the grub screw (fig. 16). Loosen the cover with a mallet if necessary and take off carefully. The slide bush and the intermediate starter spindle with starter gears will remain in the cover. Remove the gears and spindle from the cover. The catch with hooked-on cable remains in the cover.

Take the starter gear wheel (fig. 17/1) from the pedal spindle and washer (fig. 17/2) from the intermediate spindle. On models with brake cable, unhook the cable (fig. 17/3). Take off the spring ring and remove the brake lever and washer from the pedal spindle. Take complete unit of pedalling mechanism (fig. 17/4) out of the housing.

Loosen the nuts on the crankshaft and intermediate spindle (layshaft). Fit the gear holder No. 350.3.10.600.0/W 1. This sprecial tool consists of a holder to lock the crankshaft and layshaft and a socket spanner to loosen the crankshaft nut (fig. 18). Unscrew the nut, remove the holder and take the second-speed gear wheel (fig. 17/5) from the layshaft.

Remove the driver, centrifugal clutch (fig. 17/6) and second-speed gear wheel.

Use extractor No. 905.0.24.101.0 to remove the clutch drum with first-speed centrifugal clutch from the crankshaft. Figure 19 illustrates inserting the extractor, figure 20 shows extracting. Remove the washer from the crankshaft and take the intermediate spindle complete with first-speed gear wheel and free-wheeling device including ball bearing out of the housing (the ball bearing has a push seating in the cover).

Remove the spring from the sliding bush on the pedal spindle and take the engine out of engine bracket No. 905.6.31.102.2. Put the engine onto the assembling board and remove the housing screws. Turn engine round.

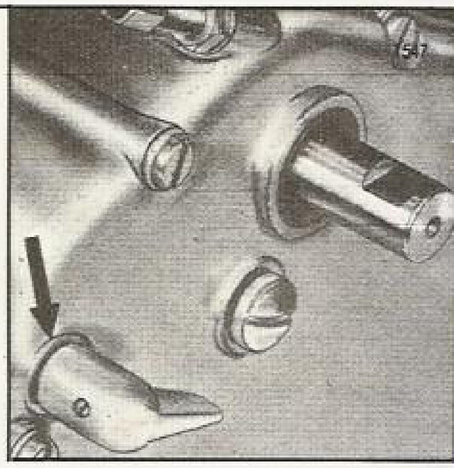
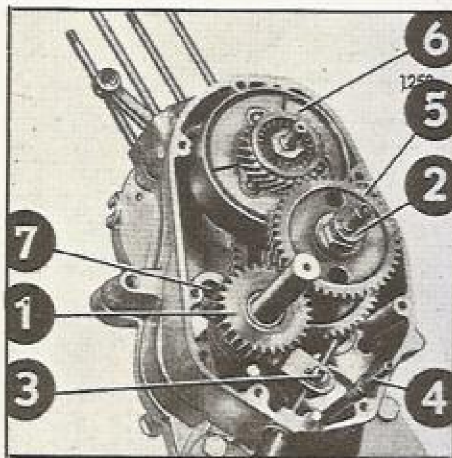


Fig. 16 ▲ Fig. 17 ▼



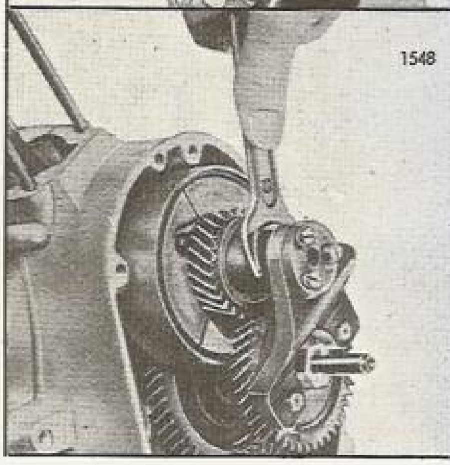
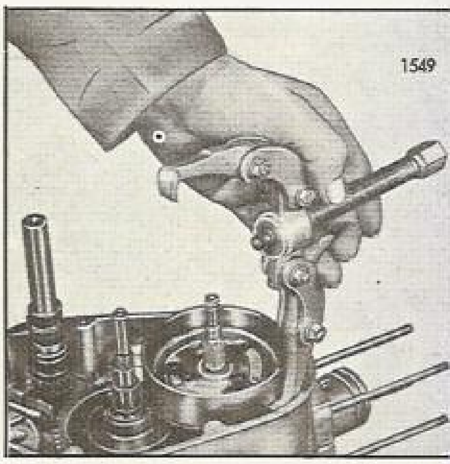


Fig. 18 ▲ Fig. 19 ▼



Dismantling the engine-types VSD and R

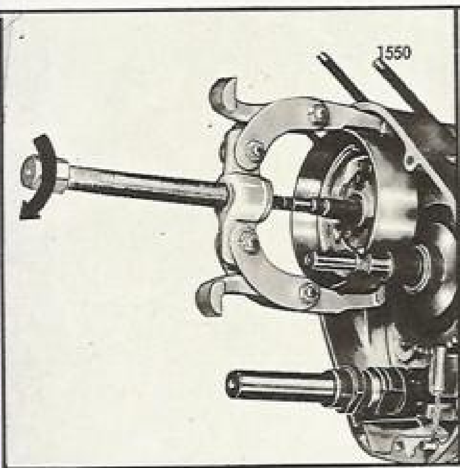
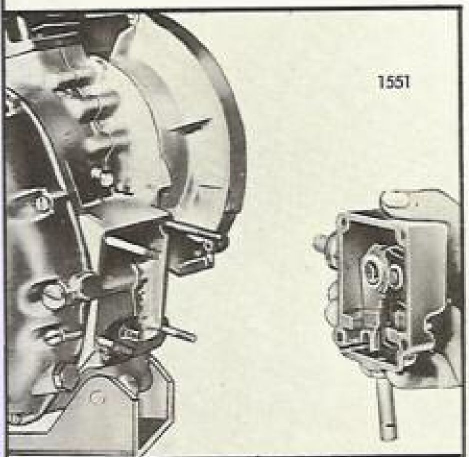


Fig. 20 ▲ Fig. 21 ▼



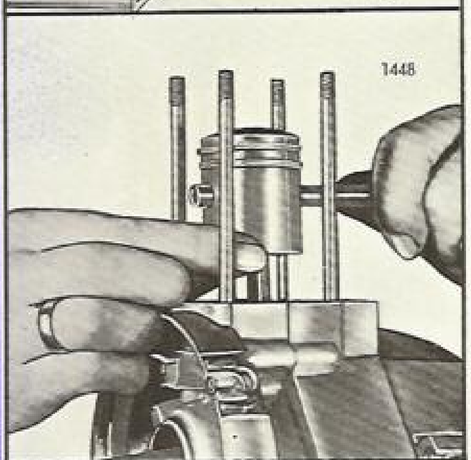


Fig. 22 ▲ Fig. 23 ▼

Remove the right-hand crankcase half (clutch side) by tapping on the layshaft with a mallet if necessary. The gear-box components and crankshaft are now accessible and can be taken out.

VSD and R engines

VSD and R engines use the same dismantling procedure. On foot-changge models first remove the foot-change unit after unscrewing the four fixing nuts (fig. 21).

All work on the left housing side (flywheel side) and the dismantling of the cylinder, head and piston is the same as for the MSV engine (fig. 22).

To remove the housing cover over the clutch, unscrew the centering screw of the guiding nut on the clutch bracket and take out the fixing screws. Turn the clutch lever until the clutch spindle releases the guiding nut (fig. 23). On models without brake cable (brakes not operated by pedal spindle), remove the cover by lightly tapping with a mallet as necessary. If a brake cable is fitted, first turn the spindle to full braking and lift up the cover by approximately 1½ in (tap if necessary). The securing device holding the brake lever to the pedal spindle is now accessible and can be removed with a screwdriver. The housing cover can now be lifted off completely.

Dismantle the clutch and primary drive by removing the large circlip from the clutch bracket and taking off the bracket. Bend up the locking plate of the nuts on the crankshaft and hayshaft. Fit the gear holder No. 360.1.70.014.1 and loosen first the nut on the layshaft (fig. 24) and then the nut on the crankshaft. Take off the clutch components and primary gear wheels.

Remove the circlip from the crankshaft and take the engine out of engine bracket No. 905.6.31.102.2. Put the engine on an assembling board, clutch side downwards, and unscrew the crankcase screws. Turn the engine round.

Remove the right-hand half of the crankcase (clutch side) by tapping lightling with a mallet on the layshaft. Gear box, control fork and crankshaft are now accessible and can be dismantled.

1st Edition

Dismantling the engine-type V

V engine

Unscrew the sparking plug and dismantle the fan hood after removing the fixing screws.

Unscrew the fan cover and take off fan housing after removing the fixing screws (two front, one back). Remove flywheel cover after taking out the holding spring ring.

Slide the holding bracket No. 905.6.36.103.2 to control the spindle and insert the other end into the opening in the flywheel (fig. 25). Remove the fixing nut. Change over the holding bracket and remove the flywheel from the crankshaft with extractor No. 050.7012. Remove the crankshaft key (fig. 34).

Take off flywheel magneto baseplate, including the rubber grommet, after unscrewing the three fixing screws. Insert the baseplate into the flywheel. Remove the fan baseplate and chain bracket after unscrewing the fixing screws. Take out the two rubber strips sealing the fan baseplate.

Remove circlip, cover disc and O ring from control spindle (fig. 35).

Fit the sprocket holder No. 905.0.36.101.2 to sprocket (by pressing), remove nut and take off the sprocket (fig. 26). Loosen the crankcase screws and turn round engine with engine bracket No. 905.6.31.102.2.

Unscrew cylinder-head nuts and take off cylinder and head. Remove gudgeon-pin circlips from piston (fig. 3), clean gudgeon pin bore outside of circlips with a scraper and press out the pin, tapping if necessary (fig. 22). If a commercial gudgeon-pin extractor is used the piston rings must be removed, care being taken not to interchange the rings on reassembly. Remove the piston. Unscrew the centering screw from the guiding nut of the clutch bracket and remove the cover fixing screws. Turn the clutch lever until the clutch spindle releases the guiding nut (fig. 23). Remove the cover by tapping. The complete starting mechanism remains in the cover (fig. 27). Take off the clutch bracket after removing the circlips. Bend up the securing plates of fixing nuts on the crankshaft and layshaft. Fit gear holder No. 905.6.36.104.2 (fig. 28) and loosen first the nut on the layshaft spindle and then the crankshaft nut.

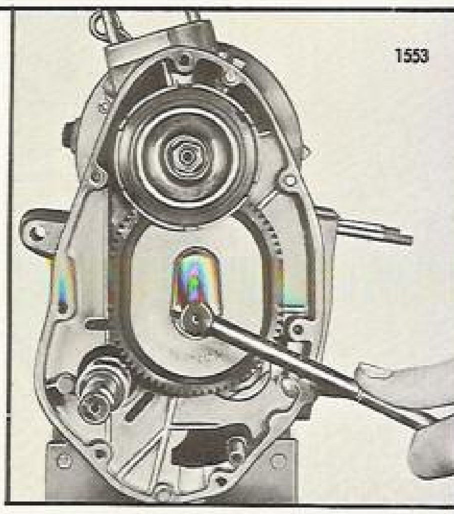
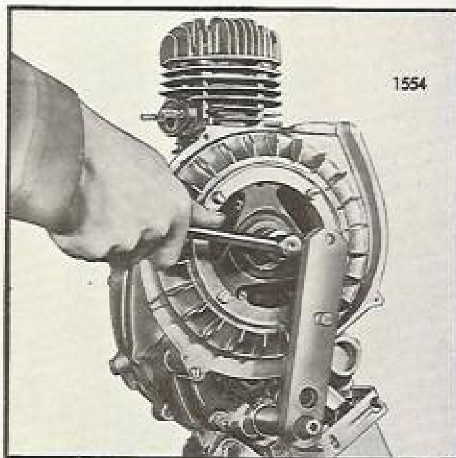


Fig 24 ▲ Fig. 25 ▼



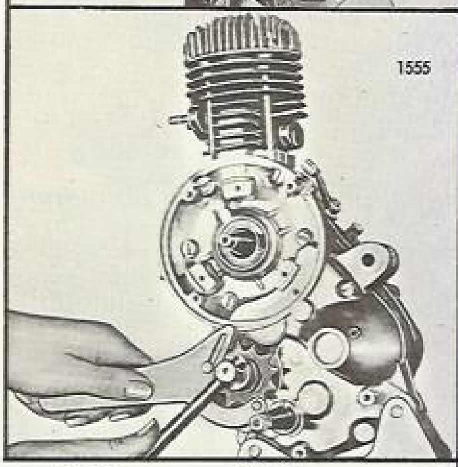
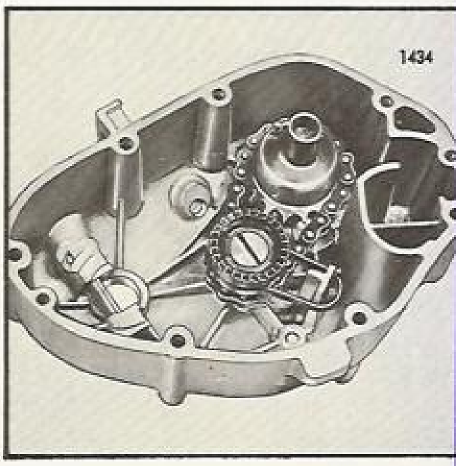


Fig. 26 ▲ Fig. 27 ▼



Dismantling the engine-type V

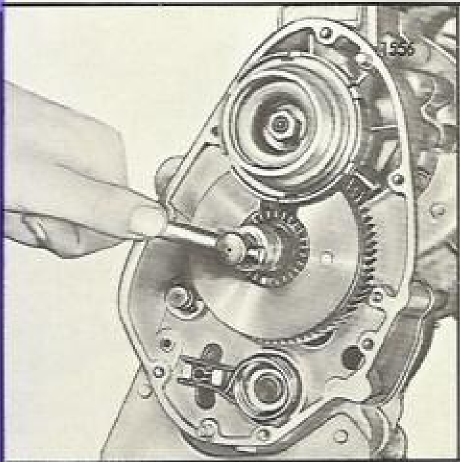


Fig. 28 ▲ Fig. 29 ▼

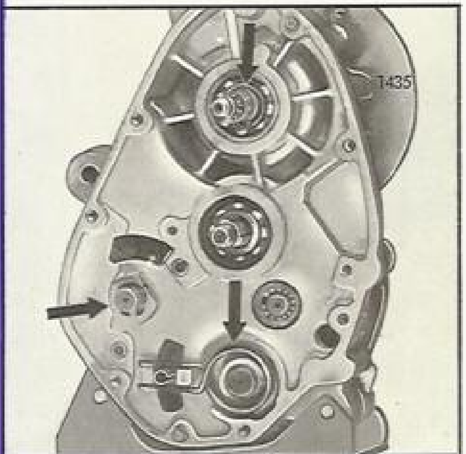
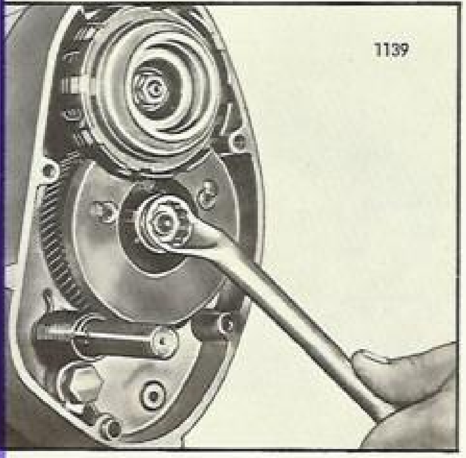


Fig. 30 ▲ Fig. 31 ▼



Remove nuts, security plates, clutch components and intermediate gear wheel with kickstarter ratchet.

Remove the circlips from the crankshaft and gear change spindle. Take out the hairpin spring from the gear control. Remove the engine from the engine bracket (fig. 29).

Put the engine on the assembly board, clutch side downwards and remove the crankcase screws. Turn the engine round.

Remove the right-hand crankcase half (clutch side) by tapping the layshaft with a rubber mallet if necessary.

Crankshaft, gear control and gear box are now accessible. Take out the crankshaft and dismantle the gearbox as follows: First remove the control-fork guide pin (fig. 30), then the top second-speed pair of gears and fourth-speed pair of gears, including the control fork. Remove the third-speed pair of gears including control fork and, finally, the layshaft, mainshaft and first-speed gear. Pull out the gear control complete (axle, drum and selector).

M engine

Contrary to all other engines, dismantling commences from the right-hand side on M types.

Unscrew the sparking plug and take off the right-hand half of the fan hood after removing the fixing screws.

Unscrew the centering screw from the guiding nut on the clutch bracket and remove the cover fixing screws. Loosen the housing cover with a rubber mallet if necessary. Turn the clutch lever until the clutch-spindel releases the guiding nut (as fig. 23) and remove the housing cover.

Dismantle the clutch and primary drive by removing the large circlip from the clutch bracket and removing the bracket. Bend up the security plates of the crankshaft and layshaft nuts. Fit gear holder No. 905.6.36.102.1 and remove firstly the nut on the layshaft and then the crankshaft nut (fig. 31). Take off the clutch components and primary gear wheels. To dismantle the kickstarter spring (not necessary in order to dismantle the engine) remove the spring pin with a 0.1102 in (2.8 mm) punch. Note the spring tension. Take the starter spring off the spindle (fig. 32). The spindle including the hooked-in spring can remain in the housing.

Dismantling the engine-type M

Turn round the engine and bracket No. 905.6.31.102.2. Take off the fan housing with the fan cover after removing the three fixing screws.

Unscrew the nuts on the cylinder head and remove the head. Take off the cylinder after unscrewing the socket screws (fig. 33) with Allen key No. 905.6.35.101.1. The cylinder must not be turned at all or the piston rings will lock into the slots and the piston could not be withdrawn.

Dismantle the piston by removing the circlips, cleaning the gudgeon-pin bore and pushing out the pin. Take the needle-bearing out of the connecting rod.

Note
To prevent any damage, reassemble the needle-bearing and gudgeon pin in the piston and replace in the cylinder.

Remove the two parts of the fan after unscrewing the four fitting screws.

Push the locking bracket No. 905.6.36.103.2 onto the gear control spindle, insert it into the slots of the flywheel (fig. 25) and remove the fixing nut. Change over the locking bracket and remove the flywheel from the crankshaft with extractor No. 050.7012 (fig. 34). Take the key off the crankshaft.

Remove the fan baseplate after unscrewing the three fixing screws. Take off the flywheel magneto baseplate with the rubber grommet after removing the three fixing screws. Insert the baseplate into the flywheel. Fit the sprocket holder No. 905.0.36.101.2 (applying pressure).

Remove the fixing nut and the sprocket (as fig. 26). Take the circlip, disc and 0 ring from the control spindle (fig. 35).

Unscrew the nut from the gear-control unit (fig. 35 – arrowed). Loosen the crankcase screws and remove the engine from the engine bracket.

Put the engine onto the assembling board, flywheel side facing upwards. Unscrew the crankcase screws. Lift off the left-hand crankcase half by tapping with a mallet if necessary.

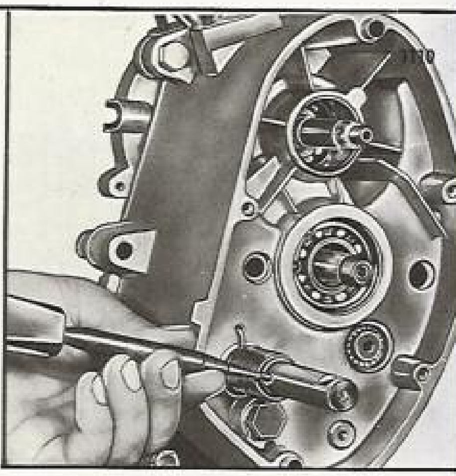


Fig. 32

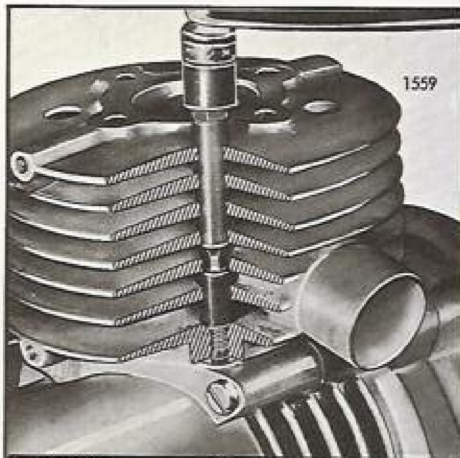


Fig. 33

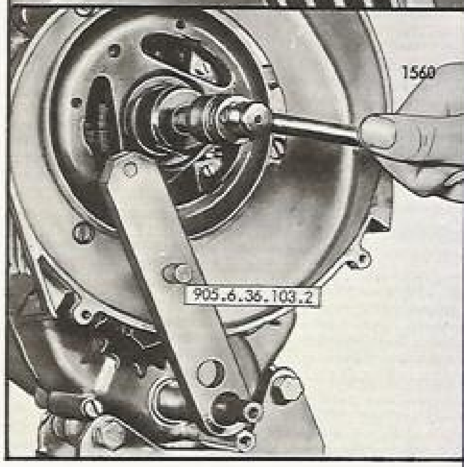


Fig. 34

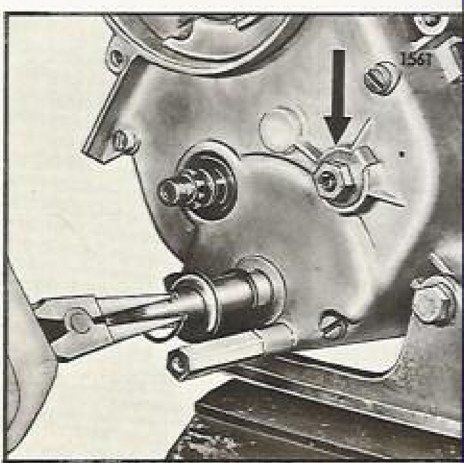


Fig. 35

Dismantling the engine-type M

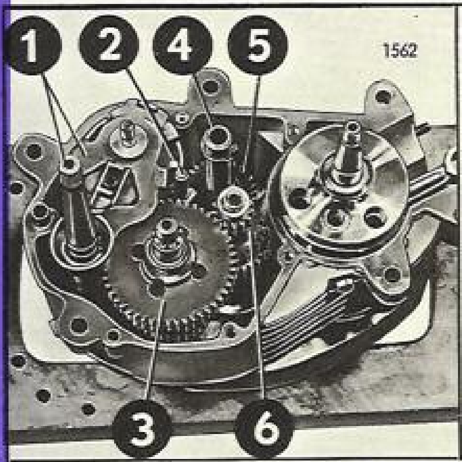
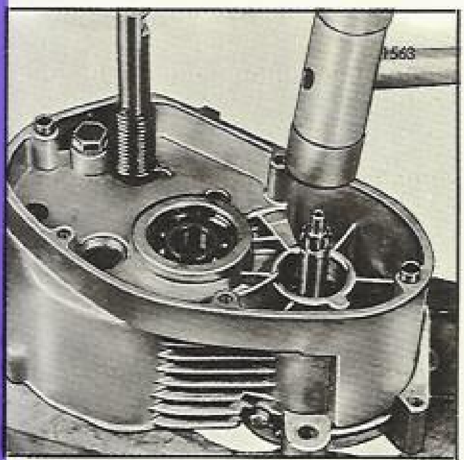


Fig. 36

Fig. 37



The crankshaft, gear control and gear box are now accessible (fig. 36). Dismantle the gears and controls as follows, noting the washers and shims.

Pull out the control spindle with selector (fig. 36/1).

Take out the guiding pin for the control forks (fig. 36/2).

Disconnect the control drum from the control fork and remove the drum.

Remove the complete gear spindle and two control forks from the housing (fig. 36/3).

Pull out the intermediate spindle for the starting gear, including bush (36/4).

Push aside the brake spring and take out the intermediate starting gear (fig. 36/5). Now pull out the complete intermediate spindle (36/6) with bush and key. If necessary, remove the starter spindle.

Take out the crankshaft. If necessary turn the engine round and use a mallet (fig. 37).

Dismantling the engine — type MAXI

MAXI Engine

Fit engine upside down into assembling base (figure 38). As mentioned, drain oil first.

Remove stator by unhooking springs and unscrewing cover from stator flange.

Dismantle magneto cover after removing fixing screws. Lock flywheel with locking device part no. 905.0.36.101.2 and remove fixing nut (figure 39). Pull flywheel from crankshaft with extractor 050.7012.

Take off magneto base plate after removing fixing screws. Disconnect plug connector and pull ignition lead out of rubber grommet.

Operate the starting clutch and decompressor at the same time and unhook the shorter Bowden cable from decompressor before dismantling cylinder.

Unhook cable first from bearing and then from decompressor — see figure 40. When removing the engine from the frame the longer cable is unhooked from the decompressor. Remove cylinder — pull down cylinder and head after removing the fixing nuts. Note the washers.

Loosen all engine screws. Tap out dowel pin and undo all screws.

Split housing, use rubber mallet if necessary.

After removing housing half, all components (figure 41) are exposed for further dismantling.

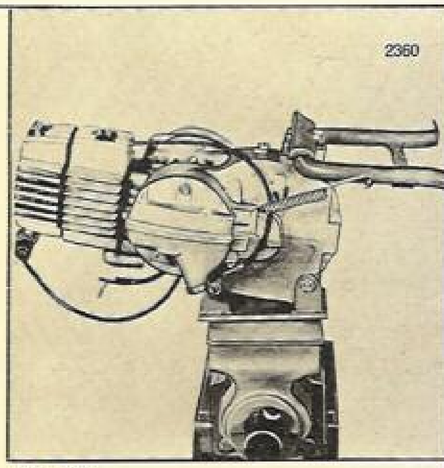
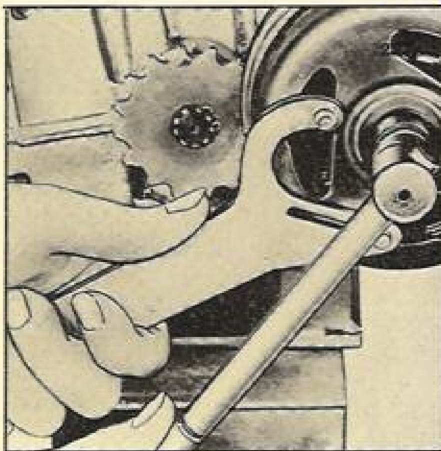


Fig. 38

Fig. 39



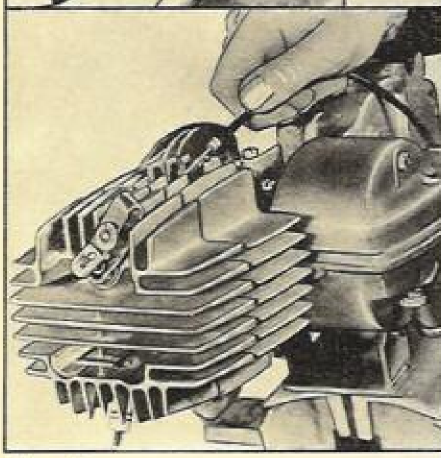
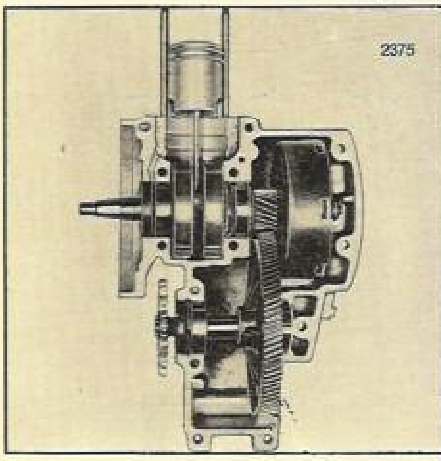


Fig. 40

Fig. 41



Dismantling the engine — type MAXI

Cylinder — Piston

Cylinder Head

Check the sparking plug thread before decoking the cylinder head. Recut the thread if necessary with an M 14 x 1.25 tap. Replace the cylinder head if the thread is badly damaged or sheared.

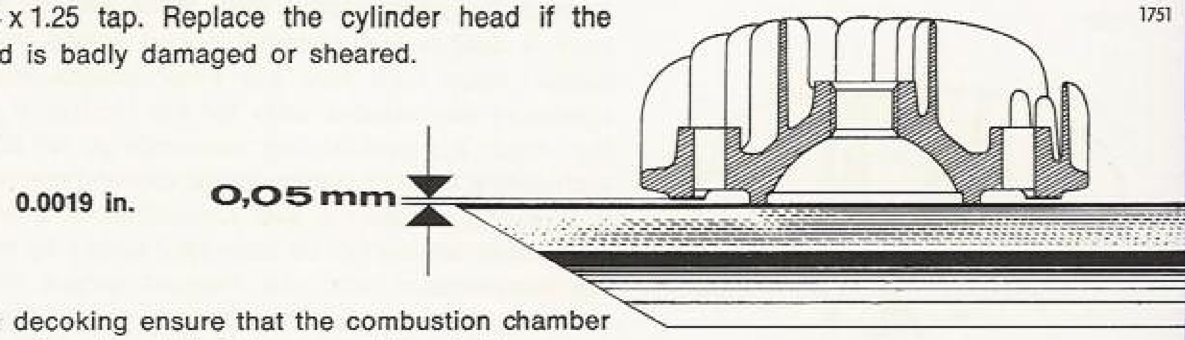


Fig. 1

When decoking ensure that the combustion chamber surface is not scratched since scratches invite renewed deposits. Use a tool made from brass or aluminium but never of steel. Check the cylinder-head seating after decoking (fig. 1). Use a straight-edge in all directions and check for gaps. If the head is deformed (fig. 2) recondition the seating on a honing plate with a honing paste (fig. 3). The resulting compression increase does not matter.

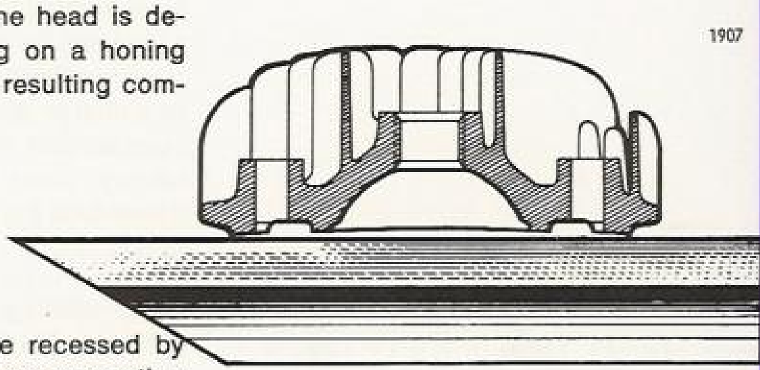


Fig. 2

The faces of our cylinder heads are recessed by 0.0019 in (0.05 mm) for improved pressure seating (fig. 1). This recess must be reproduced after honing either by filing or by turning.
Some of our engines are supplied with various compression ratios and it is therefore important to check before assembly whether the correct head is used. The relevant compression ratio can be ascertained from the instructions manual supplied with the machine. Models X 30, R and M are available with one cylinder head only. Models MS, VSD and V are available with any one of four. They differ as follows (see fig. 4 and the chart below): The cylinder head for a compression ratio of 11.5 : 1 is a turned-down version of the 10.5 x 1-ratio head. The shroud is reduced by 0.0196 in (0.5 mm) and protrudes only 0.0196 to 0.0236 in (0.5 to 0.6 mm). This version is thus easily recognisable (see fig. 4, arrowed).

Fig. 3

Compression Ratio	Dimension A
1 : 6,5	1.4566 in (37 mm)
1 : 8,5	1.3385 in (34 mm)
1 : 10,5	1.2795 in (32.5 mm)
1 : 11,5	1.2795 in (32.5 mm)

Cylinder-piston, cylinder head

1910

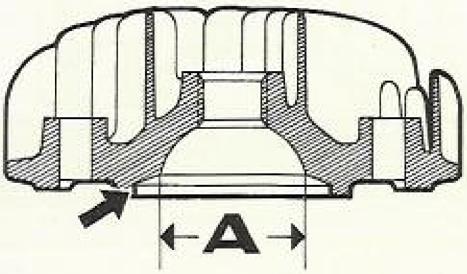


Fig. 4

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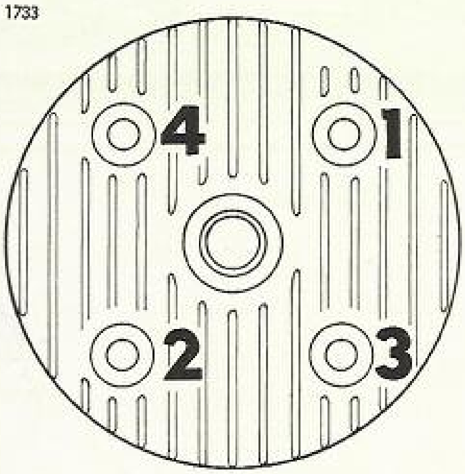

Fig. 5

The differing compression ratios are a result of the legal requirements in some countries which specify the permissable output and speed of mopeds and small motor cycles. It is therefore not permissable to change the compression ratio since models which have a deliberately reduced output would become illegal. Apart from this, our other models use the maximum permissable ratio for the design; it gives the most economical fuel consumption for today's high-output engines under normal working conditions. It is wrong to assume that the output of a normal production engine will be increased simply by raising the compression ratio. To increase output, for instance for racing, calls for a number of modifications — but these are not detailed in this manual.

In high altitudes compression ratio and engine output decreases because of the lower air pressure. This is overcome by increasing the ratio, but it is also necessary to readjust the carburettor (see group M, „Carburettor"). If a machine is to be used constantly in altitudes of 3000 to 6000 feet above sea level the compression ratio may be raised by 20 per cent by turning down the cylinder head 0.0394 in (1 mm). Afterwards the seating must be rehoned as previously described.

When refitting the cylinder head it is important to tighten in the correct sequence and use the specified torque to avoid overtightening and subsequent damage to the threads. Follow figure 5 for the sequence and refer to the list below for the recommended torques:

Engine Type	Torque
X 30, X 30 A	7.24 ftlb (1 mkg)
MSV, MSA	7.24 ftlb (1 mkg)
VSD	7.24 ftlb (1 mkg)
R engine	7.24 ftlb (1 mkg)
V engine	7.24 ftlb (1 mkg)
M engine	8.69 ftlb (1.2 mkg)

Decompressor

X 30 models and older VS models are fitted with a decompressor valve for starting or stopping the engine; it is operated by a cable from the handlebar.

Before assembling check the valve and valve seating for wear or damage.

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Cylinder-piston, decompressor

0.00394–0.00787 in.

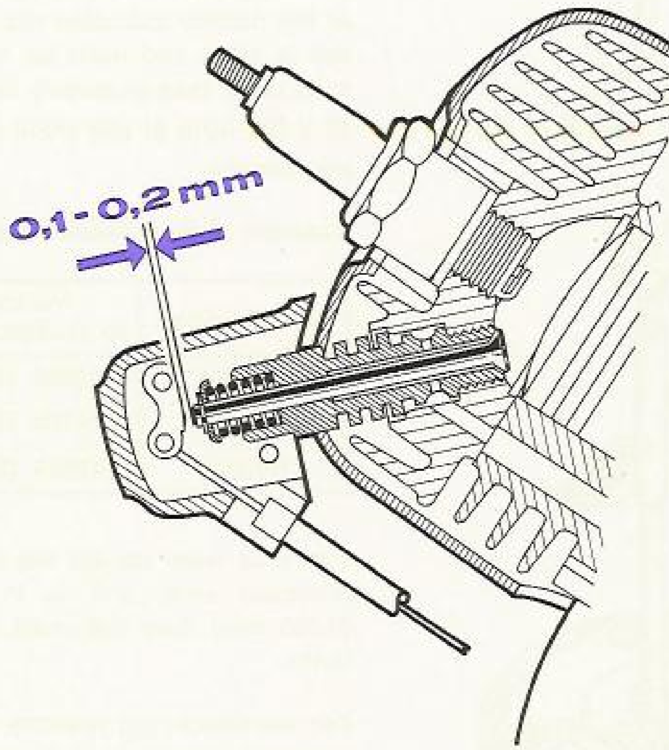
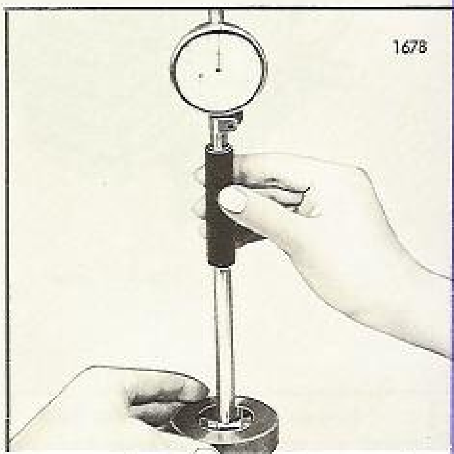


Fig. 6 ▲ Fig. 7 ▼



Replace the complete decompressor unit or valve as necessary. If the valve only is replaced regrind the seating with honing paste. The asbestos ring sealing the unit must be replaced after dismantling. When fitting the decompressor actuator ensure that there is approximately 0,00394 in (0.1 mm) of free play between the lever and valve (see fig. 6). If the play is too small or non-existant the valve will not close completely and a leak resulting in poor output and carbonisation of the valve and valve seating will result.

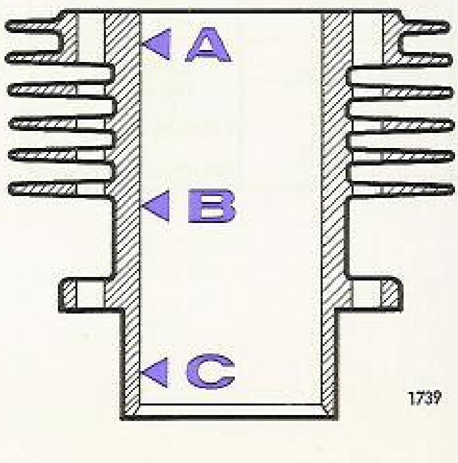
Measuring the cylinder

The cylinder bore is measured with a micrometer and a bore-measuring adaptor (both items available commercially).

Measuring procedure: Clamp the dial to the adaptor. Adjust the distance and adjust the nominal bore diameter (see chart) with a ring guage (fig. 7).

The bore must be measured at six positions, once parallel with and once diametrically opposed to the gudgeon pin at the three positions indicated in figure 8 A, B and C. The specified temperature of + 20 deg. C is important if reliable results are to be obtained. To read the result swivel the unit in the directions indi-

Fig. 8 ▼



Cylinder-piston, measuring the bore

1915

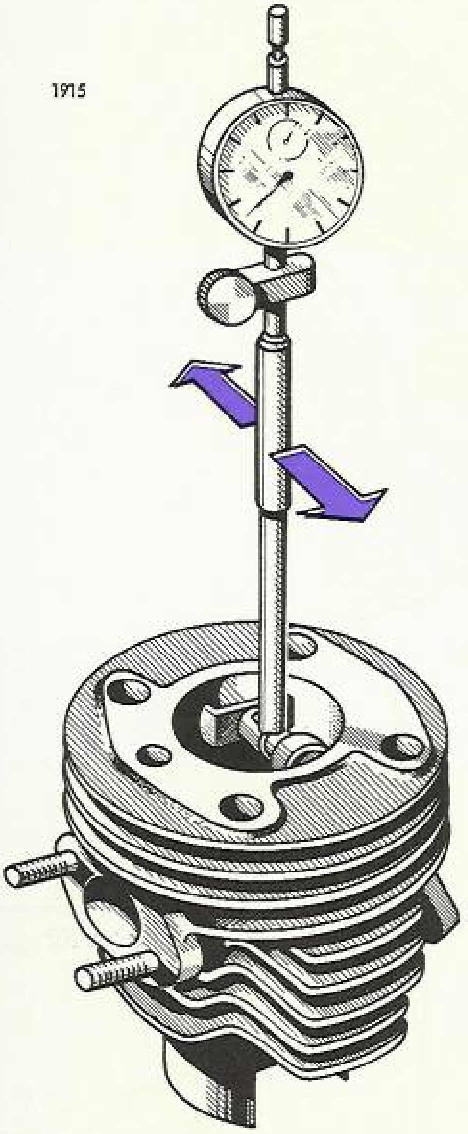


Fig. 9

cated by the arrows in figure 9. The lowest position of the pointer indicates the bore diameter. The cylinder is worn and must be replaced or rebored if the total wear (see example) has reached the wear limit or if the bore at any point is more oval shaped than permissable.

Example of Bore Measuring

Bore Position	Parallel to Gudgeon Pin	90 deg. Angle to Gudgeon Pin
Top	1.49685 (38.020)	1.49744 (38.035)
Middle	1.49704 (38.025)	**1.49763 (38.040)**
Bottom	**1.49625 (38.005)**	1.49645 (38.010)

The total wear equals the maximum wear minus the minimum wear and is in this example 0.00137 in (0.035 mm). See the chart for dimensions and wear limits.

For manufacturing reasons cylinders and pistons are grouped according to these limits, the groups being indicated by stamped letters or numbers on the top or bottom of the cylinder flange (fig. 14). Cast-iron cylinders are marked 1 or 2 (or I, II) and aluminium cylinders for M engines are stamped A to L before 1967 or 1 to 5 since 1967. The reduction of groups for the M engine from 11 to five was made possible by the practical experience showing the permissable increase of piston play. Stock keeping has therefore been simplified. The chart of cylinder bores for the M motor gives a comparison between these limit groups.

Cylinder Bore Chart

Engine	Nominal dia.	Limit I	Limit II	Wear limit	Permiss. ovality
X 30, MS, VSD	1.496456 in dia. (38.010 mm)	.00039 - .00070 in (.010 - .018 mm)	.00070 - .00098 in (.018 - .025 mm)	1.498228 in dia. (38.055 mm)	.000787 in (.02 mm)
Vand R-engine 50 cc	1.496456 in dia. (38.010 mm)	.00039 - .00070 in (.010 - .018 mm)	.00070 - .00098 in (.018 - .025 mm)	1.498228 in dia. (38.055 mm)	.000787 in (.02 mm)
R-engine 60 cc	1.653740 in dia. (42.005 mm)	.00019 - .00051 in (.005 - .013 mm)	.00051 - .00078 in (.013 - .020 mm)	1.655708 in dia. (42.055 mm)	.000787 in (.02 mm)
M-engine	1.495078-1.497047 in dia. (37.975 - 38.025 mm)	see seperate chart			.000184 in (.025 mm)

Oversized cylinders have the same dimensions but the nominal bore is 0.0196 in (0.5 mm) greater, except on M engines with chromium plated bores which do not permit reboring.

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Cylinder-piston, measuring the piston

Cylinder-bore chart for M-engine

Up to 1967		Since 1967	
Limit groups	Dimensions	Limit groups	Dimensions
A	1.495078 - 1.495275 in. (37.975 - 37.980 mm) dia.	1	1.495078 - 1.495472 in. (37.975 - 37.985 mm) dia.
B	1.495275 - 1.495472 in. (37.980 - 37.985 mm) dia.		
C	1.495472 - 1.495669 in. (37.985 - 37.990 mm) dia.	2	1.495472 - 1.495866 in. (37.985 - 37.995 mm) dia.
D	1.495669 - 1.495866 in. (37.990 - 37.995 mm) dia.		
E	1.495866 - 1.496062 in. (37.995 - 38.000 mm) dia.	3	1.495866 - 1.496259 in. (37.995 - 38.005 mm) dia.
F	1.496062 - 1.496259 in. (38.000 - 38.005 mm) dia.		
G	1.496259 - 1.496456 in. (38.005 - 38.010 mm) dia.	4	1.496259 - 1.496653 in. (38.005 - 38.015 mm) dia.
H	1.496456 - 1.496653 in. (38.010 - 38.015 mm) dia.		
I	1.496653 - 1.496850 in. (38.015 - 38.020 mm) dia.	5	1.496653 - 1.497047 in. (38.015 - 38.025 mm) dia.
K	1.496850 - 1.497047 in. (38.020 - 38.025 mm) dia.		
L	1.497047 - 1.497244 in. (38.025 - 38.030 mm) dia.		

Some reduced-output engines (Mofa, Moped and Mokick models) have the cylinder inlet bore reduced by a welded-in bush (fig. 10). To prevent any mistakes check the cylinder before assembly for the correct type or for any (possibly) illegal modification to increase output.

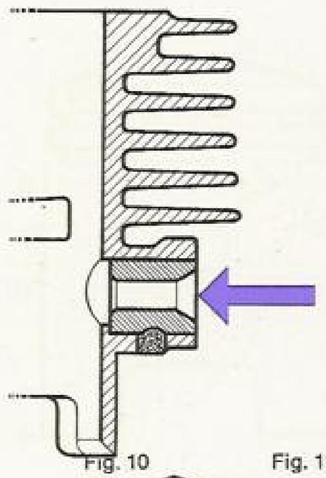

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Fig. 10

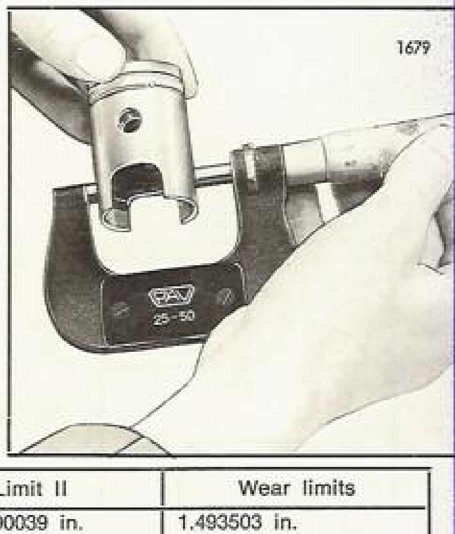
Measuring the piston

The diameter of the piston is measured with a micrometer at an angle of 90 deg. to the gudgeon pin in the lower third of the piston surface (fig. 11). Pistons are tapered to cope with the different operating temperatures (fig. 12 A, B and C) but this tapering has no influence on checking the nominal diameter.

Oversized pistons have the same tapering but are 0.0196 in (0.5 mm) larger. No oversized pistons are available for M engines. As with cylinders, the pistons are grouped according to the limits. Two piston groups are available for cast-iron cylinders and five groups (11 up to 1967) for the M engine. The limit groups are stamped on the top of the pistons (fig. 14). A comparison between the five or 11 groups respectively of the M engine pistons is given in the piston diameter chart for the engine.

The nominal dimensions for pistons are as follows.

Fig. 11



Piston diameter chart

Engine	Nominal dia	Limit I	Limit II	Wear limits
X 30, MS, VSD	1.49468 in. (37.965 mm) dia.	- .00039 to 0 in. (-.010 to 0 mm)	0 to + .00039 in. (0 to + .010 mm)	1.493503 in. (37.935 mm) dia.
V, R 50 cc	1.49468 in. (37.965 mm) dia.	- .00039 to 0 in. (-.010 to 0 mm)	0 to + .00039 in. (0 to + .010 mm)	1.493503 in. (37.935 mm) dia.
R 60 cc	1.65177 in. (41.955 mm) dia.	- .00039 to 0 in. (-.010 to 0 mm)	0 to + .00039 in. (0 to + .010 mm)	1.650510 in. (41.925 mm) dia.
M	1.49389 - 1.49586 in. (37.945 - 37.995 mm) dia.	See separate chart		

Cylinder-piston, piston clearance

Piston diameter chart for M-engine

Up to 1967		Since 1967	
Limit groups	Dimensions	Limit groups	Dimensions
A	1.494094 - 1.494291 in. (37.950 - 37.955 mm) dia.	1	1.493897 - 1.494291 in. (37.954 - 37.955 mm) dia.
B	1.494291 - 1.494488 in. (37.955 - 37.960 mm) dia.		
C	1.494488 - 1.494685 in. (37.960 - 37.965 mm) dia.	2	1.494291 - 1.494685 in. (37.955 - 37.965 mm) dia.
D	1.494685 - 1.494881 in. (37.965 - 37.970 mm) dia.		
E	1.494881 - 1.495078 in. (37.970 - 37.975 mm) dia.	3	1.494685 - 1.495078 in. (37.965 - 37.975 mm) dia.
F	1.495078 - 1.495275 in. (37.975 - 37.980 mm) dia.		
G	1.495275 - 1.495472 in. (37.980 - 37.985 mm) dia.	4	1.495078 - 1.495472 in. (37.975 - 37.985 mm) dia.
H	1.495472 - 1.495669 in. (37.985 - 37.990 mm) dia.		
I	1.495669 - 1.495866 in. (37.990 - 37.995 mm) dia.	5	1.495472 - 1.495866 in. (37.985 - 37.995 mm) dia.
K	1.495866 - 1.496062 in. (37.995 - 38.000 mm) dia.		
L	1.496062 - 1.496259 in. (38.000 - 38.005 mm) dia.		

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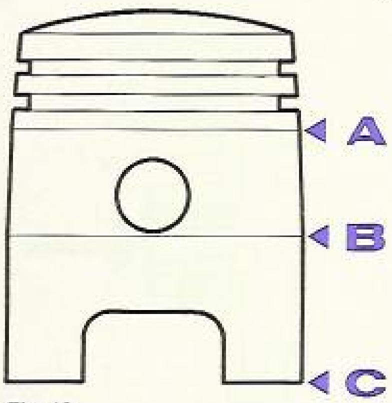

Fig. 12

As mentioned in the paragraphs relating to the cylinder and cylinder head, certain engines are modified to reduce the output. One modification is a limitation of the induction time by increasing the length of the piston (see fig. 13, dimension A) on X 30, MS and VS engines. Check the dimension A to prevent the fitting of incorrect pistons. The following chart may be helpful:

Dimension A	Maximum speed
1.142 in. (29 mm)	16 mph (25 km/h)
1.142 in. (29 mm)	20 mph (30 km/h)
1.142 or 1.043 in. (29 or 26.5 mm)	up to 25 mph (40 km/h)
0.945 in. (24 mm)	over 25 mph (40 km/h)

Fig. 13

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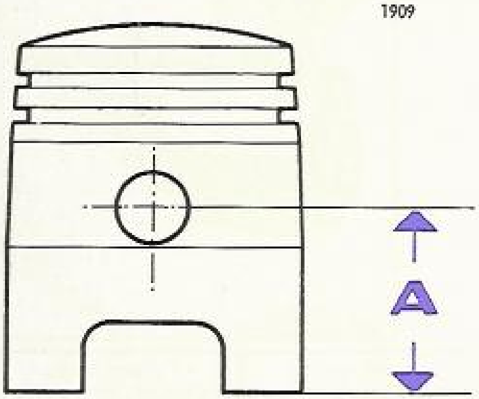

Piston Clearance

The piston clearance is the difference between the nominal cylinder bore and the nominal piston diameter.

A new cylinder and piston of the same limit group will have the correct piston clearance (for instance, cylinder limit group 1 (A) and piston limit group 1 (A) give the correct clearance – see fig. 14). An exception is the M engine with 11 limit groups. Each piston group covered two cylinder groups. A piston of group A could be fitted to a cylinder of group A or B, and so forth. Since 1967, however, only five limit groups have been used marked 1 to 5 and now one piston fits to a cylinder of the same group only.

It is not normally necessary to measure the piston clearance, therefore, except when a new piston is fitted to a used cylinder or vice versa. The piston

1st Edition

Cylinder-piston, piston ring clearance

clearance must be measured in this event. The clearance may be larger than on new components provided the ovality is still within permissable limits and is not above the wear limit. The following chart indicates the piston clearances and the wear limits.

Piston clearance chart

Engine	Clearance	Wear limit
X 30, MS, VSD	.001771 - .002559 in. (.045 - .065 mm)	.004724 in. (.12 mm)
V, R 50 cc	.001771 - .002559 in. (.045 - .065 mm)	.004724 in. (.12 mm)
R 60 cc	.001968 - .002677 in. (.050 - .068 mm)	.005118 in. (.13 mm)
M	.000787 - .001574 in. (.020 - .040 mm)	.002559 in. (.065 mm)

As a matter of principle, cylinder, piston and piston rings are usually exchanged at the same time on two-stroke engines. This is because of the reduced output and the increased noise if a new part (for instance, piston rings) is fitted to used components.

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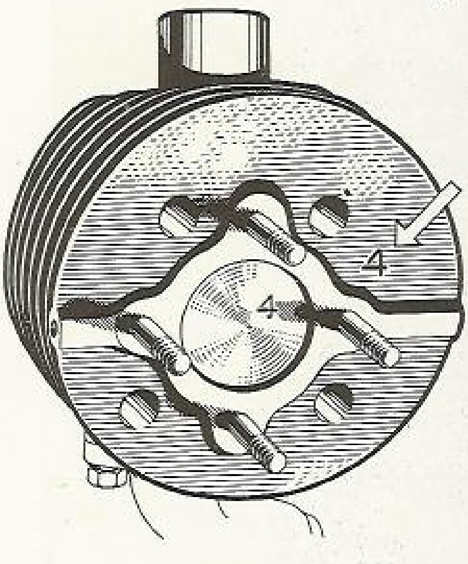

Fig. 14 Fig. 15

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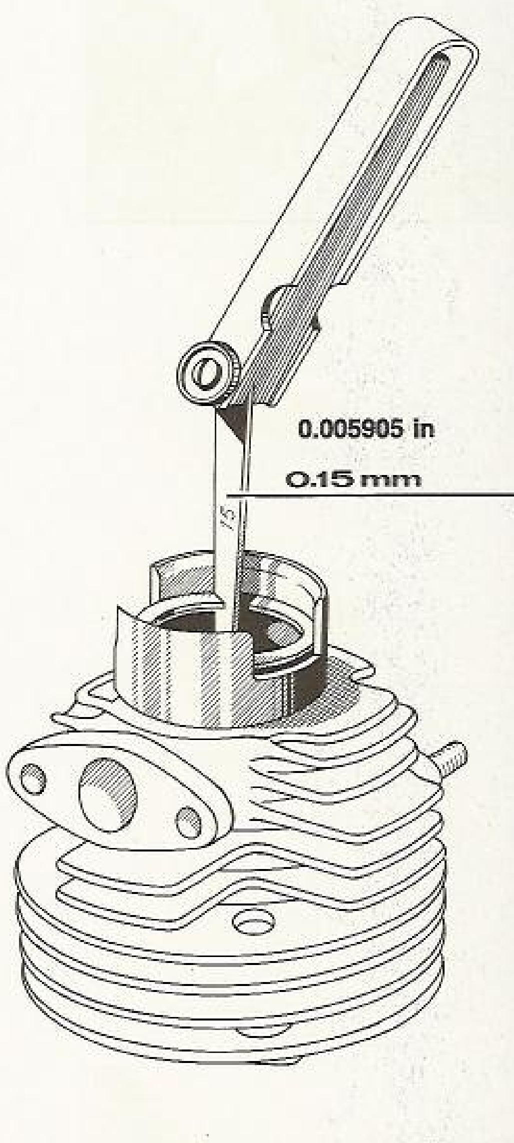


Piston rings

Piston rings must have some clearance to cope with the different loads during piston movement.

Piston ring slot clearance

The slot clearance is checked with a feeler gauge (see fig. 15) after inserting the piston ring into the lower third of the cylinder bore.

The piston ring **slot clearance** is .005905—.011810 in (.15—.30 mm)

The **wear limit** is .01968 in (0.5 mm)

If the slot clearance is too small increase it with a file or grinding disc until the correct clearance is achieved.

If the clearance is too large on new or almost-new cylinders, replace the rings. If the piston and cylinder have been used for some time check the clearances and replace the components if worn to the limit or, if the cylinder is still usable, replace the complete piston. Note: Piston rings mark the bore at the top and bottom of the stroke. The marking is sometimes almost invisible but can cause noise and, in extreme cases, even ring breakage if new rings or pistons are fitted. It is therefore necessary in such cases to chamfer the top edge of the top ring and the lower edge of the bottom ring with a file or a scraper.

Cylinder-piston, piston ring clearance

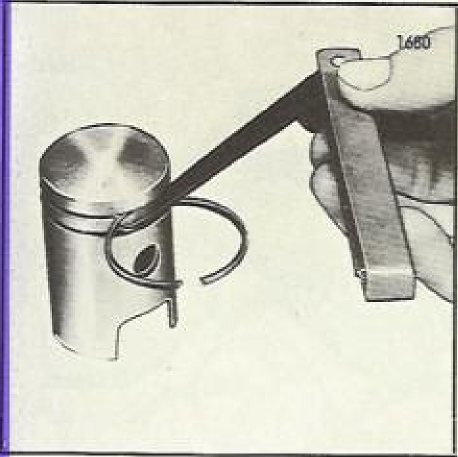


Fig. 16 ▲ Fig. 17 ▼

Piston ring flank clearance

The flank clearance can be checked with a feeler gauge (fig. 16).

The **piston ring flank clearance** is .001181–.0022756 in (.03–.07 mm)
The **wear limit** is .00394 in (.1 mm)

The flank clearance does not normally need checking because any wear is equalised by carbon deposits. Nevertheless, the rings could jam because of excessive deposits and, if this happens, the grooves must be cleaned with a broken piston ring (fig. 17). Do not use a scraper or emery cloth. Recheck the flank clearance to ascertain the extent of the wear. If above the wear limit, replace the piston and rings, or complets cylinder. Note the remarks regarding the exchange of piston rings, pistons and cylinders.

Cylinder-Piston, MAXI engine

MAXI-Engine

Repair instructions under heading E apply equally to the Maxi engine. The following is additional information for the Maxi engine.

Cylinder head

The Maxi engine has a surface-cooled cylinder and cylinder head.
Because of the design the plug is not in the centre as on all other models but is positioned as shown in figure 18. This necessitates a differently shaped combustion chamber.
This cylinder head gives a compression ratio of 9 to 1. The collar diameter (figure 19) of approximately 1.5157 in (38.5 mm) can be used for checking. Any subsequent altering of the compression ratio reduces this diameter because of the chamber shape. The plug thread is M 14 x 1.25, length of thread .4921 in (12.5 mm) (for standard plugs).
To aid starting, the Maxi models are fitted with a decompressor. Figure 18 illustrates position. The decompressor must have the specified play (figure 18). None or insufficient play causes leaks or coking of valve and seating. Furthermore note instructions on pages E 2 and 3.
Three to four aluminium foils of .00197 in (0.05 mm) thickness are fitted between head and cylinder for improved sealing. The cylinder-head nuts are tightened to a torque of 7.23 ft/lb (1 mkp). Tighten crosswise to even the strain as the head.

2364

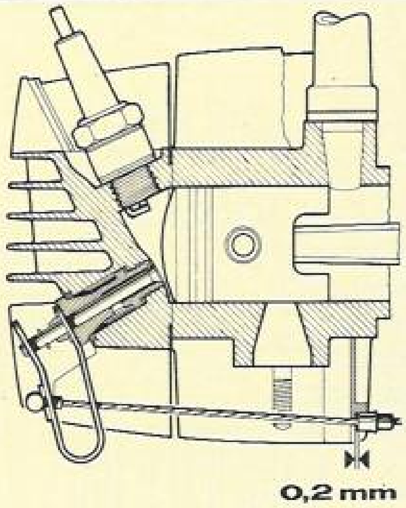
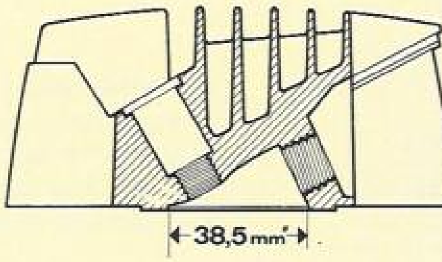


Fig. 18

Fig. 19

2365



Cylinder – Piston

The air cooled, chromium plated aluminium cylinder of the Maxi engine has five cylinder/piston wear limit combinations. The limit groups and limits are the same as for the M engine with chromium plated aluminium cylinder. The marking numbers on cylinder and piston are showm in figure 20.

Dimensions

limit group	cylinder	piston	play
1	1.495078–1.495472 in dia (37.975–37.985 mm Ø)	1.493897–1.494291 in dia (37.945–37.955 mm Ø)	.000787 in (0.020 mm) to .001576 in (0.040 mm)
2	1.495472–1.495866 in dia (37.985–37.995 mm Ø)	1.494291–1.494685 in dia (37.955–37.965 mm Ø)	
3	1.495866–1.496259 in dia (37.995–38.005 mm Ø)	1.494685–1.495078 in dia (37.965–37.975 mm Ø)	
4	1.496259–1.496653 in dia (38.005–38.015 mm Ø)	1.495078–1.495472 in dia (37.975–37.985 mm Ø)	
5	1.496653–1.497047 in dia (38.015–38.025 mm Ø)	1.495472–1.495866 in dia (37.985–37.995 mm Ø)	

Permissable ovality of cylinder bore max. .000984 in (0.025 mm)
piston stroke play .00591 in (0.15 mm), wear limit .0197 in (0.5 mm)

Cylinder-Piston, MAXI engine

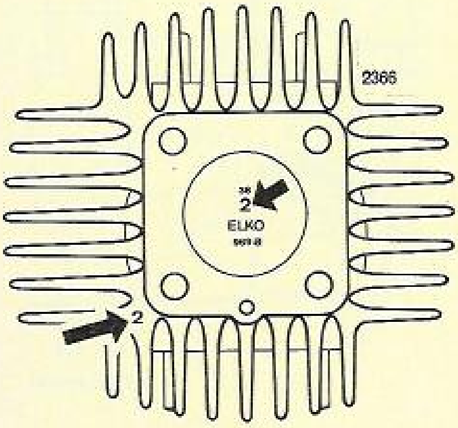


Fig. 20

To comply with legal requirements, the MAXI engine is adjusted by various means to specific outputs and speeds. The following measures have been taken on cylinder and piston.

Piston – limitation of suction time by lengthening the piston skirt, see figures 21 and 22, dimension A.

25 miles (40 km/h) and more	= dimension A 1.043 in (26.5 mm)
(25, 30 and 49 km/h) reduced 15.6, 18.8 and 30.6 miles	= dimension A 1.142 in (29 mm)

Cylinder – reduction of suction area. Slow speed types see figure 22, high speed types figure 21.

Cylinders with reduced suction area also have a reduced suction time due to the lower positioned inlet slot. These measurements are compared in figures 21 and 22. The suction area is further reduced by added reduction sleeves (figure 22). Sizes of these sleeves depend on legal requirements. The use of sleeves prevents easy increase of engine outpout.

A = lower piston length	= 1.043 in (26.5 mm)	A = 1.142 in (29 mm)
B = suction area	= 0.264 sq/in (1.7 cm²)	B = 0.155 sq/in (1 cm²)
C = Inlet duration	= 103°	C = 94°
D = overflow duration	= 95°	D = 95°
E = exhaust duration	= 133°	E = 133°

Fig. 21

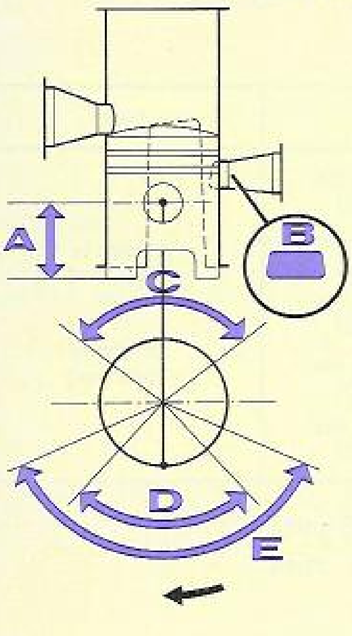
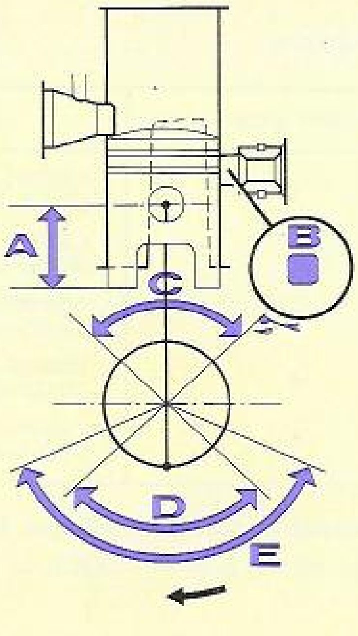


Fig. 22



Crankshaft

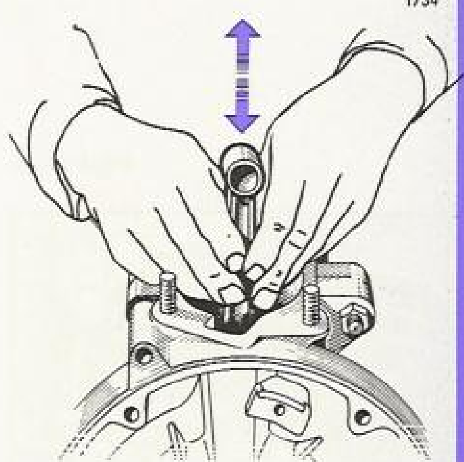
Apart from replacing the small-end and big-end bearings centering the crank pins and adjusting of the crankshaft clearance, no other repairs can be effected on the crankshaft. Crankshaft repairs need equipment not available in service stations and, therefore, service exchange crankshafts are available.

Checking by sight

All crankshafts, new or old, must be checked before assembly. The crankshaft must be cleaned and all oil removed. Check the condition of the bearings and bushes, crankpin and the surface of the packing ring and bearing seatings. Do not fit crankshafts with excessive play in the conrod, discolouring or damage or if the packing ring surfaces on the shaft are marked. Light markings can be removed with very fine emery cloth (fig. 1). Marked or blue discoloured crankpins and marked or oval-shaped crankpin bushes must be replaced. Furthermore, check the centre holes on the crankshaft ends and check the threads. Insert the key into the groove to ensure a perfect fit. It happens repeatedly that these precautions are omitted and the entire engine has to be dismantled again. Faulty components sometimes pass the rigorous factory checks or damage occurs during transit. These simple checks reveal any faults before it is too late.

Fig. 1

Fig. 2



Conrod clearance

It is difficult to check the radial clearance of the connecting rod. Exact measurement can be made only in the works after dismantling. The simplest method is to estimate the clearance by moving the conrod up and down (fig. 2).

If the clearance is correct the rod cannot be moved up or down. Replace the crankshaft if any movement can be felt. It is not necessary to measure the axial play of the conrod because it is not subject to wear. Simply check for free movement – especially if overheating or insufficient oil is suspected. If the conrod jams, replace the crankshaft.

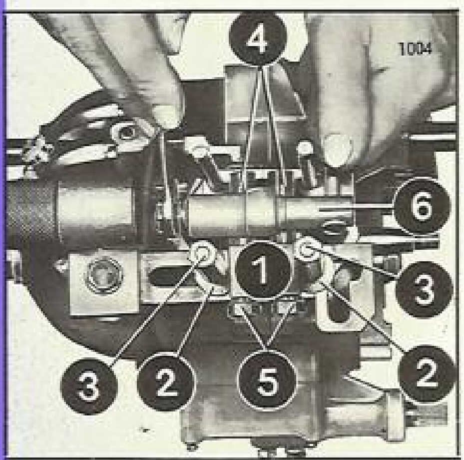
Crankshaft, gudgeon pin clearance

Gudgeon pin clearance

Dimensions of the gudgeon pin and small-end bush

Engine	Gudgeon pin nom. dia., new	Small-end bush nom. bore, new	Assembly clearance	Wear limit
X 30, MS, VSD	.39346 - .39370 in. (9.994 - 10.000 mm) dia.	.39389 - .39429 in. (10.005 - 10.015 mm) dia.	.000197 - .000826 in. (.005 - .021 mm)	.000984 in. (.025 mm)
V, R 50 cc	.39346 - .39370 in. (9.994 - 10.000 mm) dia.	.39389 - .39429 in. (10.005 - 10.015 mm) dia.	.000197 - .000826 in. (.005 - .021 mm)	.000984 in. (.025 mm)
R 60 cc	.5902 - .5905 in. (14.992 - 15.000 mm) dia.	.59078 - .5912 in. (15.006 - 15.017 mm) dia.	.000236 - .000984 in. (.006 - .025 mm)	.001181 in. (.030 mm)
M	See separate chart			

Fig. 3



The clearance between the gudgeon pin and small-end bush must be checked before fitting the crankshaft. Check, too, if the complaint is of abnormal noise, especially on our single-piston engines.

The clearance between the gudgeon pin and the bore in the piston does not need checking because our engines do not wear to any degree at this point. Exceptionally, a number of different pin sizes are available for M engines.

The gudgeon-pin clearance depends on the difference between the actual pin size and the actual bore of the small-end bush. On M engines it depends on the actual size of the gudgeon pin, needle bearing and conrod bore (see page F 4).

The gudgeon pin is measured with a micrometer and the bush with an internal measuring device or a bore gauge. Dimensions and wear limits are given in the dimension chart.

Replacing the conrod bushes

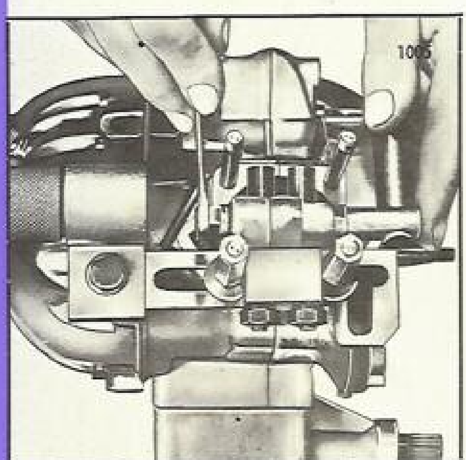
Conrods are fitted with bronze bushes for the gudgeon pin except on M engines. The replacement of the bushes and pressing in of the gudgeon pin requires extreme accuracy.

The following special tools are necessary:

Press tool	Part Number
for all 50 cc engines (except M types)	905.6.33.101.0
for all 60 cc R engines	905.6.33.102.0
Ream and centering device for all engines except the M type . . .	Hunger 005.0

Figures 3 to 2 show all operations needed on a 60 cc R engine. The illustrations apply similarly to all other models.

Fig. 4



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Crankshaft, replacing the conrod bushes

Extracting the conrod bush (fig. 3)

Fit the reaming device (fig. 3/1) with sleeves (fig. 3/2) to screws (fig. 3/3). Clamp the conrod with the eccentric bolt (fig. 3/4) of the reaming device and tighten the counter nuts (fig. 3/5). Remove the conrod bush with the press tool (fig. 3/6). Use the press tool as in fig. 3.

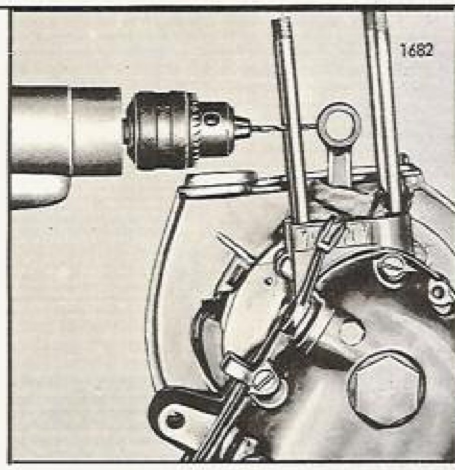


Fig. 5

Pressing in the conrod bush (fig. 4)

To fit the new conrod bush use the press tool according to figure 4. Lubricating holes are drilled after pressing in the bush and should be cleaned and deburred (fig. 5).

Centering the conrod (fig. 6)

The conrod must be centered before reaming. Relax the eccentric bolts (fig. 3/4) after loosening the nuts (fig. 3/5). Select the guiding sleeve according to the reamer (fig. 6/1) and push into the insert of the centering device (fig. 6/2). Push the reamer, tapered-end forward, into the conrod bush. Clamp the conrod with the eccentric bolts and counter nuts.

Note: Do not move the conrod in any direction when clamping.

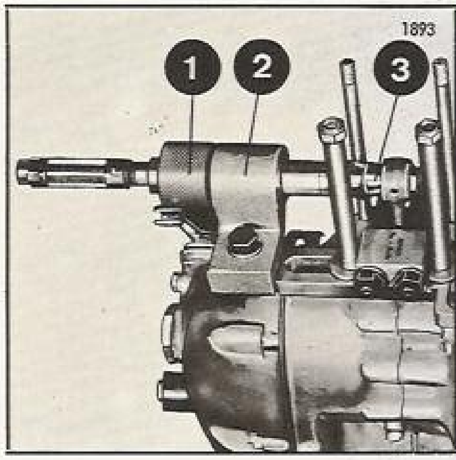
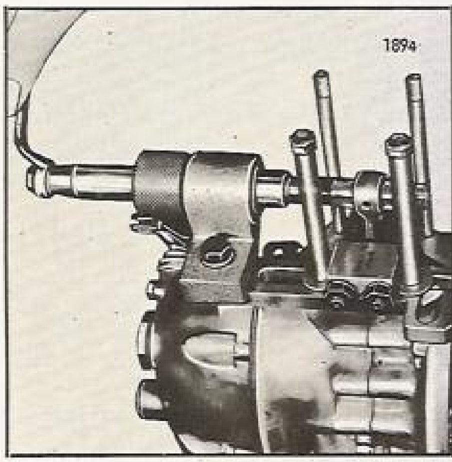


Fig. 6

Reaming the conrod bush (fig. 7)

To prevent chippings falling into the crankcase, cover the aperture with a cloth before reaming begins. The conrod bush may now be reamed carefully with the adjustable reamer. Lubricate with oil or paraffin (kerosene). The forward adjusting nut on the reamer is marked. Adjusting from mark to mark gives .00787 in (.02 mm). The permissable clearance between the bush and gudgeon pin and the wear limit are detailed in the charts. Too much play results in noise, noticable when throttling down. Lubricating holes or slots and the conrod bush must be cleaned and deburred after reaming. The lightly oiled gudgeon pin, standing vertical, must move slowly through the reamed hole under its own weight. Always use a new gudgeon pin after replacing the small-end bush.

Fig. 7



Crankshaft, M-engine

Fig. 8

Gudgeon pin, needle bearing and conrod selection for M-engine

M engines with aluminium cylinders have needle-roller small-end bearings, contrary to practice on all other models. The following points must be observed closely in order to achieve the specified accuracy in assembly limits.

1. Gudgeon-pin bore and gudgeon pin

The gudgeon-pin clearance in the piston is 0 to .000216 in (0 to .0055 mm). A colour code is used to indicate the different limit groups. The gudgeon-pin bore is marked on the lug (fig. 8) with the following colours:

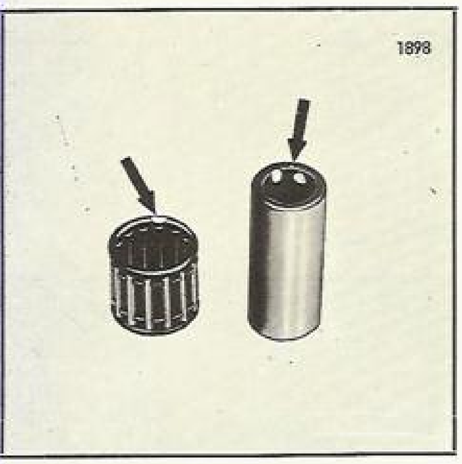
Black	.472342–.472440 in (11.9975–12.0000 mm) diameter
White	.472440–.472539 in (12.0000–12.0025 mm) diameter
Blue	.472578–.472677 in (12.0035–12.0060 mm) diameter
Yellow	472677–.472775 in (12.0060–12.0085 mm) diameter

Since 1967 the black and white groups have no longer been in use. Gudgeon pins are marked on the face (fig. 9) with one to four coloured dots. For nominal sizes see paragraph 2, for assembly, see paragraph 3.

2. Gudgeon-pin, conrod and needle-bearing selection.

Gudgeon pin, conrod and needle-roller bearing must be selected before assembling in order to give the correct clearance. The different limit groups are marked as follows:

Fig. 9



Gudgeon pins: On the face with one to four coloured dots, indicating groups one to four (fig. 9).

Group	
1	.472559–.472677 in (12.003–12.006 mm) diameter
2	.472440–.472559 in (12.000–12.003 mm) diameter
3	.472322–.472440 in (11.997–12.000 mm) diameter
4	.472204–.472322 in (11.994–11.997 mm) diameter

Needle bearings: Colour dot on the cage (fig. 9) indicates the groups 0, 1, 2 or 3. Group 0 is not used in production but is for service purposes only.

Group	
0 = yellow	.05905–.05913 in (1.500–1.502 mm) needle diameter
I = red	.05897–.05905 in (1.498–1.500 mm) needle diameter
II = blue	.05889–.05897 in (1.496–1.498 mm) needle diameter
III = white	.05881–.05889 in (1.494–1.496 mm) needle diameter

Connecting rods: Figures 1 to 5 stamped on the connecting rod head (fig. 10) indicate the limit groups 1 to 5.

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Crankshaft, assembly chart

Group	
1	.58905–.59039 in (14.992–14.996 mm) diameter
2	.59039–.59055 in (14.996–15.000 mm) diameter
3	.59055–.59070 in (15.000–15.004 mm) diameter
4	.59070–.59086 in (15.004–15.008 mm) diameter
5	.59086–.59102 in (15.008–15.012 mm) diameter

Assembly procedure according to paragraph 3.

3. Assembly chart

To simplify the assembly of the components mentioned in paragraphs 1 and 2, proceed according to the chart (fig. 15). For example, if the cylinder and piston are to be replaced and the engine has a crankshaft with the conrod marked "4".

Conrod 4 requires needle-bearing „red" (vertical selection), gudgeon pin marked with two dots on the face and a piston marked in blue or yellow internally (horizontal selection). Note: The correct needle-bearing is shown at the intersection of the vertical and horizontal lines.

If, for instance, the crankshaft has to be replaced, follow the chart in reverse order and the correct crankshaft is found, proceeding from piston to gudgeon pin to needle bearing.

To simplify stockholding, only parts marked with diagonal lines in the chart (fig. 15) are available.
Pistons marked in yellow or blue are not separate spare parts.

Gudgeon pins 1, 2 and 3

Needle-bearings 0–yellow; 1–red; 2–blue and 3–white. The yellow bearing (oversized) is available only as a spare part for repairs.

Crankshaft with conrod 3 only. Since the crankshaft is available only with conrod 3, select the appropriate needle-bearing to match the existing gudgeon pin.

Example 1 (fig. 11)

The following selection was fitted to the engine:
crankshaft of group 5
needle-bearing of red group
gudgeon pin of group 1
piston of yellow group

The following selection applies after changing the crankshaft:

crankshaft of group 3
needle-bearing of white group
gudgeon pin of group 1
piston of yellow group

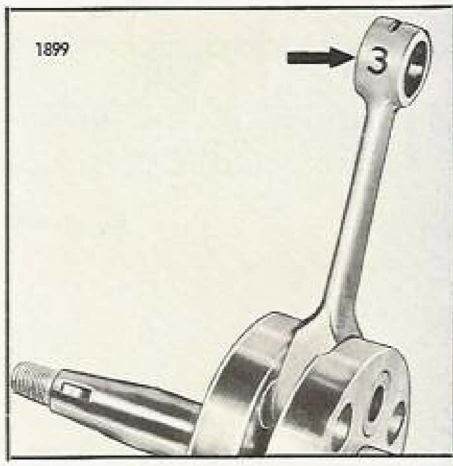

Fig. 10

1916

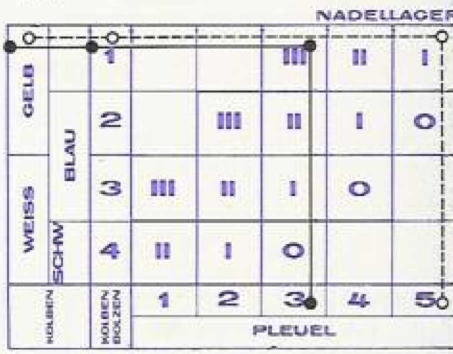

Fig. 11

Nadellager = needle bearing
Gelb = yellow
Blau = blue
Weiß = white
Schwarz = black
Kolben = piston
Kolbenbolzen = gudgeon pin
Pleuel = conrod
also for fig. 12, 13 and 14

Crankshaft, M-engine

1917

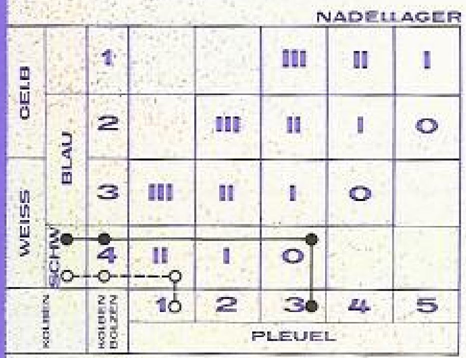

Fig. 12

Example 2 (fig. 12)

The following selection was fitted to the engine:

crankshaft of group 1
needle-bearing of blue group
gudgeon pin of group 4
piston of black group

The following selection applies after exchanging the crankshaft:

crankshaft of group 3
needle-bearing of yellow group
gudgeon pin of group 4
piston of black group

If a piston or the complete cylinder needs replacing, the chart and the following examples show how, by changing the needle-bearing or gudgeon pin respectively the correct clearance is obtained. The groups blue and yellow are not be separated for spare parts purposes and have the same parts number.

1918

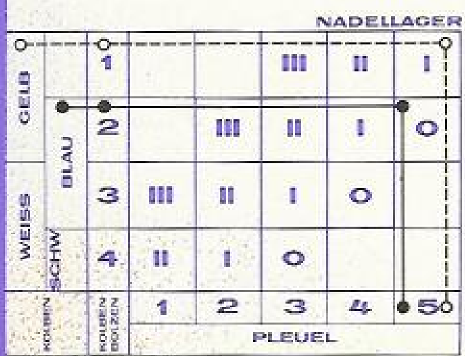

Fig. 13

Example 3 (fig. 13)

The following selection was fitted to the engine:

piston of yellow group
gudgeon pin of group 1
needle-bearing of red group
crankshaft of group 5

The following selection applies when fitting a cylinder complete or a piston of group blue:

piston of blue group
gudgeon pin of group 2
needle-bearing of yellow group
crankshaft of group 5

1919

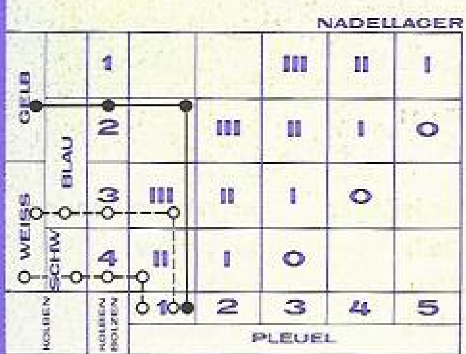

Fig. 14

Example 4 (fig. 14)

The following selection was fitted to the engine:

piston of blue or white groups
gudgeon pin of group 3
needle-bearing of white group
crankshaft of group 1

or the following selection:

piston of black or white groups
gudgeon pin of group 4
needle-bearing of blue group
crankshaft of group 1

If it is then required to fit a piston or complete cylinder with a piston of the yellow group, the following selection is needed. This is only partly possible with new parts and therefore not indicated on the chart. However, the selection is possible as a result of some wear of the control bore under normal use:

piston of yellow group
gudgeon pin of group 2
needle-bearing of white group
crankshaft of group 1

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Crankshaft, assembly chart

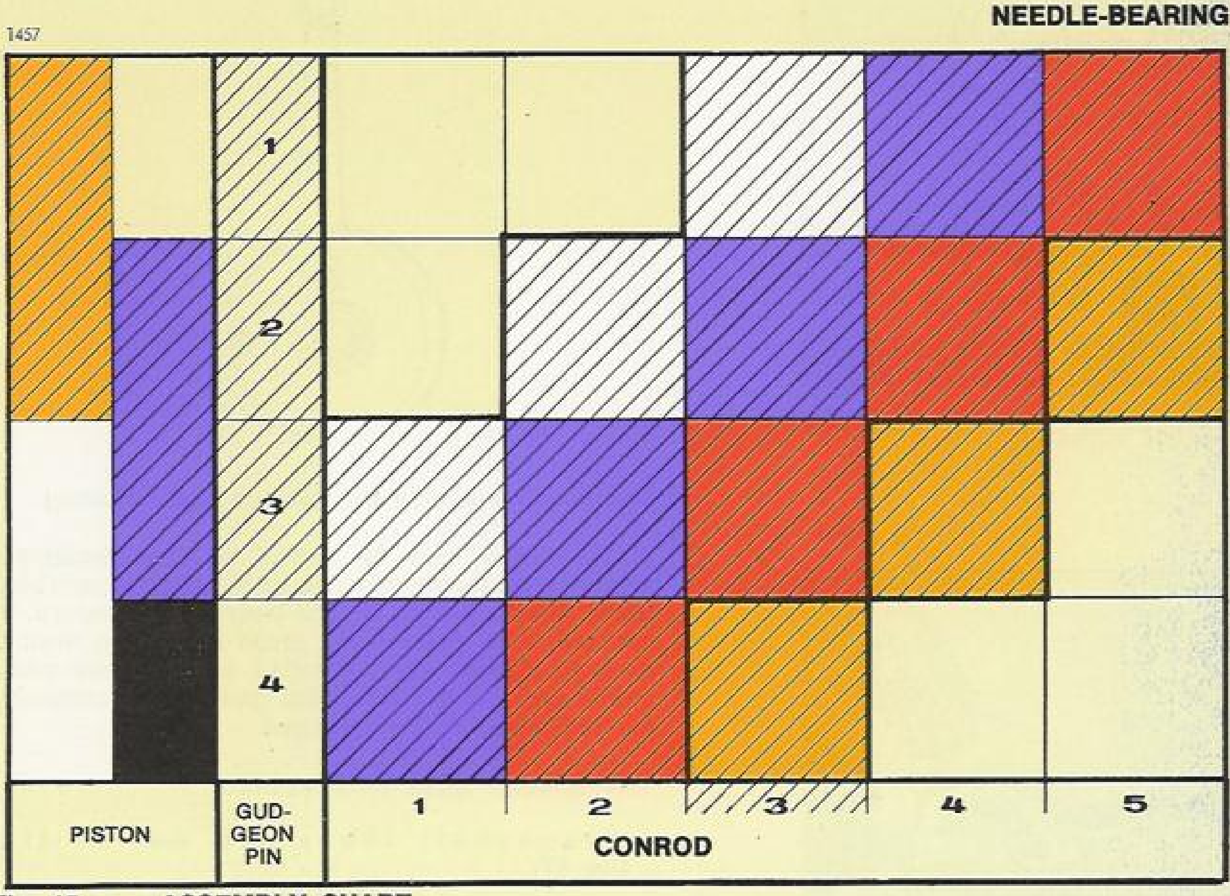

Fig. 15 ASSEMBLY CHART

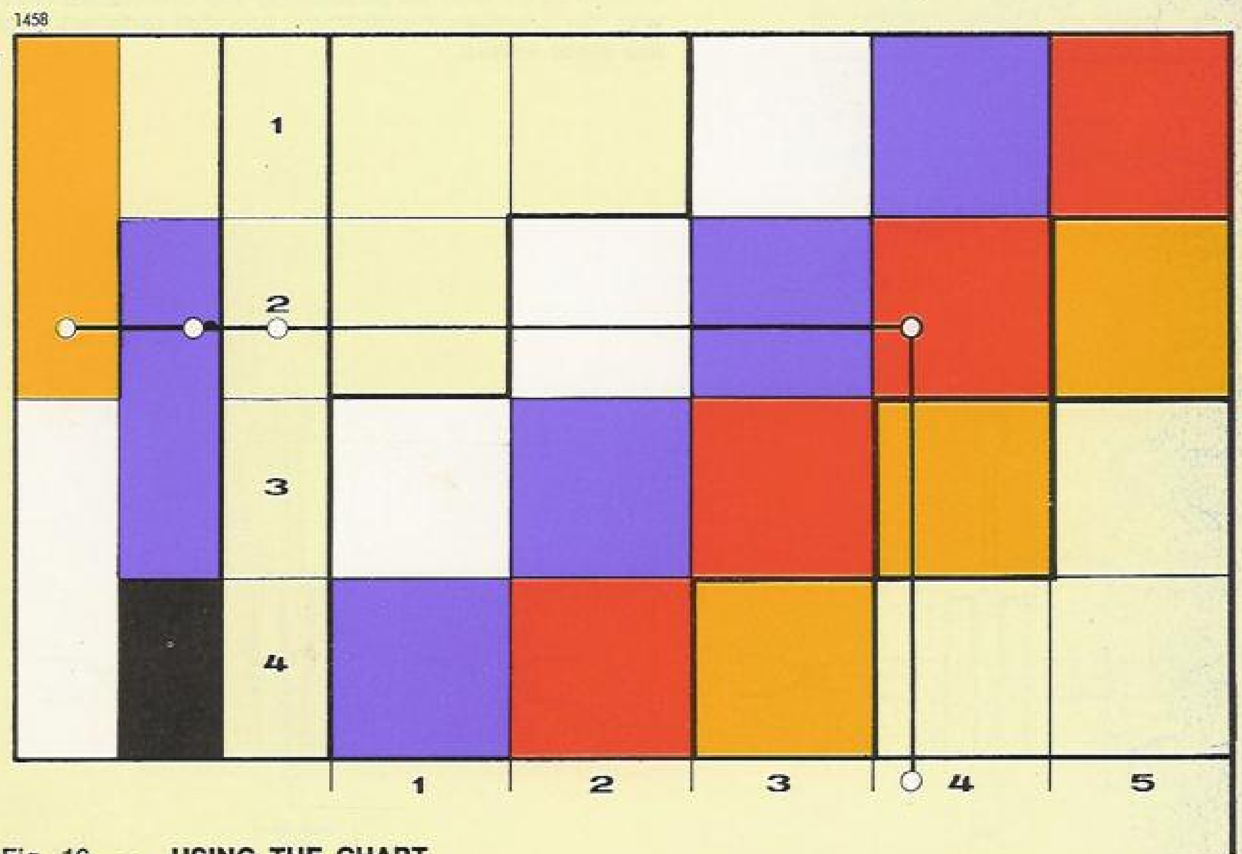

Fig. 16 USING THE CHART

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Crankshaft-testing the balance

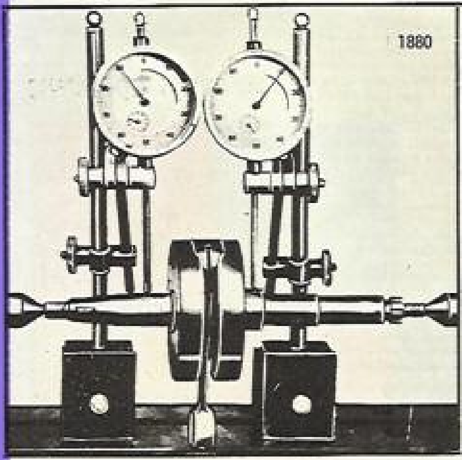


Fig. 18

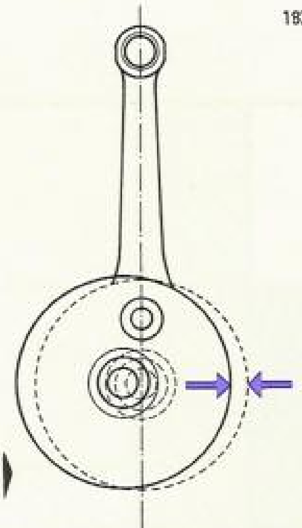


Fig. 17

Crankshaft — testing the balance and centering

A crankshaft can be out of balance because of incorrect assembly, cleaning or insufficient care being taken when pressing on the bearings. Therefore, the balance of all crankshafts (even new ones) must be checked. Clamp the crankshaft between two centre points and check with a dial gauge. The crankshaft centres must not be damaged.

Two different faults are possible:

1. Crankshaft lobes are out of true (fig. 17).

Measuring (fig. 18) produces the following result: Measured as near as possible to the crankshaft lobes with the crankshaft stationary, one dial registers plus, the other minus.

Fig. 19

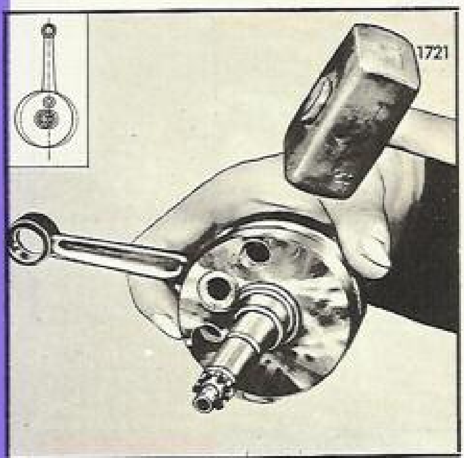


Fig. 20

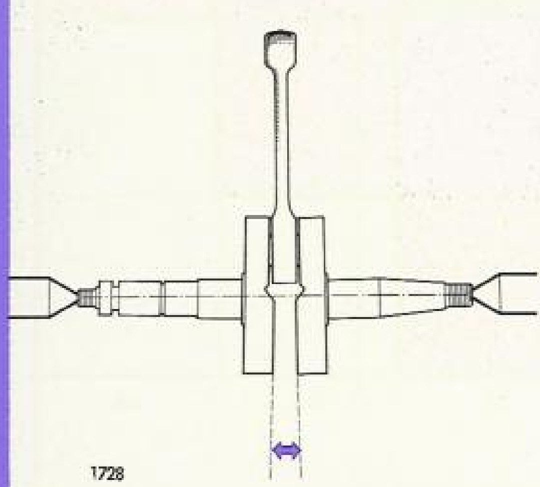
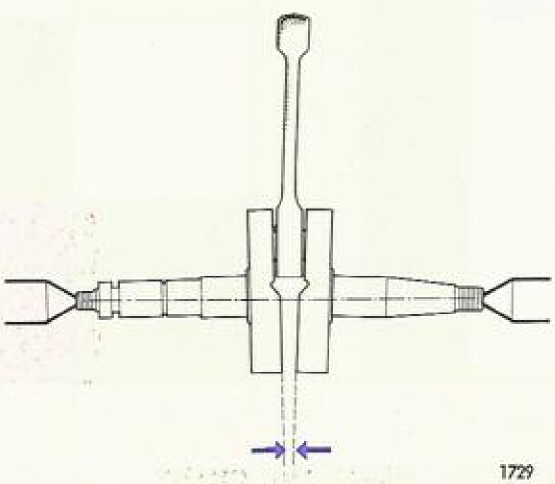


Fig. 21



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Crankshaft-conrod alignment

Mark the position of the maximum plus reading on the lobe of the crankshaft and straighten by hitting the mark with a copper hammer or similar tool, as indicated in fig. 19.

Measure the crankshaft again and repeat as necessary.

The permissable difference is .001574 to .001968 in (.04 to .05 mm), representing an out of balance of .000787 to .000984 in (.02 to .025 mm).

2. Crankshaft lobes not parallel
(fig. 20 and 21)

Clamp the crankshaft between the centre points as shown in fig. 22 and measure as described in paragraph 1. Readings taken on the stationary crankshaft are either both plus or both minus, depending on the position of the shaft (see fig. 22).

Again mark the position giving the maximum reading. Straighten by hitting with a copper hammer (fig. 23) if the lobes are bend outwards (fig. 20) or by inserting a tapered bar (fig. 24) if they are bent inwards (fig. 21).

Measure again and repeat as necessary.

The permissable discrepancy between plus and minus is .001574 to .001968 in (.04 to .05 mm), representing an out of balance of .000787 to .000984 in (.02 to .025 mm).

Conrod alignment

As previously mentioned, the conrod can be out of alignment and need replacing. Measuring and straightening can be effected if the crankshaft is dismantled (fig. 25) or, if still fitted to the engine, after removing the cylinder and piston (fig. 26).

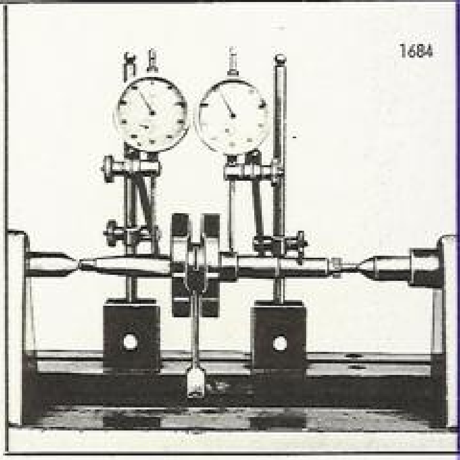


Fig. 22

Fig. 23

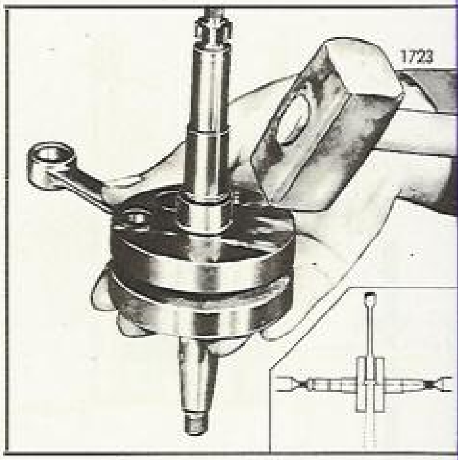


Fig 24

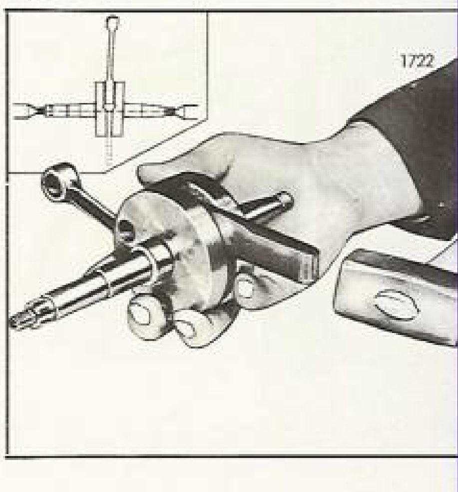
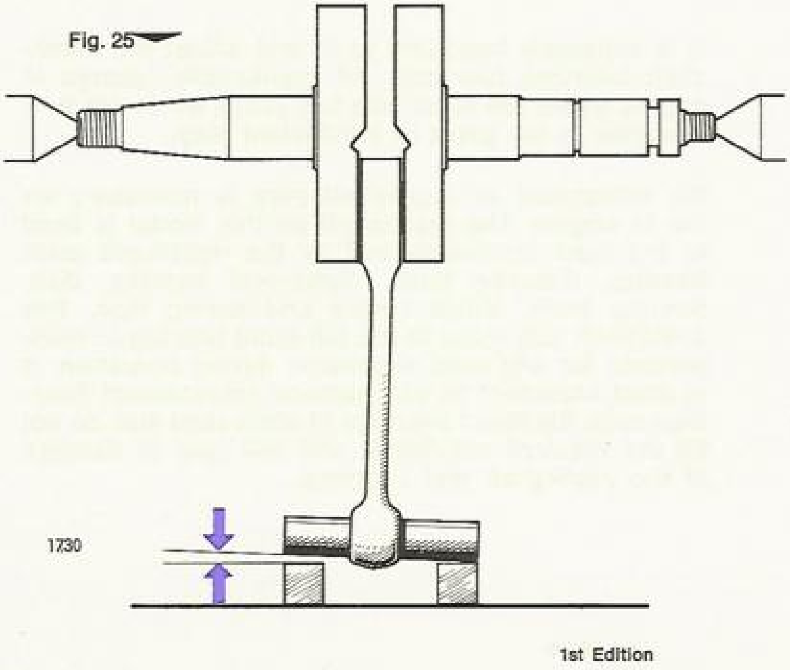


Fig. 25



Crankshaft-bearing play

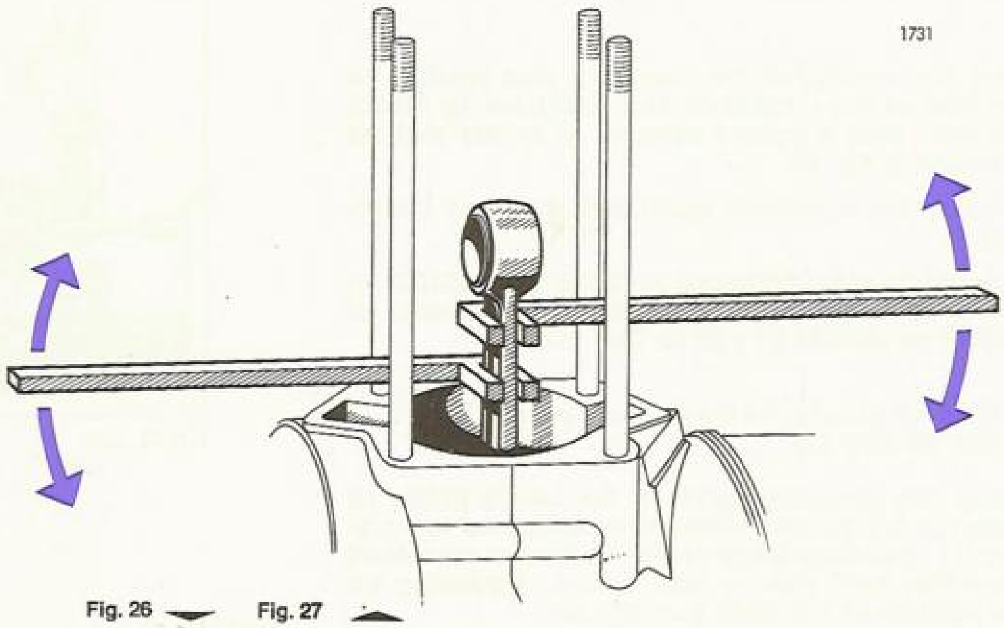
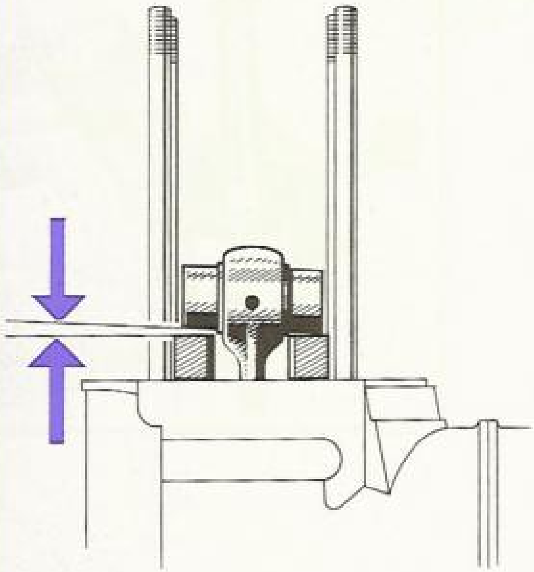


Fig. 26 Fig. 27



Measure as illustrated with a pair of steel blocks accurately ground to equal height, the gudgeon pin and a feeler gauge or similar device.

Make up two aligning forks and straighten conrod according to fig. 27.

Fig. 28

Crankshaft bearing play

It is extremely important to fit and adjust the crankshaft bearings correctly. All crankshafts (except M engine types) are fitted with ball races which are very sensitive to too great or insufficient play.

No adjustment of crankshaft play is necessary on the M engine. The crankshaft on this model is fixed to the right crankcase half by the right-hand main bearing, distance bush, clutch-end bearing, disc, bearing bush, clutch centre and spring disc. The crankshaft can move in the left-hand bearing to compensate for any axial expansion during operation. It is most important to use genuine replacement bearings only. Standard bearings of equivalent size do not fill the required conditions and will lead to damage of the crankshaft and bearings.

1st Edition

Crankshaft - adjusting the bearing play

1. Fitting and adjusting of crankshaft bearings

All models except M-engine.

The following special equipment is necessary to check the crankshaft bearing play:

1 dial gauge (obtain locally)

2 measuring device No. 350.1.70.013.0

Remove the fan components, flywheel and flywheel magneto base from the engine housing.

Fit the measuring device to the left of the crankcase (flywheel magneto fixing) with the knurled fixing screws.

Clamp the dial gauge to the exact centre of the crankshaft.

Measure by rocking the crankshaft in the direction of the arrows (fig. 28) and read the actual bearing play.

The **bearing play** must be .002362 to .004724 in (.06 to .12 mm).

If the play is above .005905 in (.15 mm), remove the engine, dismantle and adjust or replace the crankshaft bearings if necessary.

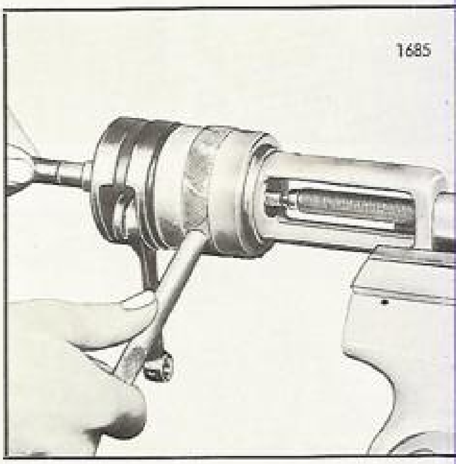
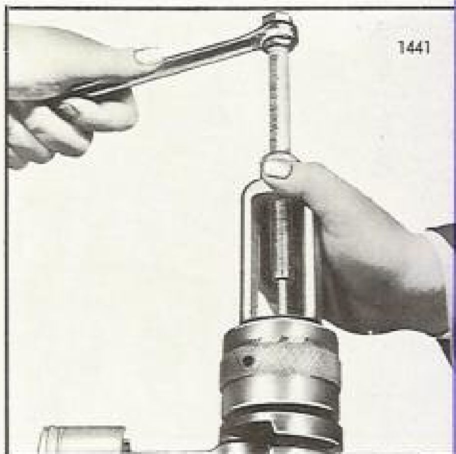


Fig. 29

Fig. 30



Fitting and adjusting of bearings

The following special tools are necessary to adjust the bearing play:

extractor	No.	905.0.24.102.0
guide for fitting dial gauge . .	No.	905.6.32.103.0
gauge to adjust nominal distance	No.	050.1.1032/L 44
dial gauge	obtain locally	

Alle components must be cleaned and oiled before assembly. Genuine replacement bearings are supplied packed in polythene bags and are greased with Vaseline. Further greasing is not necessary. Remove the inner rings of ball bearings from the crankshaft with extractor No. 905.0.24.102.0. This extractor is adjustable and fits either bearing size. The extractor has a three-jaw chuck and is first tightened by hand and then with the bar provided (fig. 29). Extract the bearings as shown in fig. 30. Outer bearing rings are pressed out of the housing with a suitable punch after pressing out the sealing rings from inside.

Crankshaft - adjusting the bearing play

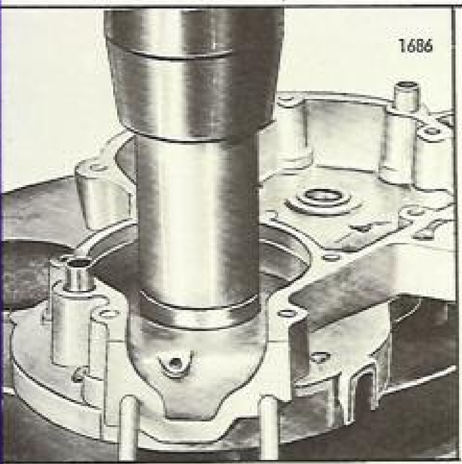
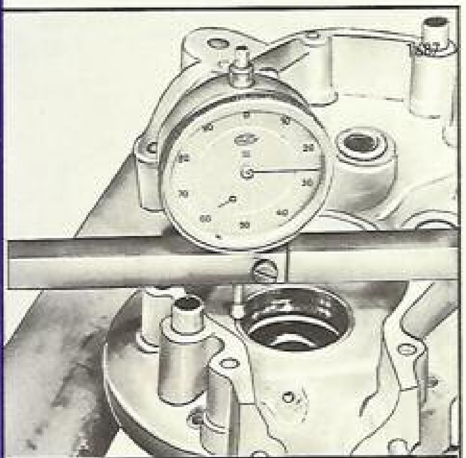


Fig. 31 ▲ Fig. 32 ▼



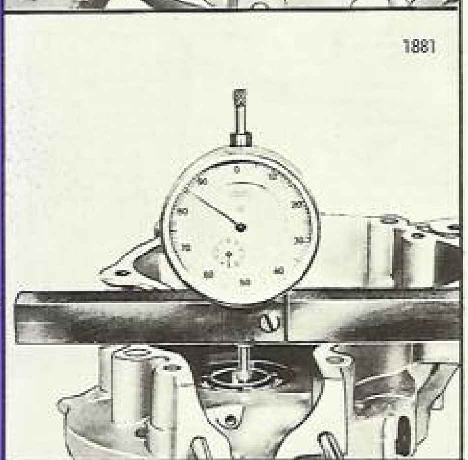
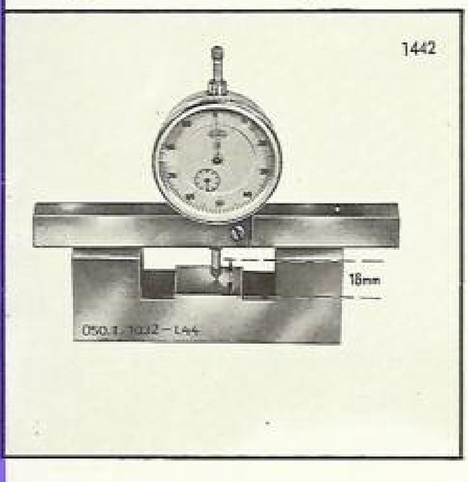


Fig. 33 ▲ Fig. 34 ▼



Start assembling by pressing the outer rings into the crankcase halves (fig. 31). Insert the washers first on 60 cc engines.

Check correct fitting with the dial gauge. Fit the gauge to the gauge bar (fig. 32) and check at four different points on the outer ring face. Equalise any differences by tapping the face with a brass bar. Do not tap the ball track. Check again with the dial gauge.

Now insert the inner rings with the ball cages into the crankcase halves, inscriptions facing outwards, taking care not to mix up the inner rings.

Measuring the bearing distance (fig. 33)

The specified bearing distance is 1.41732 in (36.00 mm), giving .70866 in (18.00 mm) for each crankcase half. Check the difference between specified and actual distance by means of the dial gauge fitted to the gauge bar. Adjust the dial gauge to zero at a depth of .70866 in (18.00 mm) with the depth gauge (fig. 34). Measure one crankcase half including the sealing ring, the other without (fig. 33). The sealing ring is between .01061 and .01296 in (.27 and .38 mm) thick. Deduct .00787 in (.2 mm) from the measured distance to allow for the compression of the sealing ring.

Example:

The left crankcase half was measured with the sealing ring .0161 (41)	+ 0.7248 in	(18.41 mm)
The right crankcase half was measured .002755 (07)	+ 0.7114 in	(18.07 mm)
Deduct .00787 in (.2 mm)	– 0.00787 in	(0.20 mm)
bearing distance	1.4283 in	(36.28 mm)

The actual bearing distance of the crankshaft (check balance before assembling) is ascertained at the factory and stamped on the right-hand lobe in hundredths of millimetres. The bearing distance on the crankshafts may be from 1.4133 to 1.4232 in (35.90 to 36.15 mm). Distances below 1.4173 in (36.00 mm) are stamped to the lobe with figures 90 to 00, representing 1.4133 to 1.4173 in (35.90 to 36.00 mm). Distances above 1.4173 in (36 mm) are indicated with the figures 01 to 15, representing 1.4177 to 1.4232 in (36.01 to 36.15 mm).

1st Edition

Crankshaft - adjusting the bearing play

If, for any reason, the marking is illegible or if the crankshaft has been realigned or straightened the bearing distance must be measured again. Use a micrometer or accurate caliper according to fig. 36.

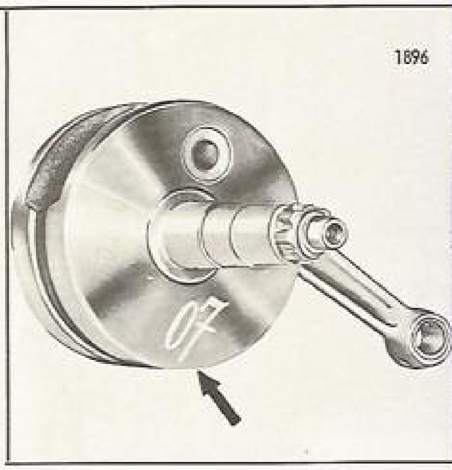
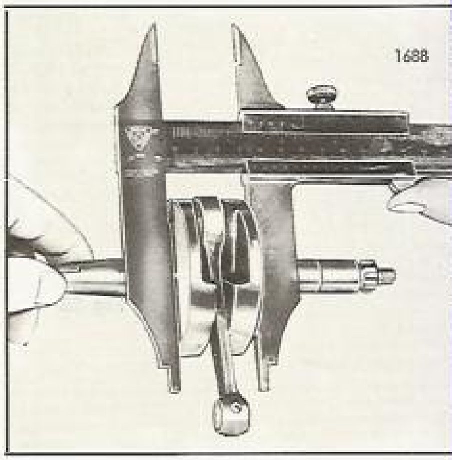


Fig. 35

Ascertaining the bearing play

The bearing play is the difference between the previously measured bearing distance of the crankcase and the stamped or measured bearing distance on the crankshaft.

Fig. 36



Example:

Bearing distance of crankshaft including pressed sealing ring	1.4283 in	(36.28 mm)
Actual bearing distance of crankshaft .00275 (07)	1.4200 in	(36.07 mm)
giving a bearing play of	0.0083 in	(0.21 mm)

The correct bearing play must be obtained. Therefore, fit a .00394 in (.1 mm) thick shim between one bearing inner ring and a .00196 in (.05 mm) thick shim below the other a total of .00591 in (.15 mm). Press the inner rings onto the crankshaft; it will now have a bearing play (see example) of

.00827 in (.21 mm) — .00591 in (.15 mm)
= .00236 in (.06 mm)

Note: The press table No. 320.1.70.012.2 must be used to press on the inner rings to the crankshaft lobes to prevent any deformation of the crankshaft.

Continue assembling the engine after checking the bearing play. When pressing home the sealing rings ensure that there is a gap of approximately .0394 in (1 mm) between the sealing ring and bearing (see fig. 38) or the lubricating holes for the bearings will be blocked.

Fig. 37

Crankshaft — M-engine

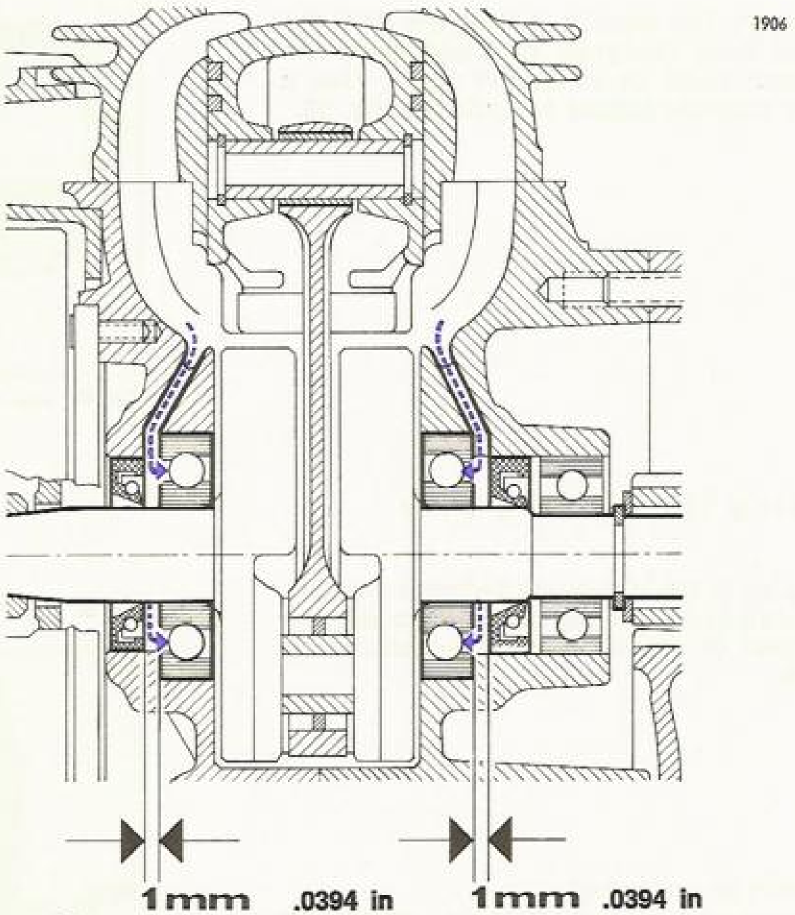


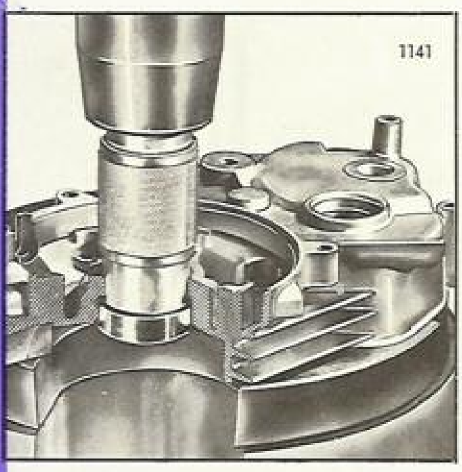
Fig. 38

Fit the left-hand sealing ring (flywheel magneto side) with the lips pointing inwards and the right-hand ring with the lips outwards. Use a suitable pressing tool. Fit the rings from the outside.

After fitting the right-hand sealing ring press in the third crankshaft bearing from the outside (this does not apply to two-speed and automatic engines).

2. Assembly of crankshaft bearings, M engine

Fig. 39



The following special tools are required to fit and remove the crankshaft bearings:

Extractor for right-hand main bearing	No. 905.6.34.101.0
Press bush	No. 905.6.33.103.1
Press table for crankshaft bearing	No. 320.1.70.012.2

Pressing out the bearings:

Left crankcase half:

Lift off the sealing ring with a screwdriver or similar tool. Press out the outer ring of the bearing with punch No. 905.6.33.103.1 according to figure 39.

Crankshaft — M-engine

The inner ring with the roller cage of the bearing is pressed onto the crankshaft. Remove with extractor No. 905.6.34.101.0 according to fig. 40.

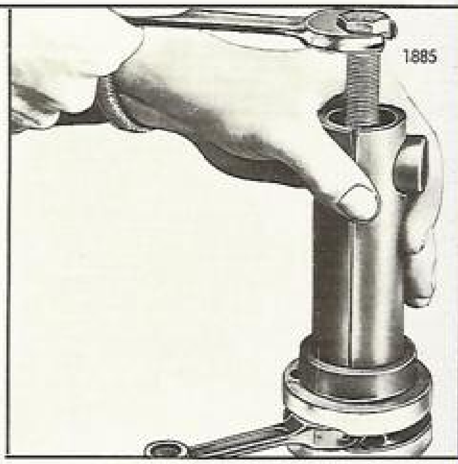


Fig. 40

Right crankcase half:

Take out the sealing ring and remove the clipring situated behind the sealing ring. Use a punch of a smaller diameter than the internal diameter of the crankshaft-end bearing to press out the clutch-end bearing, including the distance bush from the inside.

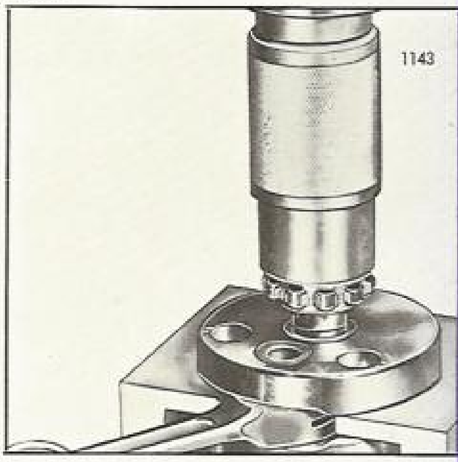
Pressing in the bearings

Left crankcase half:

Press home the inner ring with punch No. 905.6.33.103.1. The press table No. 320.1.70.012.2 must be used to prevent deformation of the crankshaft (see fig. 41). The outer bearing ring is pressed in from the outside as illustrated in fig. 42.

Press in the sealing rings from the outside, lips facing inwards.

Fig. 41

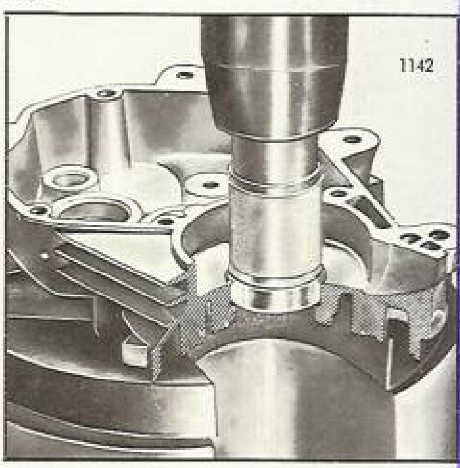


Right crankcase half:

The large inner bearing is pressed home completely from the outside with a suitable punch. The outer smaller bearing is pressed in from the outside after inserting the distance bush. Note: The distance bush must not move. Counteract pressure underneath the inner bearing to prevent tensioning the inner rings.

Fit the circlip behind the inner bearing and press in the sealing ring, lips outwards.

Fig. 42



Crankshaft

Crankshaft — MAXI engine

Fig. 43 ▲

MAXI Engine

Gudgeon Pin

A bronze bearing bush for the small end is pressed into the conrod.

Play is as follows:

Assembly play .000315 to .000787 in (0.008 to 0.020 mm)
Wear Limit .000984 in (0.025 mm)

Gudgeon-pin bore in the piston and gudgeon pin are specially selected. Marking of piston is illustrated in figure 43 and is in colours yellow or blue.
Dimensions are quoted in the following chart.

Bore .4724 in (12 mm) diameter Group		Gudgeon pin .4724 in (12 mm) diameter Group		Play
Yellow	.4727 to .4726 in (12.0085 to 12.0060 mm) dia.	2	.47245 to .4724 in (12.003 to 12.000 mm) dia.	.000118 to .000336 in (0.0030 to 0.0085 mm)
Blue	.4726 to .4725 in (12.0060 to 12.0035 mm) dia.	2	.47245 to .4724 in (12.003 to 12.000 mm) dia.	.000019 to .000236 in (0.0005 to 0.0060 mm)
		3	(12.000 to 11.997 mm) dia. .4724 to .4723 in	.000137 to .000354 in (0.0035 to 0.0090 mm)

The gudgeon pins have face marks according to groups 1—3 (see figure 43).

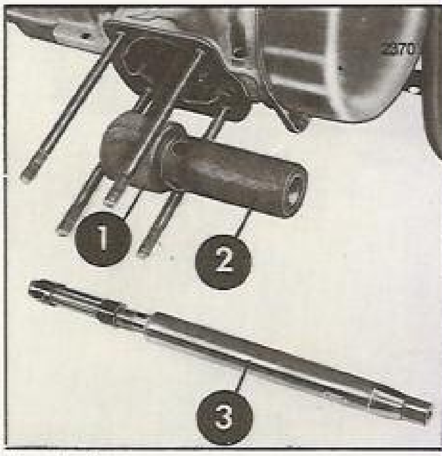


Fig. 44 ▲

Replacing conrod bush

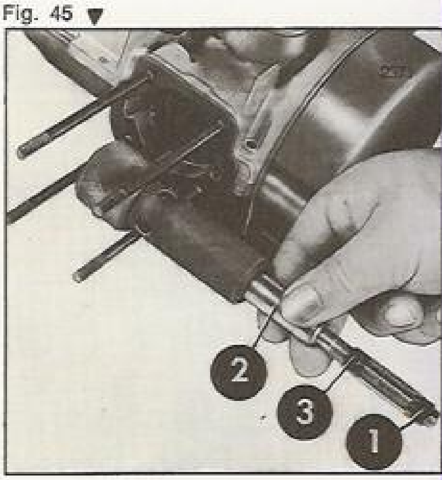
The conrod bush wears under normal useage and must be replaced if necessary.

The following tools are necessary:

		Part No.
Press tool		905.6.33.105.0
Reaming tool		905.6.17.101.0
Reamer	Hunger	P 11.5—12.5

Workshop equipped with Hunger-Puch 005.0 or 005.1 ream and centering device only the indicated reamer and guide bush for this reamer are needed.
Fixing and removing of conrod bush is described on page F 2 and applies also to the Maxi engine.
If the Hunger-Puch 005.0 or 005.1 ream and centering device is used, proceed according to descriptions on page F 3. Figures 5 to 7 apply in general.
If device part 905.6.17.101.0 is used, proceed as follows:

Fig. 45 ▼



Centering of conrod:

The conrod must be accurately centered in the device for reaming.
Insert conrod into clamping nut (figure 44/1) and screw in guide bush (figure 44/2).
Insert reamer (figure 44/3) and center conrod with taper at reamer (figure 45).
Clamp conrod by turning guide bush.

Crankshaft – MAXI engine

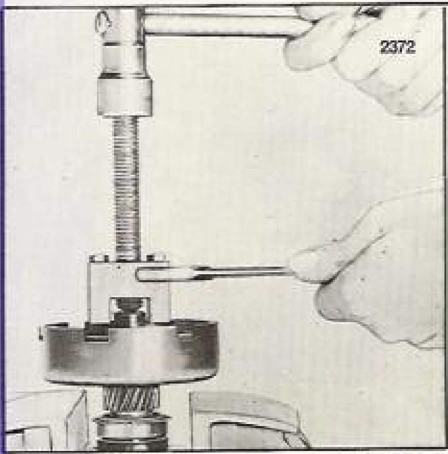
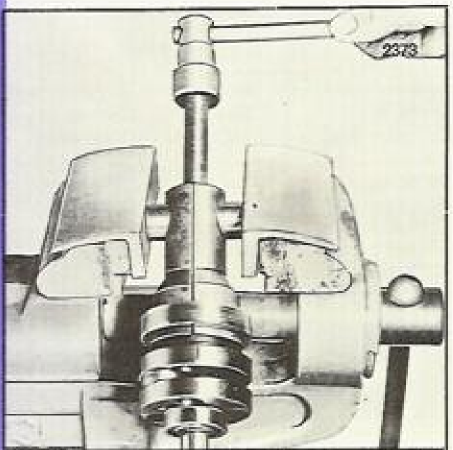


Fig. 46 ▲ Fig. 47 ▼



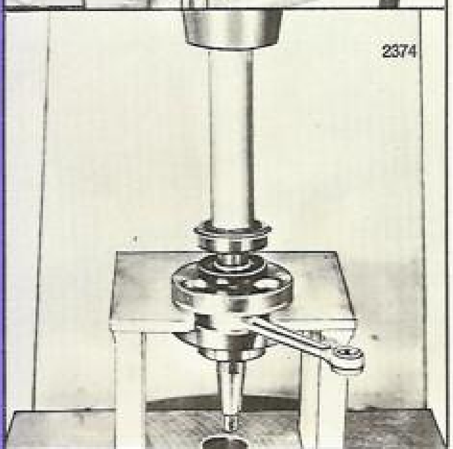
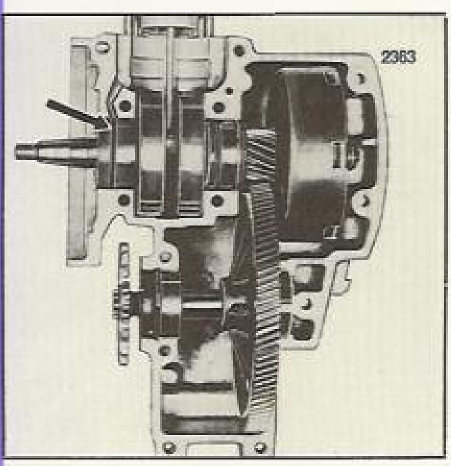


Fig. 48 ▲ Fig. 49 ▼



Reaming of conrod bush

The front adjusting nut (figure 45/1) of reamer (figure 45/2) has an indicator giving adjusting possibilities in graduations of .000787 in (0.02 mm). Loosen counter nut (figure 45/3) insert reamer and expand to bush diameter with adjusting nut (figure 45/1). Take reamer out of bush and expand by one mark. Lock blades with counternut (figure 45/1).

Lubricate with oil while carefully reaming the conrod bush. Check hole with gudgeon pin. Ream until pin slides into hole without any play.

Dimensions are given in chart on page F 17.

Fitting and removing of crankshaft bearings

Split the crankcase and take out crankshaft with centrifugal clutch. Remove piston after taking off circlips and pressing out gudgeon pin.

Take spring clip out of centrifugal clutch (no tools necessary) and remove clutch discs of starting clutch complete with actuating bolt and bearing. Clamp clutch end web of crankshaft into vice using plastic or aluminium jaws and remove nut of centrifugal clutch. Clamping of the other or of both webs disturbs the balancing.

Fit extractor part no. 905.6.34.102.0 as illustrated in figure 46 and pull off centrifugal clutch from crankshaft.

Extract crankshaft bearings as illustrated on figure 47 with extractor part no. 905.6.34.102.0. To refit, use press table part no. 320.1.70.012.0 and press sleeve part no. 350.1.70.012.0 – see figure 48.

To assemble, fit bearings, sealing rings and complete centrifugal clutch to crankshaft and insert into housing (figure 49). Figure 49 illustrates sequence of fitting components onto crankshaft. No bearing play need be adjusted. For adjustment of centrifugal clutch see group K-automatic.

On assembly, a lubrication gap is necessary between bearing and sealing ring on magneto end – see figure 49.

All other jobs on crankshaft are according to pages F 1–15.

1st Edition

Clutch and primary drive

Power Transmission

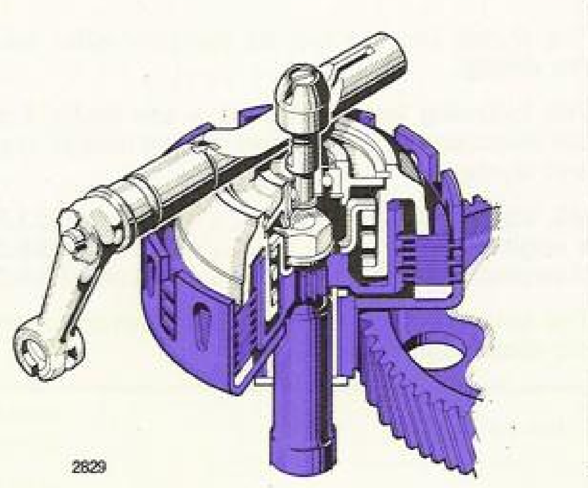


Fig. 1 Clutch engaged

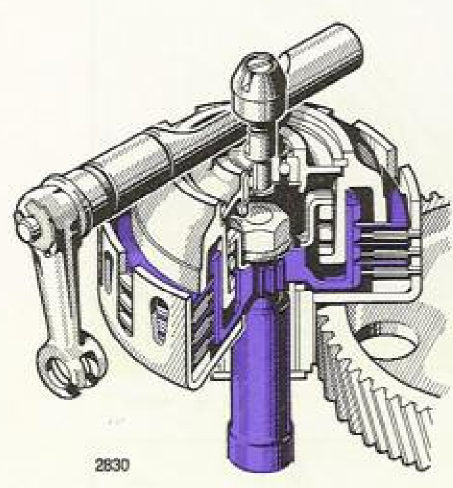


Fig. 2 Clutch disengaged

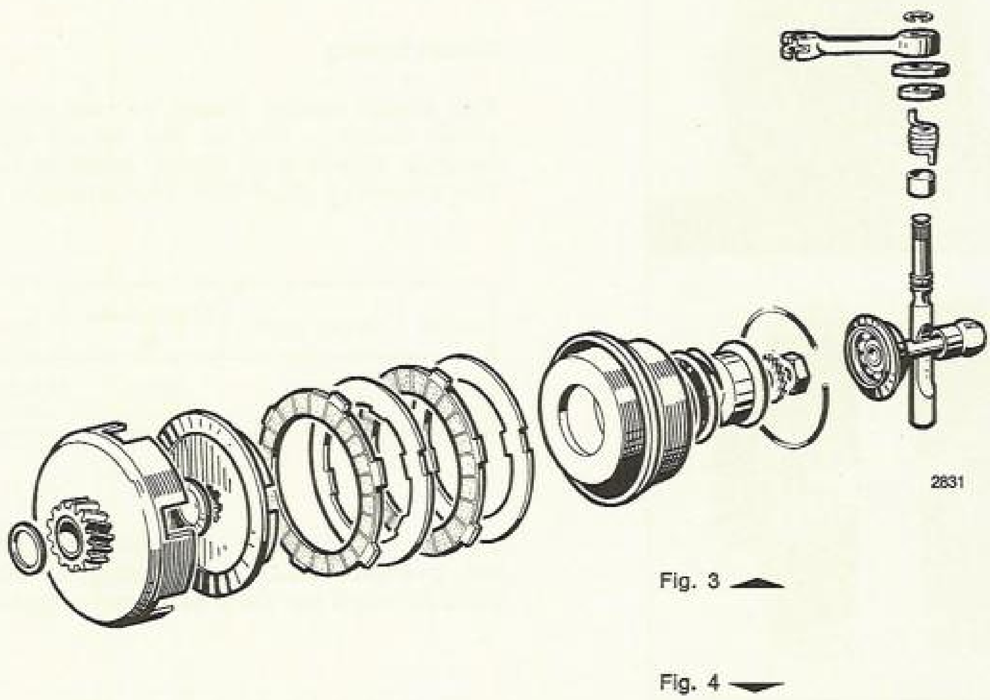
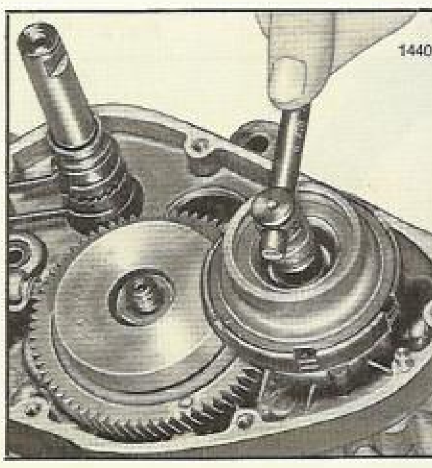


Fig. 3

Fig. 4



All our models except the automatic types use oil-immersed multi-disc clutches Automatic types are described separately under the group K automatic. Noting the following details on adjustment and wear limits guarantees proper functioning.

Dismantling and Assembling of Clutch and Primary Drive

When removing the clutch cover, the guide screw for the spherical nut on the clutch bearing is unscrewed. Turn clutch lever forward to permit clutch shaft to pass the spherical nut when removing clutch cover.

Clutch and primary drive

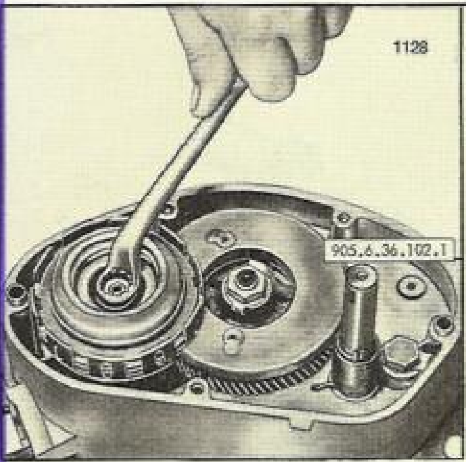


Fig. 5 ▲ Fig. 6 ▼

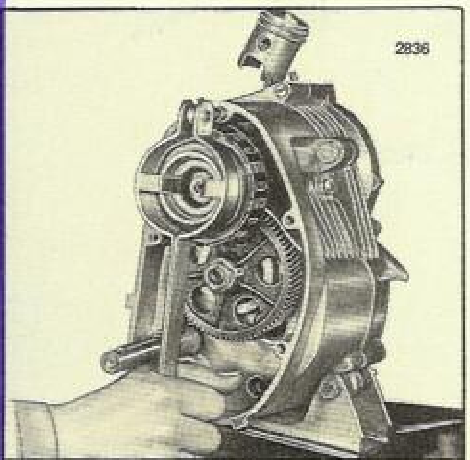
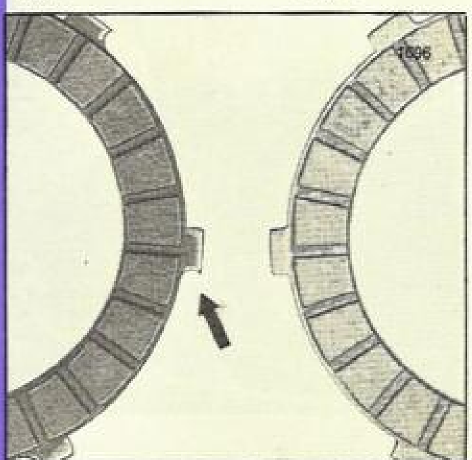


Fig. 7 ▲ Fig. 8 ▼



The clutch bearing can be removed after taking out the circlip.

The following locking divices – see figure 4 and 5 – are necessary to loosen and tighten nuts of crankshaft and layshaft.

MS, VS, R and X 30 engine . Part no. 360.1.70.014.1
V engine . . . . Part no. 905.6.36.104.2
M engine . . . . Part no. 905.6.36.102.1

The following torques must be observed for assembling clutch and primary drive.

Nut for clutch	18.08 ft/lb (2.5 mkp)
Nut for primary gearwheel	39.78 ft/lb (5.5 mkp)

Clutch Spring

The clutch spring (same for all models) is a part which wears – that is, the spring ages and looses tension. Check with spring balance or with vernier. The following chart lists all necessary data:

Length	Wear Limit	Pretensioned to	New	Wear Limit
.748 in (19 mm)	.709 in (18 mm)	.551 in (14 mm)	88.2to97.02lb (40–44 kp)	79.38 lb (36 kp)

To function properly, the springs must be assembled pre-tensioned. Use spring tensioner part no. 905.6.31.105.0 for easy assembly (figure 6).

Wear of Clutch Hub, Drum and Plates

Such wear will occur on any clutch at some time and cause bad or jerky engaging or disengaging, or slipping and noise from clutch.

The following illustrations (figure 7 and 8) compare new and worn components. If such wear is within the wear limits, correct with file.

Furthermore, check thickness of used plates or linings prior to assembling. Replace if below wear limits.

The following chart quotes dimensions and wear limits.

1st Edition

Clutch and primary drive

Test clutch	New	Wear limit
Grooves in clutch drum	.2835 to .2847 in (7.2–7.23 mm)	.3228 in (8.2 mm)
Grooves in clutch hub	.2756 to .2843 in (7.0–7.22 mm)	.3228 in (8.2 mm)
Prongs of lined plates	.2677 to .2756 in (6.8–7.0 mm)	.2362 in (6 mm)
Prongs of steel plates	.2598 to .2677 in (6.6–6.8 mm)	.2362 in (6 mm)
Thickness of lined plates	.1024 to .1102 in (2.6–2.8 mm)	.0945 in (2.4 mm)
Thickness of steel plates	.0591 in (1.5 mm)	discolouring or grooved

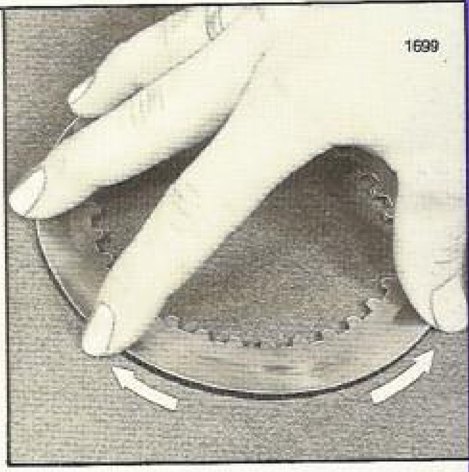


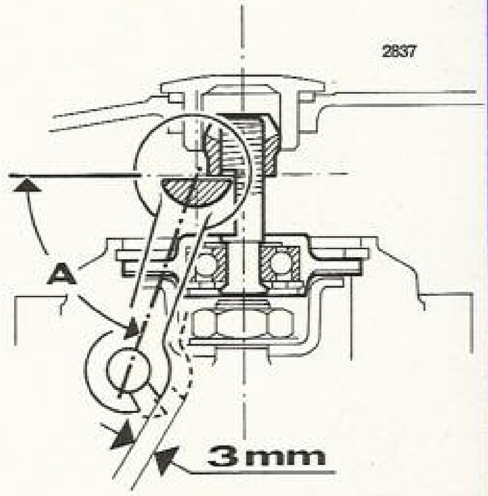
Fig. 9

New and used clutch plates must be flat. Check against ground plate or glass. Use emery cloth to correct if necessary (figure 9).

Adjusting the clutch

The following illustration shows position of clutch lever to bearing and of spherical nut to clutchshaft. This position gives maximum movement at minimum force. Note particularly the play between clutchshaft and spherical nut. Insufficient play will damage the clutch bearing quickly. The clutch cable being suspended the minimum clearance at the declutching lever ought to cover about .1181 inches (3 mm). The angle "A" show in figure 10 amounts to 58°. Furthermore, note play of clutch. Bowden cable of .000787 in (0.2 mm) between bearing and cable sleeve. This play will give the hand lever a free movement of approximately .3937 in (1 cm) – see figure 11.

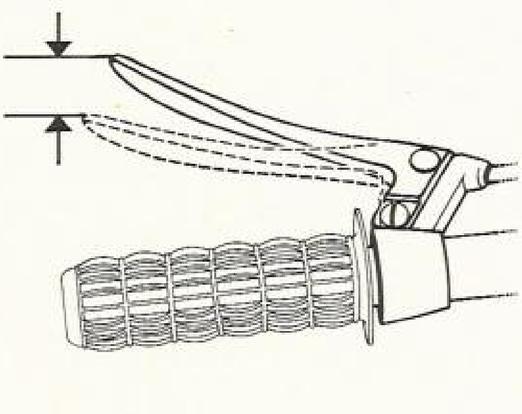
Fig. 10

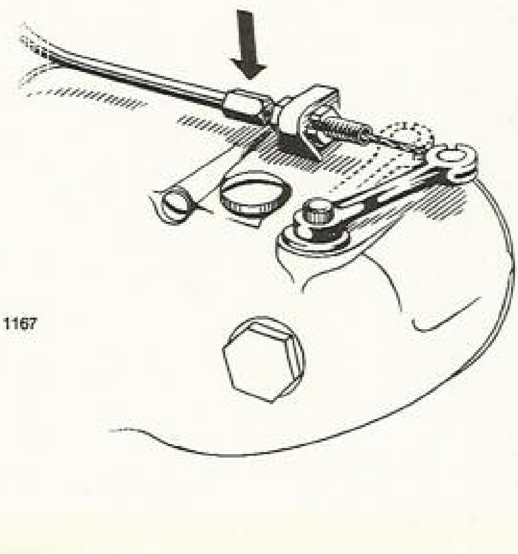


Torques

Housing screws	3.62 to 5.06 ft/lb (0.5–0.7 mkp)
Housing cover screws	3.62 to 5.06 ft/lb (0.5–0.7 mkp)

Fig. 11





Clutch and primary drive

1st Edition

Gearbox

Gear and starter mechanism parts must be checked visually. Few gear parts are subject to wear except selectors and pushrods. The following illustrations (figure 1 – 3) show such parts worn by normal use.

If such parts are not checked properly before fitting, the gearbox will tend to jump out of gear.

Furthermore, if a gearwheel is to be replaced due to wear, it is necessary to replace the engaging gear-wheel as well to prevent noise.

Also check bearings and sealing rings before assembling. Only new sealing rings and circlips should be used for assembling. Our gearboxes are fitted with roller bearings having loose rollers – if one is lost all must be replaced. On all our models the clutch end bearing is screwed to the layshaft and adjustment of play is therefore not necessary. It is also important to fit the washers of rollerbearings having loose rollers with the collar pointing to the rollers for proper lubrication (see figure 4).

Measuring axial play of Gearbox

The axial play of gearshafts and, on models MS and VSD, of starter layshaft must be checked and adjusted if necessary.

As described under the group "crankshaft", measure with depth gauge and vernier housing and shaft preassembled with gears and washers but without shims. Shim thickness is established by the measurements.

The difference between housing and shaft is compensated to give the permissable play. A pressing-in shrinkage of 0.00787 in (0.2 mm) must be allowed for the sealing ring. The permissable play for gearshaft and starter layshaft is

0.00393 to 0.01181 inch (0.1 to 0.3 mm)

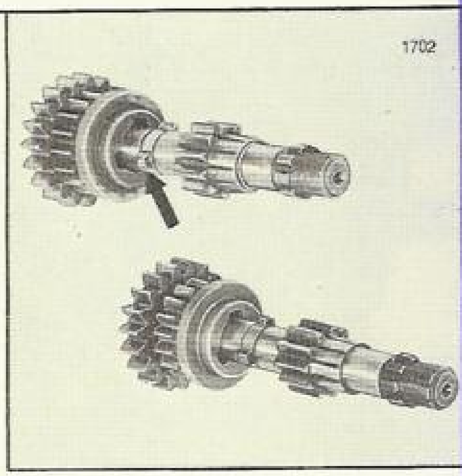
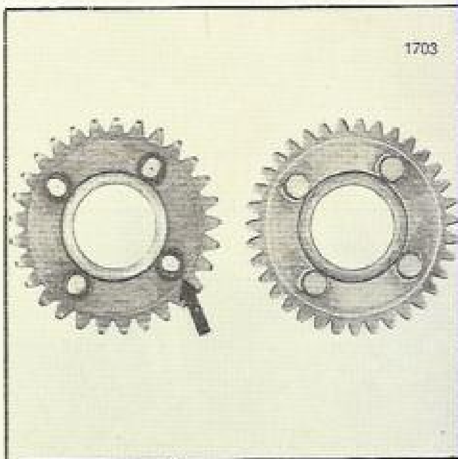


Fig. 1 ▲ Fig. 2 ▼



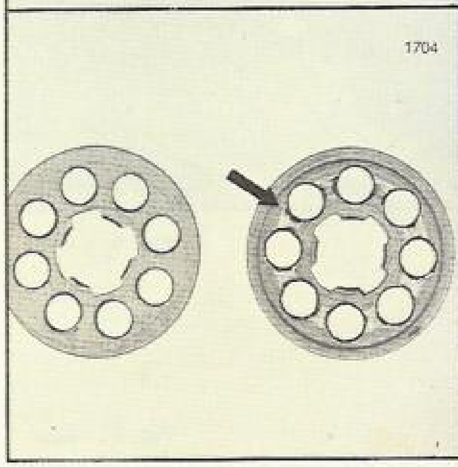
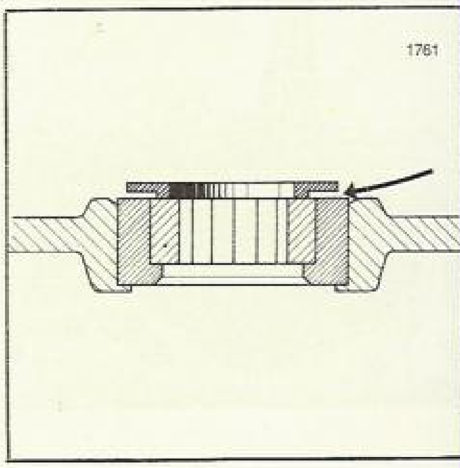


Fig. 3 ▲ Fig. 4 ▼



Gearbox

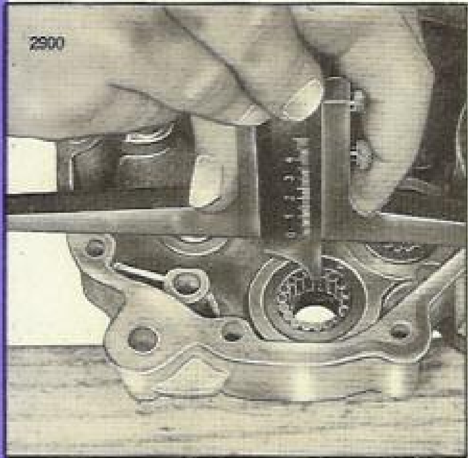


Fig. 5

Example:

Depth of left housing including seal, from face to bearing bush (figure 5)	0.98031 in (24.90 mm)
Depth of right housing, from face to bearing bush	+ 0.71653 in (18.20 mm)
Total depth of housing	1.69684 in (43.10 mm)
Less length of shaft including washers	− 1.67322 in (42.50 mm)
Less press-in shrinkage of sealing ring	− 0.00787 in (0.20 mm)
Gives an axial play of	0.01574 in (0.40 mm)
The play is reduced by exchanging a washer by an .00787 in (0.2 mm) thicker one to the correct limit of	0.00787 in (0.20 mm)

The mainshaft is adjusted with the washer fitted at the clutch end between bearing and gearwheel. The washer is available in various thicknesses from .06299 to .09842 in (1.6 to 2.5 mm).

The longitudenal play of the intermediate spindle is established by the same method and adjusted with washer added on either side between bush and spindle. These washers are available in thicknesses from .07480 to .09448 in (1.9 to 2.4 mm).

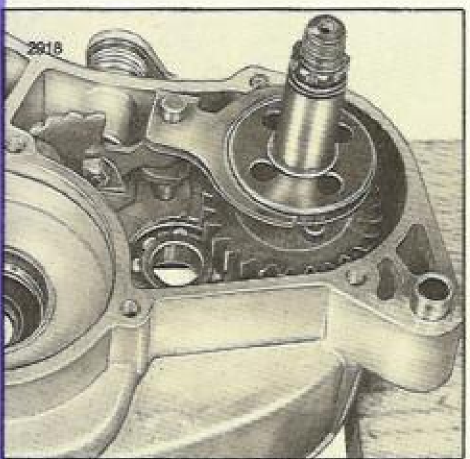


Fig. 6

Assembling of gearbox:

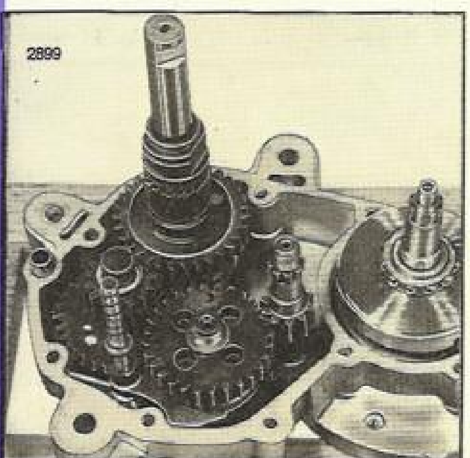
Note: Older MS and VSD models have a washer below the 2nd or 3rd speed gearwheel. On later models this is replaced by a collar.

X 30 engine

Insert correct washer along with 1st gearwheel into the right housing half. Slide control bush onto mainshaft. Engage control fork into ball lever and fit control rail (figure 6). Insert layshaft and fit 2nd gearwheel.

Older models have a washer at the layshaft and at the 2nd gearwheel on the mainshaft. On later models are these washers omitted by using thicker gears. When fitting the left housing half check that the ratchet remains in position.

Fig. 7



MS Engine

Add layshaft and mainshaft with 2nd gearwheel to the previously prepared left housing half. Selector fork and rail are assembled. Push fork onto control bush and slide bush onto mainshaft. At the same time insert the control rail into the appropriate hole in housing. Fit 1st gearwheel to mainshaft and add the correct sized shim washer. Complete assembling (figure 7).

Gearbox

VSD- and R-Engine

Fit to the left housing half.

Fit mainshaft with 3rd gearwheel, jaws pointing inwards, into roller housing. Add shims to either side of starter spindle and fit into bearing bush.

Fit 2nd gearwheel, toothed face pointing to 3rd speed, to mainshaft. Match up fork with driving groove of 2nd gearwheel on mainshaft. Do not insert control rail (rail and fork are one assembly) into hole of housing so that the 2nd gearwheel, held by the fork, is located high up on the mainshaft (towards 1st speed).

Stick washer with grease to the 3rd gearwheel end of layshaft. Insert layshaft into roller bearing and, at the same time match the driving ring of 2nd gearwheel on layshaft to driving groove of 2nd gearwheel on mainshaft (figure 8). Now push control rail into housing. Test assembly by turning layshaft a few times. Add 1st gearwheel, jaws pointing down, to mainshaft. Adjust longitudinal play of spindle with the correct sized shim washer. Add washer to bearing of starter spindle. Fit starter spindle, circlip end first (figure 9). The brake spring of the starter bush must be fitted forward to almost touch the outer wall of the housing as viewed to the guide in the right housing half. Adjustment of control segments and Bowden cable is described in group 1, controls.

V-Engine

The 4-speed-V-engine is assembled in the left housing half after measuring the bearing play.

Fit control cam complete with control spindle (see group 1, controls). Insert washer for mainshaft and add 1st gearwheel. Now fit mainshaft (figure 10) and layshaft. To assemble gears, first insert the loose pair of gearwheels into the appropriate control fork and push the complete assembly onto mainshaft and layshaft (see figure 11). After assembling the gears, fit the correct sized washer – thickness established by measuring according to paragraph "mainshaft" – to mainshaft and slide control rail through the two control forks. Note: bearings must be free from oil

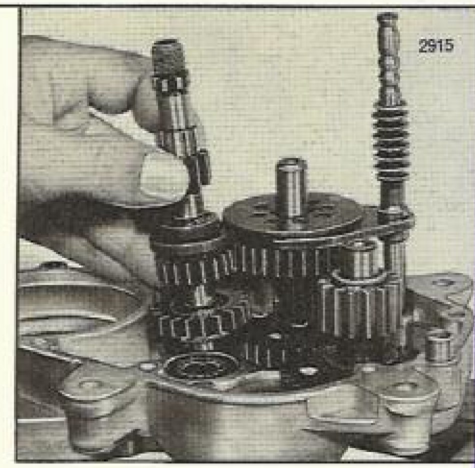
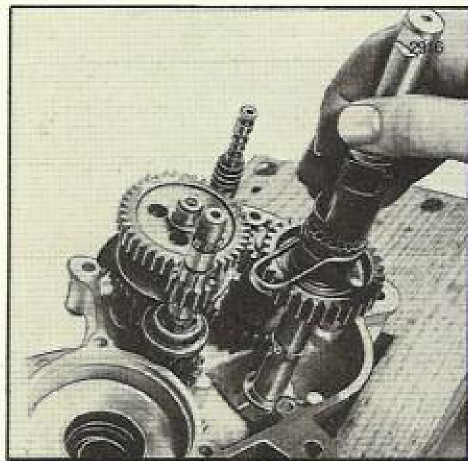


Fig. 8 ▲ Fig. 9 ▼



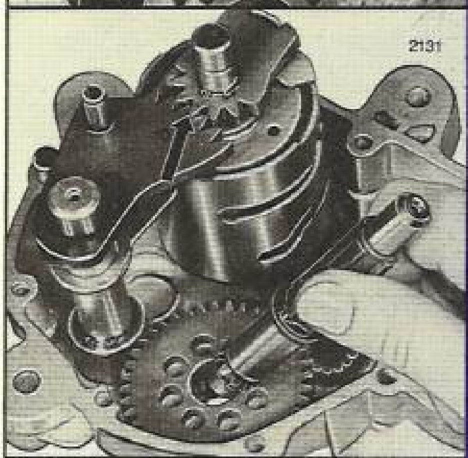
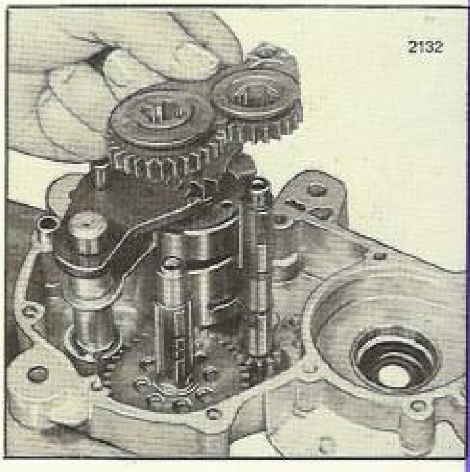
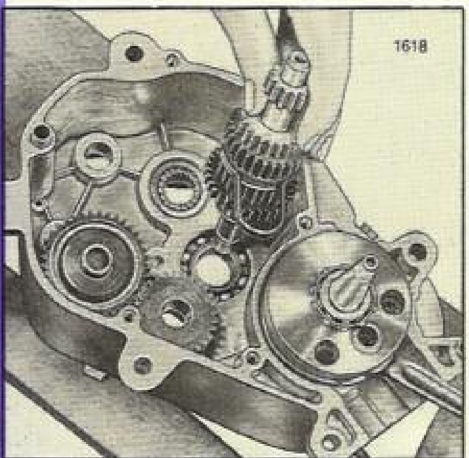


Fig. 10 ▲ Fig. 11 ▼



Gearbox

Fig. 12 ▲ Fig. 13 ▼



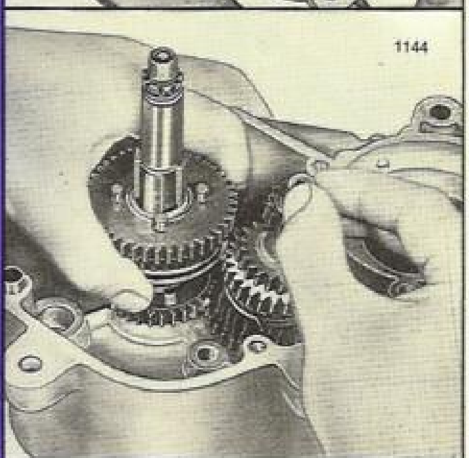
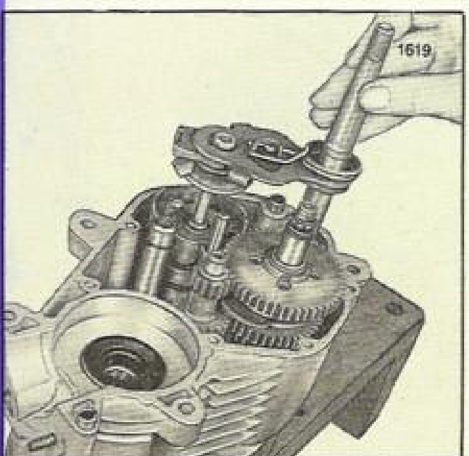


Fig. 14 ▲ Fig. 15 ▼



or the oil film will prevent the rail being pushed home completely (figure 12).

M-Engine

Mainshaft: The 1st and 4th gearwheels are fitted loosely onto the mainshaft; the 2nd and 3rd gearwheels are located by 2 outer circlips. The control bush for the 1st and 2nd speed is the same as the one for the third and fourth speed.

Layshaft: Part of the layshaft is one piece and the remaining parts are pressed-on. The shaft cannot be dismantled.

Mainshaft assembly commences as follows: First fit circlip to shorter spindle and push on 3rd gearwheel followed by 2nd gearwheel from chain wheel driving end. The 2nd circlip can now be fitted. Add one each of the two identical control bushes to either end of the already fitted gearwheels. Fit large washer, 4th gearwheel and small washer to shorter spindle end.

The M-engine is assembled in the right housing half, clutch end on assembly board. Complete layshaft, centering sleeve and key are inserted together into the housing.

Note: The brake spring of the starter bush must be fitted in such a way that when viewed from top, the shorter end of the spring points to the right – figure 13. Insert complete mainshaft into roller bearing (fig. 14).

Lift up control bush and insert control fork for 3rd and 4th speed, guide pin pointing upwards. Fit control cam, ratchet guide upwards, after lifting up control fork for 3rd and 4th speed. Assemble control fork for 1st and 2nd gear, guide pin downwards. Slide control rail through both forks and insert in housing.

Assembling starter shaft: Push brake spring towards crankshaft and put intermediate starter wheel on top of bearing bores. Push brake spring back. Insert longer end of intermediate starter shaft with intermediate sleeve (do not mix up with intermediate sleeve of crankshaft) into housing. Fit washer, 1st gearwheel and then shim washer to mainshaft.

Fix control cam in idling position.

Add spring and ratchet to control cam. Push control shaft with selector and preassembled control spring (hair-pin spring) onto camshaft and into housing (figure 15). Loom of control spring must be in the middle. Add washer to shaft of control cam and continue assembling.

Controls

In general, all points mentioned under gearbox apply here too. Selector difficulties are normally not due to faults in the selector unit but due rather to fair wear of certain often used parts. If the selector is in working order, do not strip complete unit but check all wear parts and functioning of selector unit and ratchet.

Note the following points in repairs necessary due to selector difficulties.

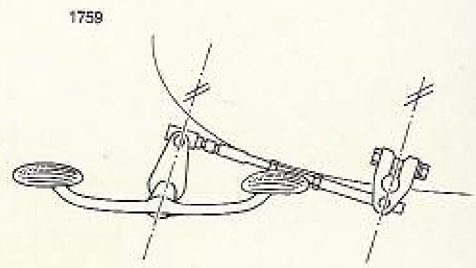


Fig. 1

Check prior to engine dismantling

Correct functioning of clutch. A clutch which does not disengage causes difficulties in selecting gears or prevents engagement of gears.

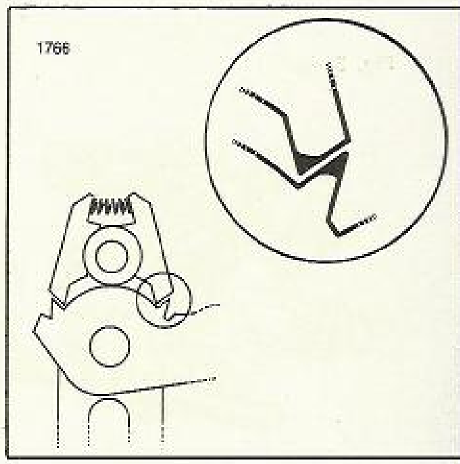
Check adjustment of Bowden cable. Incorrectly adjusted Bowden cables cause various difficulties – jumping out of gear or inability to select a gear. Subsequent damages are wear of gear dogs, bent or worn control forks and such like.

On model DS with footchange the position of the two selector levers – foot change lever for automatic should be noted. Both levers must be parallel to give equal selector distance – figure 1. Check mounting of selector unit. Loose mountings cause selector difficulties.

Check ratchet: Difficulty in gearchanging is often caused by the ratchet.

Check selector lever and spindle for ease of movement.

Fig. 2

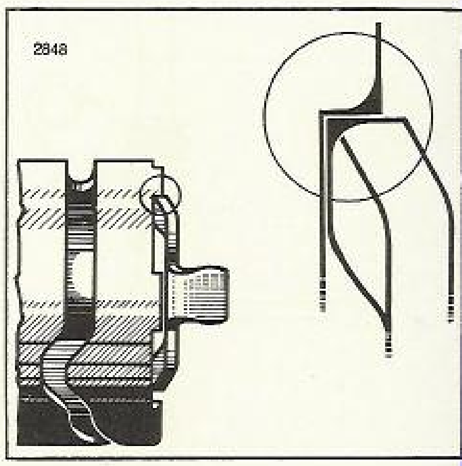


Check prior to engine assembly

Wear on gear dogs, shaft ends and gearwheels – see section on gearbox – figure 1–3.

Wear on selector pins and drivers – see figure 2 and 3. No rounded edges are permissable. Worn selector forks are very rare. Blue discoloured or deformed forks must be replaced.

Fig. 3



Notes for assembling

Assembly of selector units can be seen on sketches illustrating selector diagrams – see figures 4–11.

X-30-Engine (figure 4)

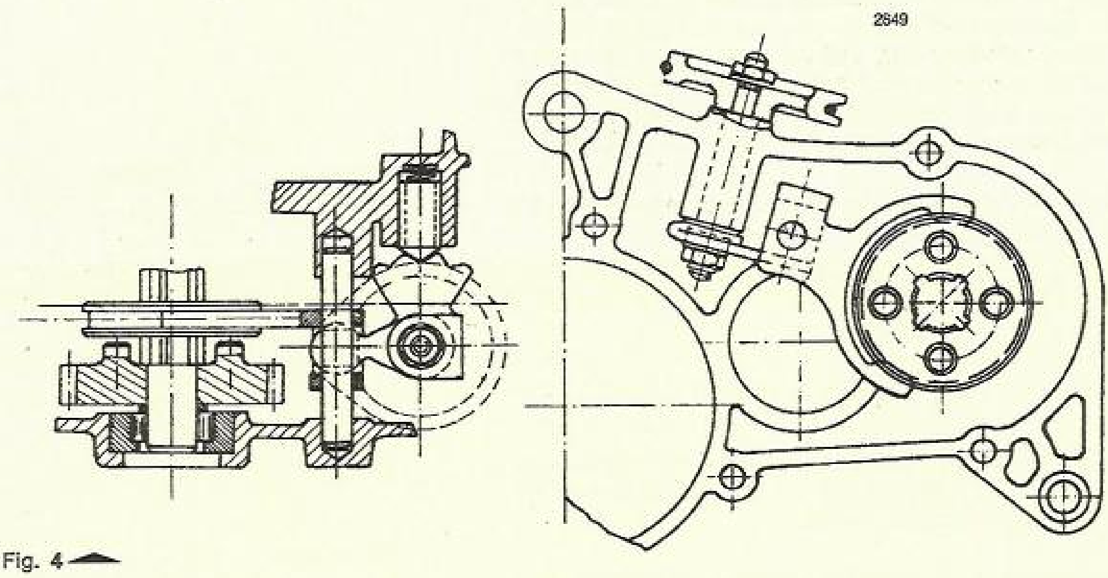


Fig. 4

Fig. 5

MS-Engine (figure 5)

If replacement of inner or outer selector lever is required on assembling check the relevant positions – see figure 5. Both levers are fitted together by a toothed system and locked with circlips. The two levers must be assembled as shown in figure 5.

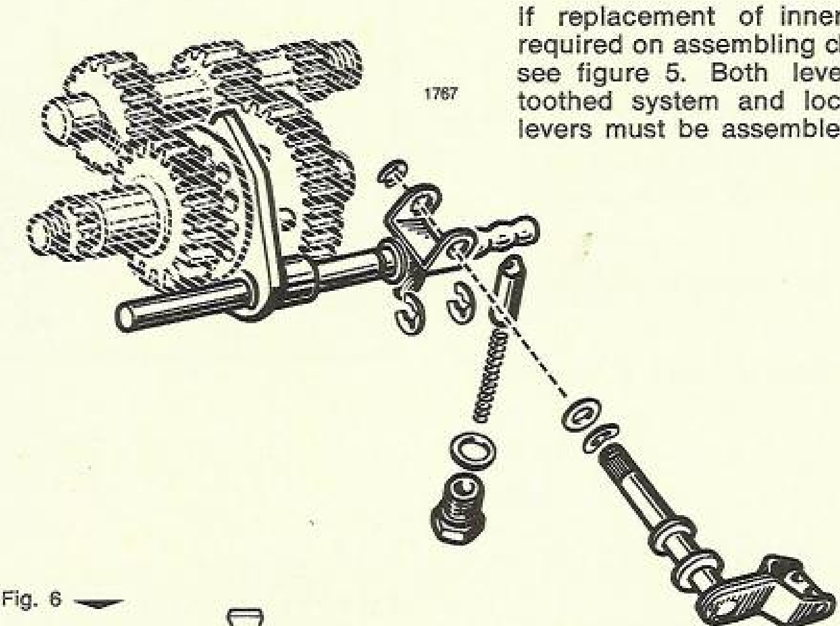
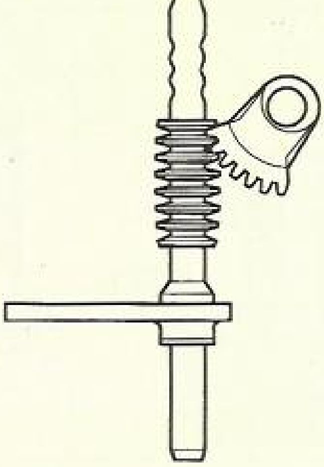


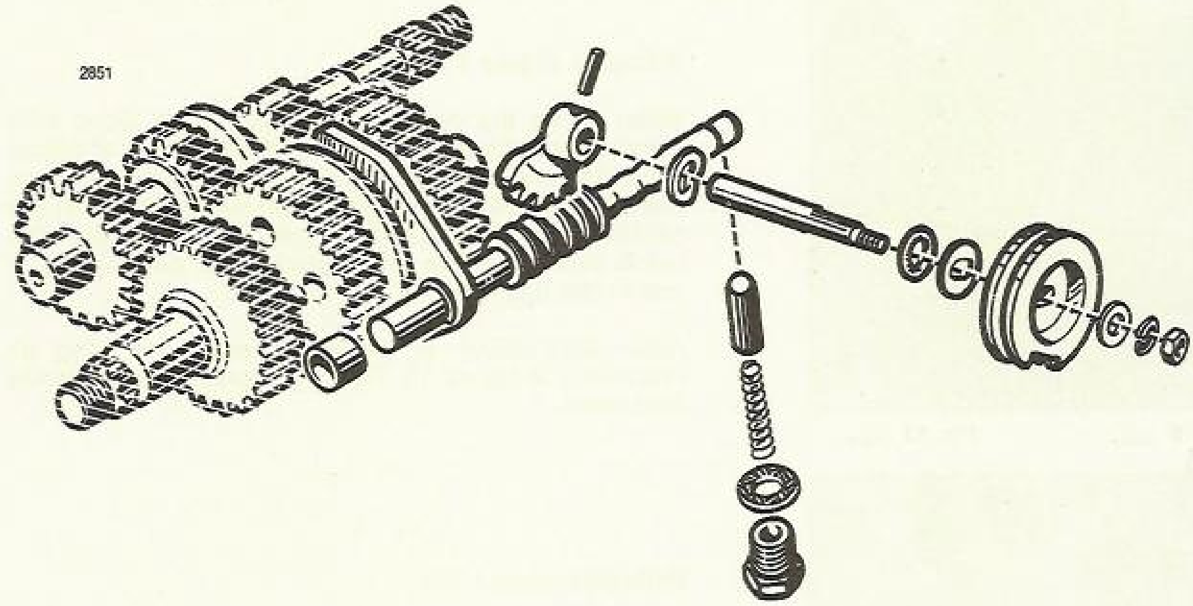
Fig. 6



VSD- and R-Engine-hand controlled (fig. 7)

Turn selector quadrant entirely inward and set pair of gears for 2nd speed by means of selector fork into idling position (position between 1st and 2nd speed) so that the first (outer) tooth of quadrant engages into the first tooth space of selector rail (fig. 6) after placing the housing half right hand side.

2851



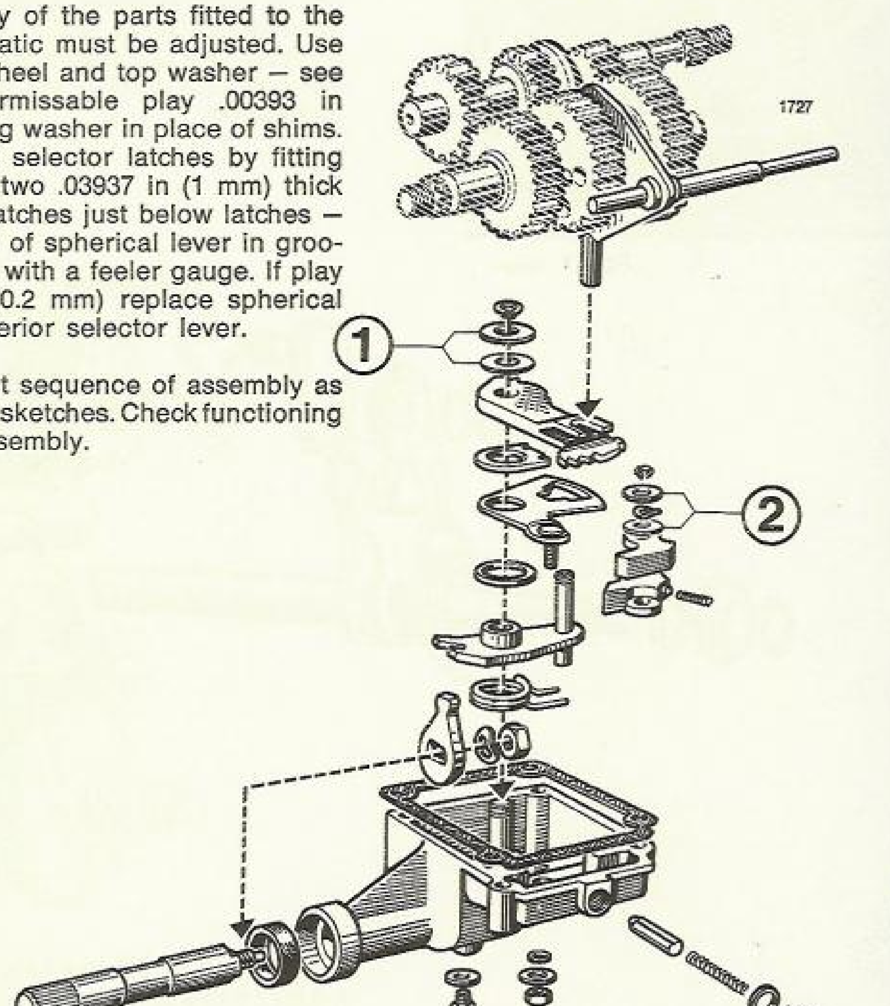
VSD- and R-Engine — foot controlled (figure 8)

On these models, the play of the parts fitted to the bolt situated in the automatic must be adjusted. Use shims between selector wheel and top washer — see figure 8/1. Maximum permissable play .00393 in (0.1 mm). Do not use spring washer in place of shims. Also adjust the lift of the selector latches by fitting a spring washer between two .03937 in (1 mm) thick washers to fixing bolt of latches just below latches — see figure 8/2. Check play of spherical lever in grooves of inner selector lever with a feeler gauge. If play is more than .00787 in (0.2 mm) replace spherical lever and if necessary interior selector lever.

Furthermore, check correct sequence of assembly as illustrated in the following sketches. Check functioning of selector before final assembly.

Fig. 7 ▲ Fig. 8 ▼

1727



Controls

Fig. 9 Fig. 10

V-Engine (figure 9 and 10)

When fitting the complete selector drum along with selector spindle make sure that the toothing of selector finger and selector spindle engage properly, i. e. the middle tooth of selector finger must engage in the centre of selector spindel toothing. Check that the catch clicks into the idling position of catch plate – see arrow figure 9.

After assembling of engine fit selector spring as illustrated in figure 10. Fit spring pretensioned (ends acrossed).

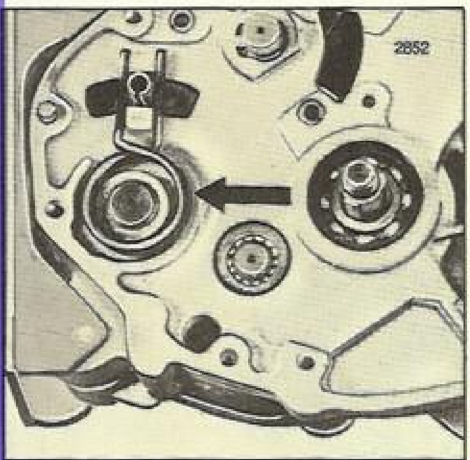
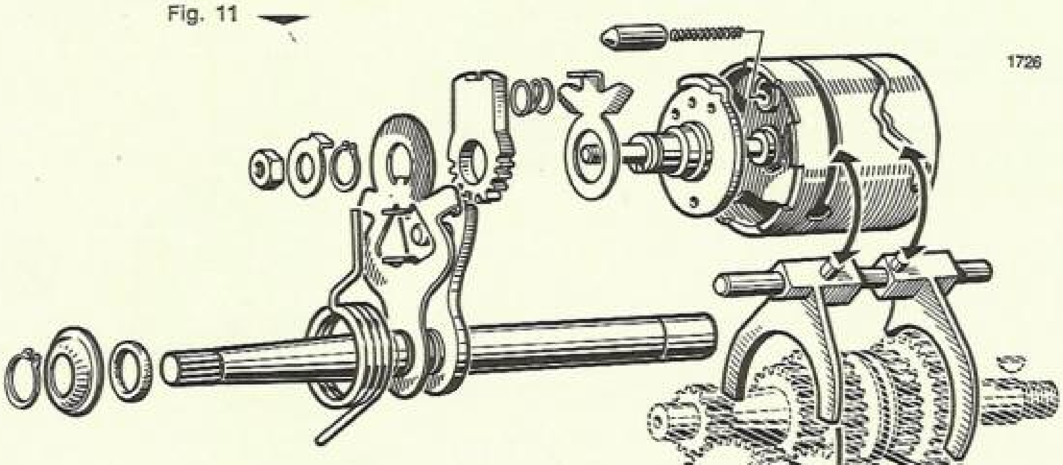


Fig. 11

M-Engine (figure 11)

Pre-assembly automatic selector on selector spindle and insert into housing. Selector cam and gearwheels are in idling position. Line up loop of selector spring to center to allow spring centering collar from right housing half to pass through freely on assembling. If not done, the spring may jam and prevent assembling of housing.



Adjusting of selector on hand-controlled models

Special attention is needed when adjusting the Bowden cable on hand controlled 2 and 3 speed models. Assembling and adjusting as follows:

1st Edition

Controls

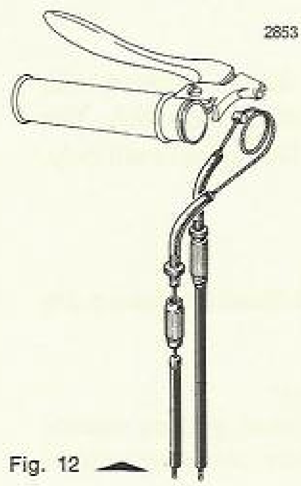


Fig. 12

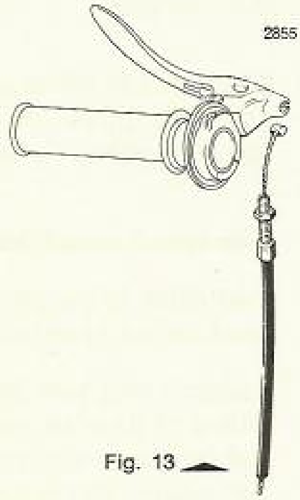


Fig. 13

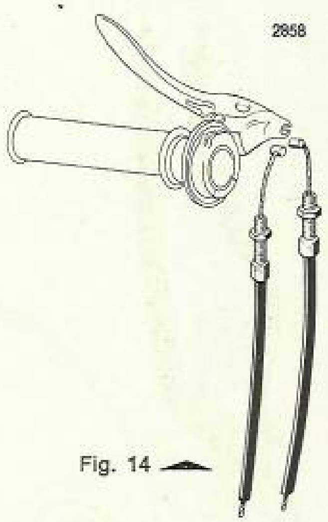


Fig. 14

X 30

Two different hand-controlled systems are used on X 30 models. System one uses twin Bowden cable and selector wheel on engine. System two uses Bowden cable, selector lever and return spring on engine. Assembling and adjusting as follows:

System using twin Bowden cable:
Dismantle gear selector grips. Push back cable sleeve to find longer cable tag. Wind longer tag around grip as illustrated in figure 12. Lay cable into guide and assemble grip and fit complete unit to handlebar.
Push cable sleeve completely on to grip and establish longer cable end. Hook longer cable into right side of roller and shorter one into left side of roller – see figure 15. Selector spindle of engine and grip must be in idling position. Unscrew Bowden cable screws on bearing until both cables are equally tensioned – a gap of approximately .00787 in (0.2 mm) should be left between cable and sleeve. Unequally tensioned cables cause selecting difficulties or jumping out of gear. Too much tension makes selection difficult. Finally check selection. Adjusting screws on handlebar grip are for fine adjustment only.

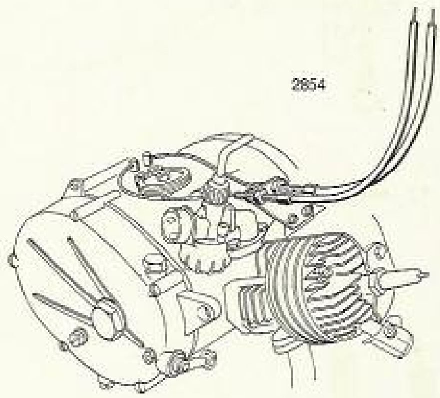
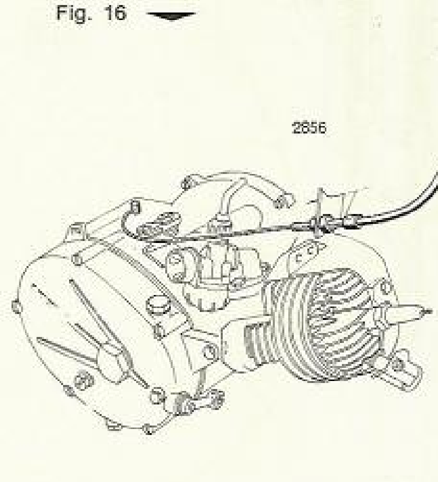


Fig. 15

Fig. 16



System using single Bowden cable:
Dismantle handlebar grip – Grip contains two grooves. Hook Bowden cable to back one – figure 13. One of the two cable guides in handle is closed; insert cable into other. Push grip housing together and fit to handlebar.

Check engagement of 2nd gear. Return spring of selector lever engages engine automatically in 2nd gear. Move grip to position for 2nd gear and hook Bowden cable to switch lever and bearing, see figure 16.

Controls

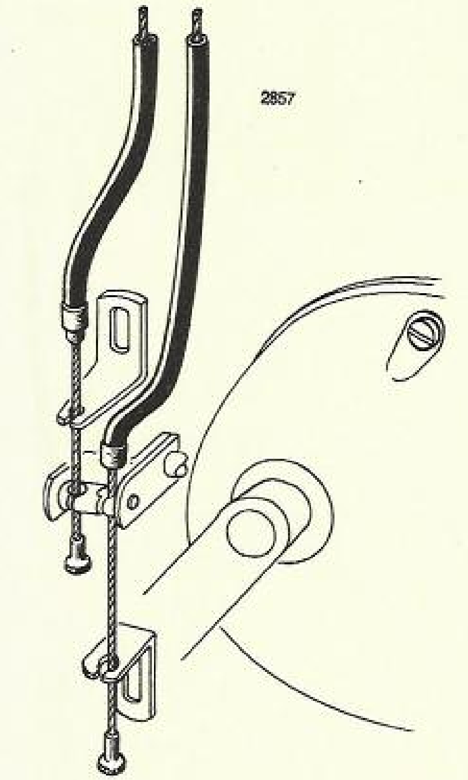


Fig. 17

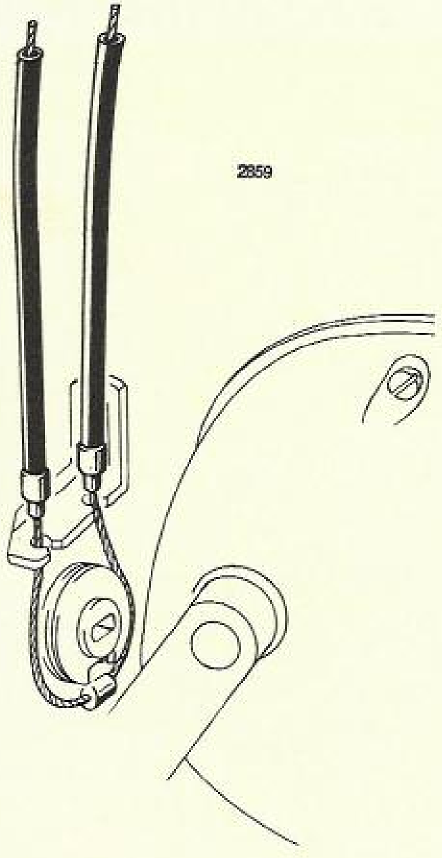


Fig. 18

Move grip to idling position and adjust position with adjusting screw on bearing. Check selector. The adjusting screw on the grip is for fine adjustment only.

Two-speed model MS/VS

Two kinds of handlebar grip and Bowden cables are used on two-speed models.

System using twin Bowden cables:
Fitting of Bowden cable to handlebar grip as described in group X 30 models, systems using twin Bowden cables. See figure 12.

Coarse adjustment is affected by lifting or lowering the cable bearings and subsequent tightening of adjusting screws – figure 17. Handlebar grip and engine selector lever must be in idling position. Use adjusting screws in handle for final adjustment. Finally check selector.

System using two Bowden cables:
Check which of the two Bowden cables has the longer free end.

Hook longer end into back of rotary handle and shorter one to the front – figure 14. Adjusting commences as described previously – system using twin Bowden cable – see figure 17.

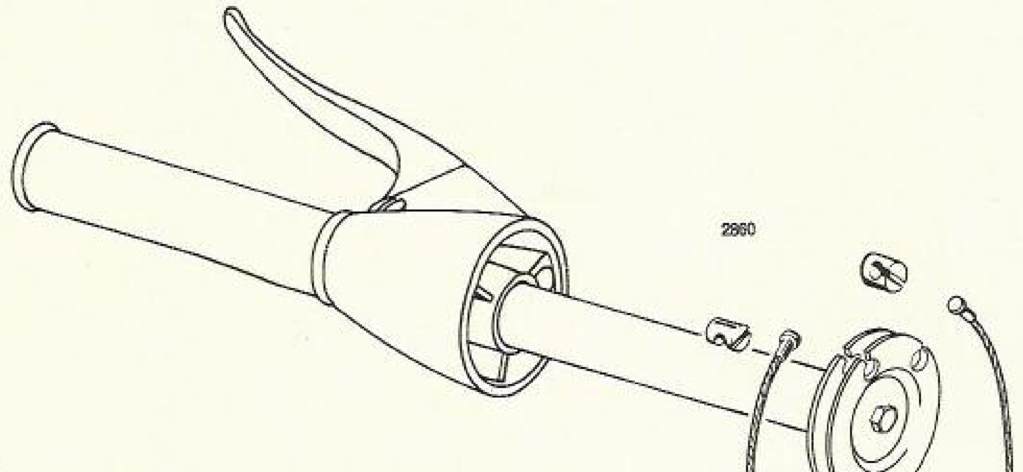
Three-speed models

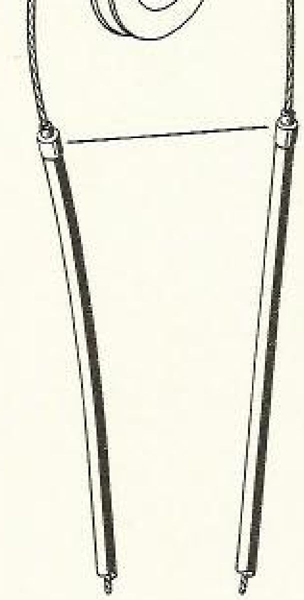
VSD, DS, VZ

On three-speed models, hook open end of Bowden cable into handlebar grip and closed end with clamping nipple to control wheel of control segment on engine. Fit longer tag to the back and shorter one to the front. Push twist drum and housing together, insert Bowden cable into guides and fit grip – see figure 14.

Move control wheel and twistgrip to position for first gear. The shortest end of Bowden cable, viewed from the clamp, is hooked to the inside of the previously loosened bearing on frame and the longer end to the outside. Insert the clamp into the control wheel – figure 18.

Move control wheel and twistgrip to position for second gear (centre position). Lift the bearing to pretension Bowden cable and tighten the fixing screw. Use adjusting screws on the grip for fine adjustment. Check functioning of gear change.





R 50/60

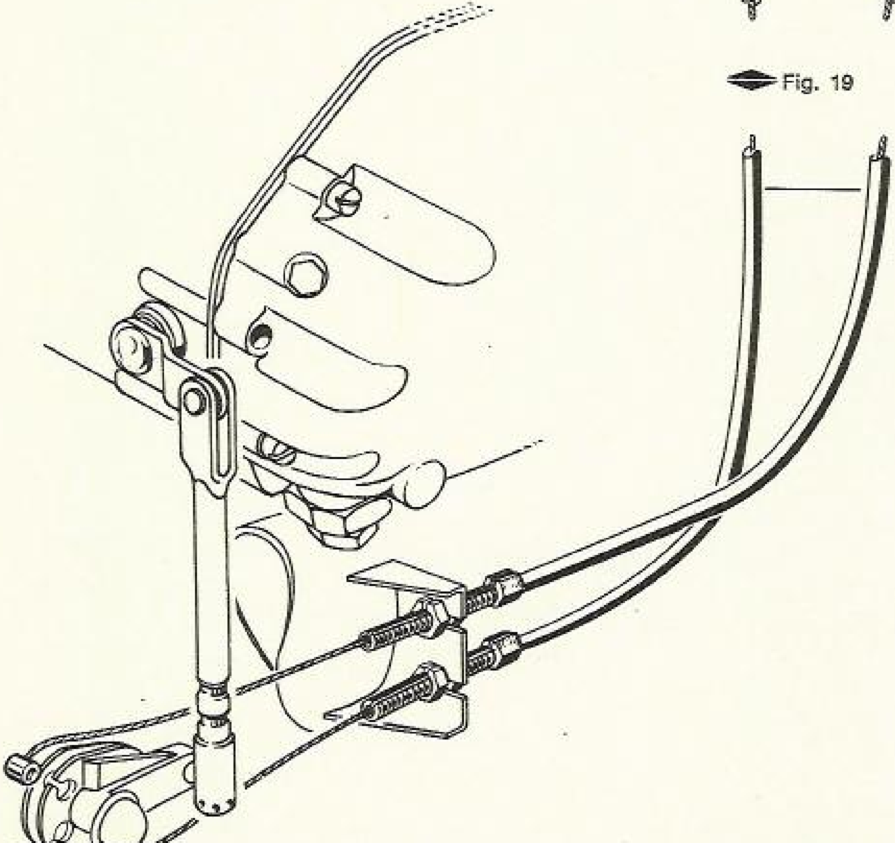
These models have a cable drum on the twistgrip and a selector lever fitted to the frame. Two equally long Bowden cables are used to connect the components. The selector lever is connected with a draw rod to the control lever on the engine.

Fit Bowden cables as illustrated in figure 19.

After fitting the Bowden cables to the grip and selector lever, move to position for second gear. Tension both cables together with adjusting screws on bearing. As already mentioned, a play of approximately .00787 in (0.2 mm) must be present between cable sleeve and bearing (adjusting screw).

Check the operation of the gear change.

Fig. 19



Controls

Starting system — Pedalling system

X 30, X 30 A and Maxi

No separate starters are fitted to these models. Starting is affected by pedalling. The engine is connected to the rear wheel by a second chain. On X 30 models, the second speed must be selected. Models X 30 A and Maxi have a separate manually operated starting clutch to connect gearbox to engine when starting. Its function is illustrated in the force flow diagrams on page K 2. Adjustment of the starting clutch is described previously under group K automatic, page 3 for model X 30 A and page 4 for Maxi model. Adjustment of Bowden cables is given in group P page 1 and 2.

Ensure regular lubrication of chain and tensioning roll and check possible wear of chain and sprockets.

MSV-, VSD- and R-Engines

The starters used on these models are basically the same. Figure 1 shows the 2-speed engine with pedals and figure 2 the 3-speed engine with kickstarter.

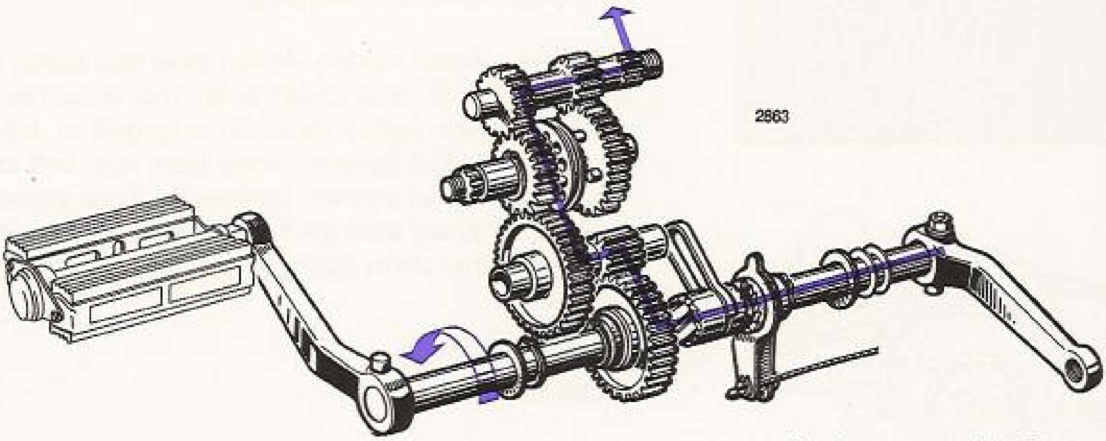
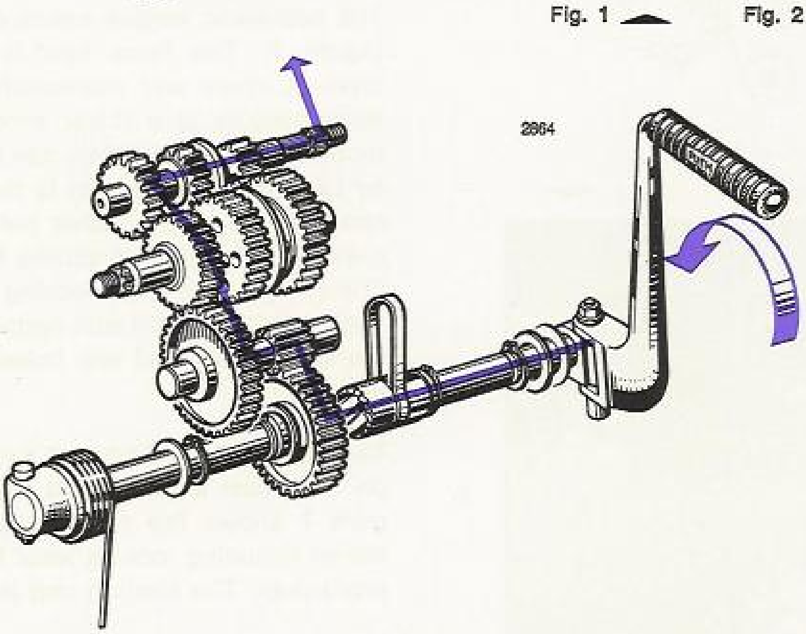


Fig. 1 ▲ Fig. 2 ▼



Starting system — Pedalling system

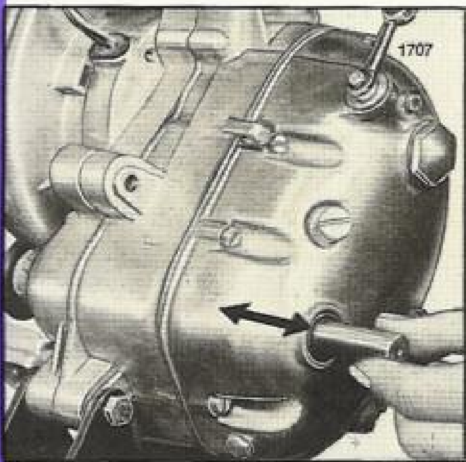
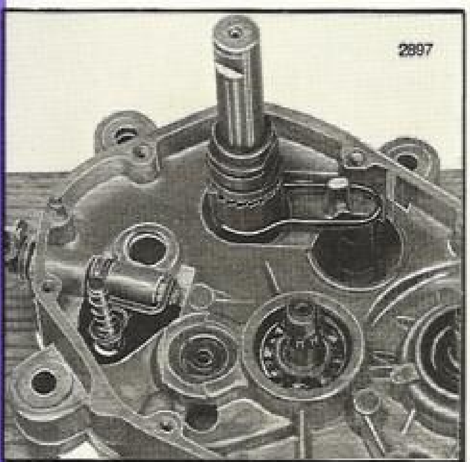


Fig. 3 ▲ Fig. 4 ▼



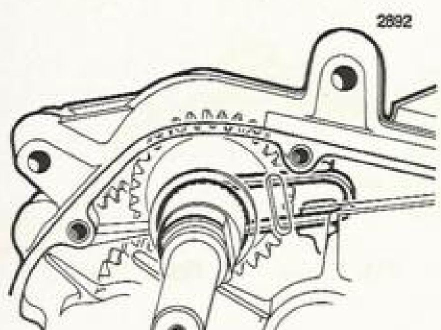
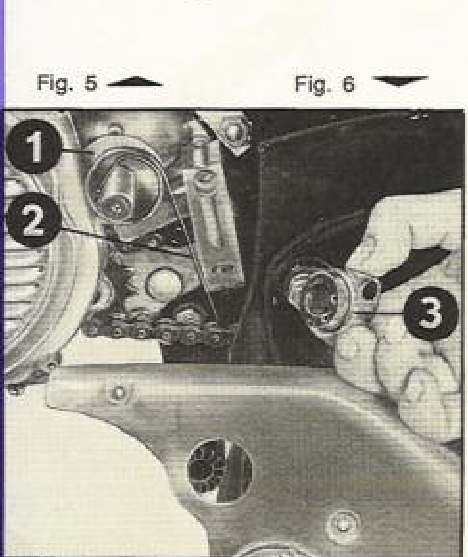


Fig. 5 ▲ Fig. 6 ▼



Depending on legal requirements, either kickstarter or pedals are fitted. Measuring the play of the starter layshaft is described in group "gearbox", page H 1. Play of starter shaft is not measured.

Simply fit right housing shaft provisionally and check play by moving shaft – see figure 3. Add shims between washer and shaft to obtain a play of approximately .00787 to .0197 in (0.2 to 0.5 mm). Use layshaft shims. On engine assembly check correct fitting of brake spring for slider in housing – see figure 4 and figure 5 — prior to fitting housing cover. When pedalling forwards (starting) the slider is actuated by a steep spiral on the pedal spindle to connect the crankshaft or when pedalling backwards (braking) to connect to brake lever. Functions are illustrated in figure 1 and figure 2.

Assembling the kickstarter commences as follows: Slide washer figure 6/1 onto the left side of pedal spindle. Fit return spring figure 6/2, longer end pointing downwards as illustrated.

Fit cover. Roller models do not have this cover. Slide hub figure 6/3 onto pedal axle. The outwards bent end of return spring must be engaged in hole on hub. Fit key and tighten. Screw back stop bolt and fit kickstarter pedal pointing backwards. Turn assembled kickstarter pedal from top to bottom until stop bolt can be fitted. The return spring is now properly tensioned.

MSA-Engine

The automatic engine needs a separate starting unit (figure 7). The force flow is from starting axle to layshaft, chain and crankshaft. A spur faced sliding bush couples to a driver screwed to the crankshaft models fitted with pedals can be used without engine by pedalling. The design is the same as on 2 and 3-speed models with pedals but a cable operated lock prevents engaging of sliding bush with starting unit. The starting unit has a locking lever (on housing) preventing engagement with pedal unit. Models with kickstarter are not fitted with these locks or the pedal unit layshaft.

The complete starting unit except the starting wheel on the pedal axle is fitted to the housing cover. Figure 7 shows the preassembled cover of a pedal model including locking lever for slider connecting to crankshaft. The starting unit is assembled as follows.

1st Edition

Starting system — Pedalling system

The driver on the crankshaft is screwed on when assembling the centrifugal clutch. Slide starting wheel on starting spindle and engage in driver. Fit starting wheels with chain, intermediate bush and slider with brake spring into engine housing cover as illustrated in figure 7. Note: the shorter end of the spring must point downwards. The washer for the layshaft is stuck with grease to the shaft at the motor-end bearing position (see figure 7 arrow). Slide bush for starting counterwheel into wheel (see figure 7 arrow). Fit washer for starting counterwheel to layshaft (figure 8).

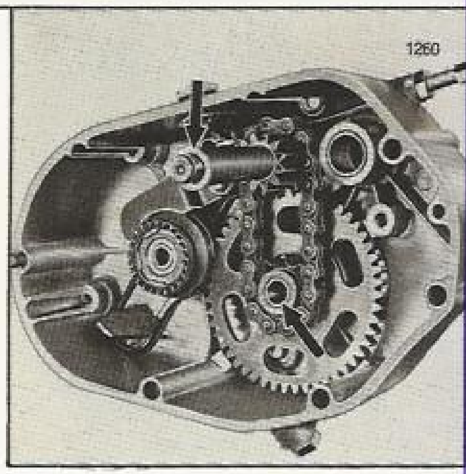
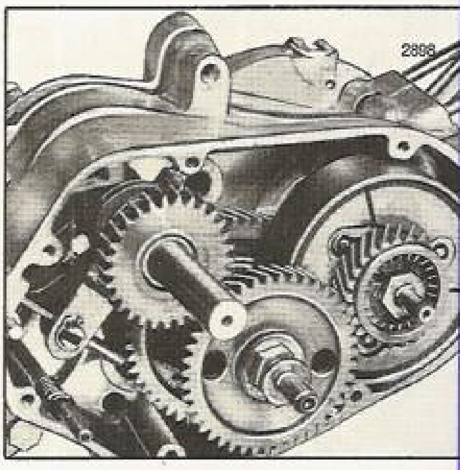


Fig. 7

Push preassembled housing cover partly home, reach with hand between engine and cover and guide selector spindle into cover and starting counterwheel onto layshaft. Push cover home completely by slight knocking and turning forwards of pedal axle. Tighten cover with srews. The cover gasket is stuck with grease to the engine block before assembly. Fitting of kickstarter lever and return spring as for 2- and 3-speed models having kickstarters.

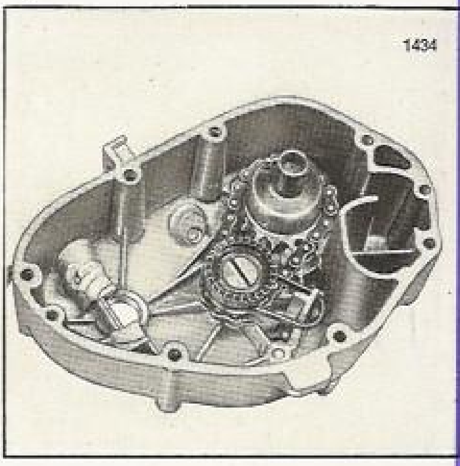
Fig. 8



V-Engine

This engine is started by the kickstarter lever through a chain to the layshaft. Connecting is affected by a bendix bush. The complete starter unit is fitted into the right housing shaft (figure 9). The layshaft contains only the driver.

Fig. 9



To dismantle starter unit, remove kickstarter lever and use screwdriver to take lockring out of housing cover. The circlip on the starter spindle is now in reach and can be removed with a circlip pliers. Unscrew bearing bolt of small sprocket and remove complete starter unit with chain together. Assemble in reversed procedure. Loose bearing bolts are fixed with „Loctite“. Unscrew stopscrew before fitting kickstarter lever and tension return spring with this lever. Pre-tension spring connected to starter spindle by turning the lever backward unit the stop bolt can be screwed in.

Starting system — Pedalling system

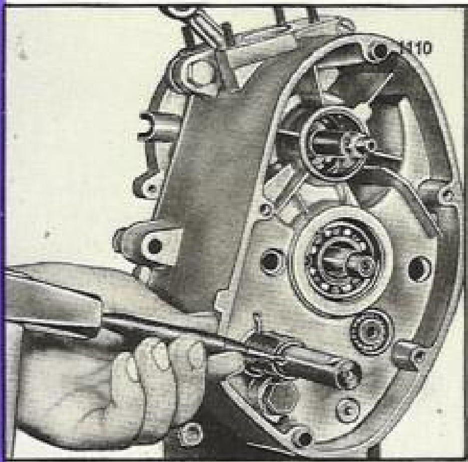


Fig. 10

M-Engine

The starter of this engine consists of kickstarter spindle, layshaft and gear wheels to gearshaft. The engine is connected by a bendix on the gearshaft. The starter unit is part of the gearbox, assembling is described in group H page 4.

Only the return spring can be reached after removing kickstarter and housing cover. The spring is pretensioned and fixed in housing and to starter spindle. The spring can be taken out after removing the pin.

Hold spring with pliers to prevent accidents. Pretension spring on assembly (figure 10) and knock pin home.

Automatic gearbox – MSA

X 30 A and MSA automatic

The automatic consists of two centrifugal clutches and an idling unit. At approximately 2800 engine revolutions the first gear is selected by the centrifugal clutch to start off. The rider controls the machine by means of the throttle. The acceleration depends on the movement of the throttle control but should always be soft and without sudden jerks. The centrifugal clutch of the second gear comes into operation at approximately 15 mph. The second gear is engaged and the idling unit cancels the transmission to the first gear. The procedure is reversed on speed reduction or braking. The second gear clutch disengages at approximately 12 mph and first gear takes over. Further speed reduction reduces engine speed, the first gear clutch disengages and the machine stops (see scheme of power transmission, page K 2).
MSA models are started from the starter shaft, through a chain starting clutch connecting rear wheel to crankshaft during starting.

When starting the X 30 A engine the connection between rear wheel and crankshaft is established by means of a separate starting clutch.

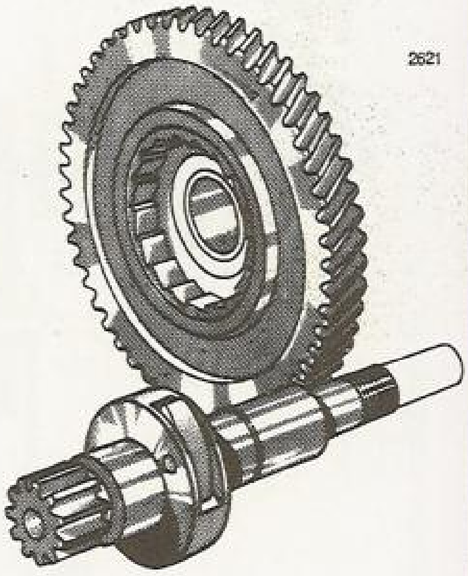
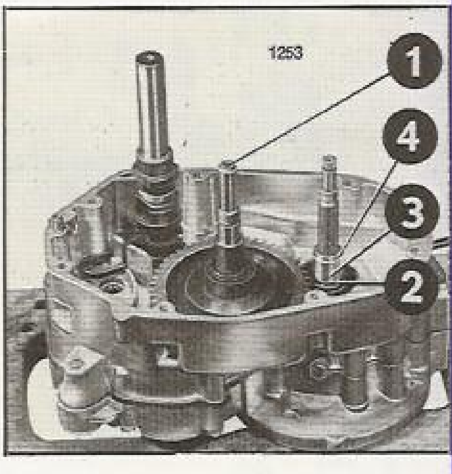


Fig. 1

Adjusting and assembling of automatic gearbox. Layshaft with idling unit (figure 1)

The layshaft gearwheel of the first gear contains an idling unit. On engaging second gear the transmission is interrupted by means of this unit. To dismantle, the circlip is removed and the shaft taken out of gearwheel. On assembly, note the shim fitted below the circlip. Adjust play to .00197 to .00393 in (0.05 to 0.1 mm).
Use the crankshaft shims for adjusting.

Fig. 2



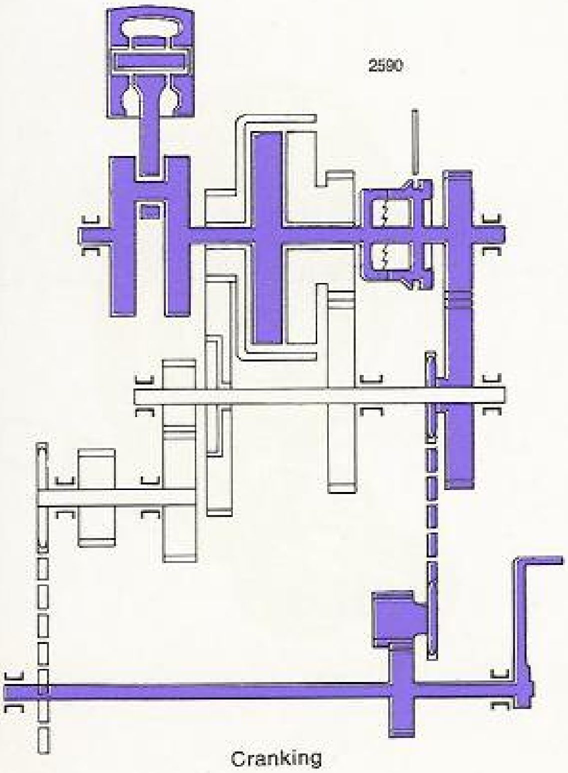
Adjusting and assembling of centrifugal clutch

Fit layshaft with first speed gear and idling unit (figure 2/1) into flange. Fit washer (figure 2/2), to crankshaft – chamfer pointing to crankshaft. Add steel bush (figure 2/4), bronze bush (figure 2/3) and clutch housing to crankshaft. Measure axial play of clutch housing.
Measure axial play of clutch housing (see figure 3 and figure 4).
The axial play of clutch housing must be .0059 to .00787 in (0.15 to 0.20 mm).

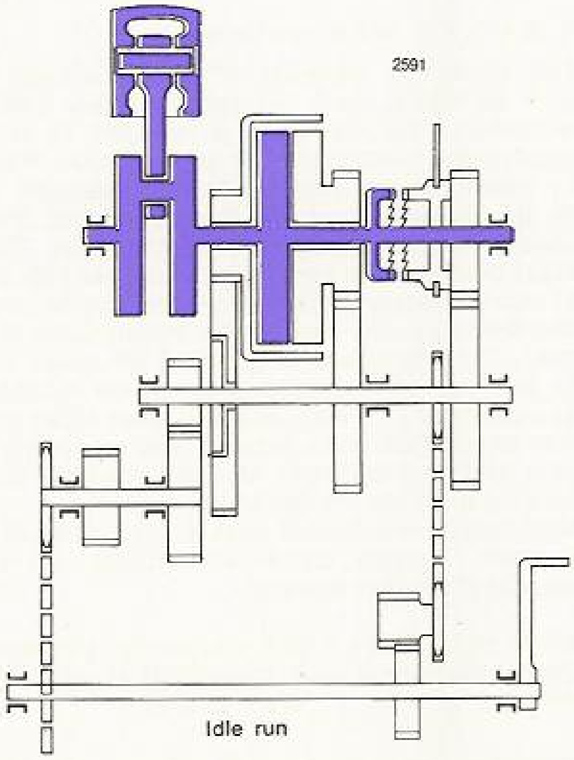
Example

Length of clutch housing (figure 3)	1.106 in	(28.1 mm)
Length from clutch housing to bearing bush collar (figure 4)	1.063 in	(27.0 mm)
Difference	.0433 in	(1.1 mm)
Axial play	– .00787 in	(0.2 mm)
Difference	.0354 in	(0.9 mm)

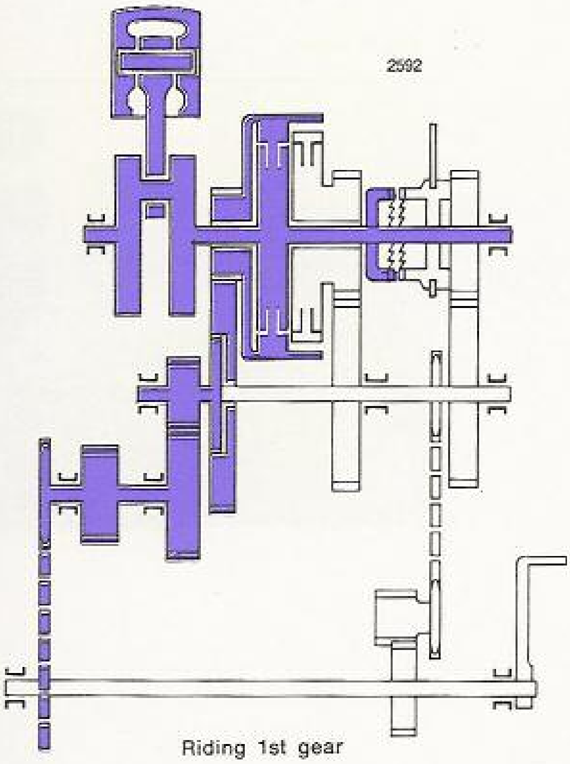
Automatic gearbox — MSA



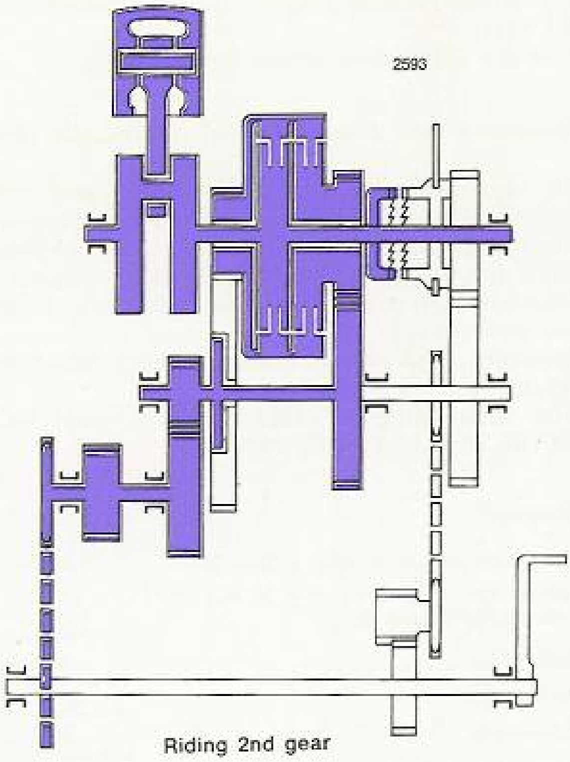
Cranking



Idle run



Riding 1st gear



Riding 2nd gear

Power transmission

1st Edition

Automatic gearbox – MSA

The difference of .0354 in (0.9 mm) is compensated by shims added to the clutch housing. Shims are available in thinesses of .0059 in (0.15 mm), .0118 in (0.30 mm), .0197 in (0.50 mm) and 0.394 in (1 mm).

Push first gear centrifugal clutch (smaller bore), grub spring outwards, onto crankshaft (figure 5/1).

Add washer .0197 in (0.5 mm) to clutch (figure 5/2).

Fit steel bush (figure 5/4), bronze Bush (figure 5/3) and second-speed centrifugal clutch (larger bore), grubspring inwards, to crankshaft. Insert key into layshaft.

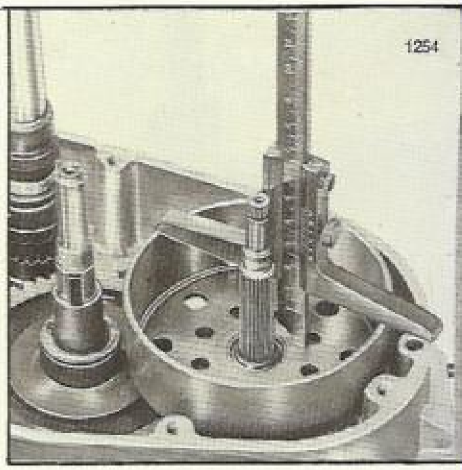
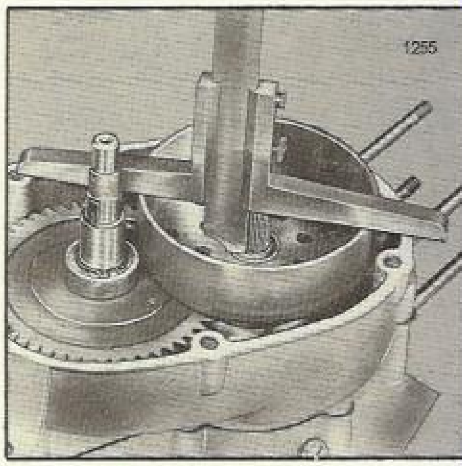


Fig. 3

Add second-speed layshaft to first.
Insert serrated second-speed gearwheel into centrifugal clutch. Measure axial play of second speed gearwheel on crankshaft.

Fig. 4



Measuring axial play of second speed gearwheel

The axial play must be .0059 in (0.15 mm) to .00787 in (0.20 mm).
Example (see figure 6 and figure 7).

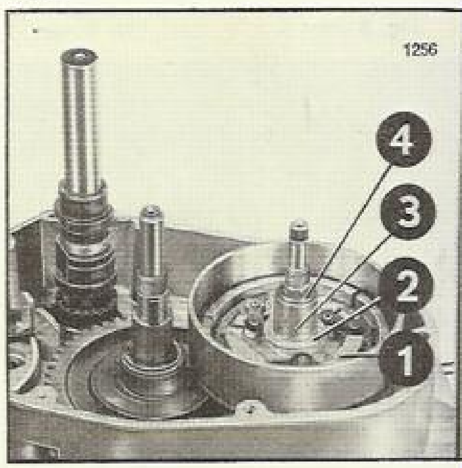
Length between end of second-speed gearwheel and collar of second-speed gearwheel (figure 6)	.4567 in (11.6 mm)
Less length between end of second-speed gearwheel and collar of steel bush (figure 7)	– .4094 in (10.4 mm)
Difference	.0472 in (1.2 mm)
Less axial play	– .00787 in (0.2 mm)
	.0394 in (1.0 mm)

The difference of .0394 in (1 mm) between second-speed gearwheel and steel bush is adjusted with shims added between driving disc and driver.

Fit driver and fix locking device part no. 320.70.017.2 (X 30 A) or part no. 350.3.10.600.0/W 1 (MSA) respectively and tighten nuts on crankshaft and second speed gearwheel on layshaft.

For X 30 A only

Fig. 5



Measuring distance between engine and engaged starting clutch

The starting clutch will function properly only if the distance between the engine and engaged clutch (figure 8) is adjusted to 1.5955 ± .0118 in (40.5 ± 0.3 mm).

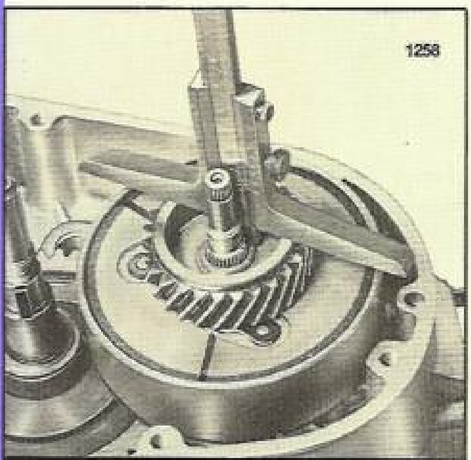
Measure as follows:
For easier measuring remove springring and spring (see figure 9).

a) From end of driver to engine (figure 9 length A)
b) From driver to driving disc and washer (figure 9 length B)

The second measurement is deducted from the first.

Automatic gearbox — Maxi

Fig. 6 ▲ Fig. 7 ▼



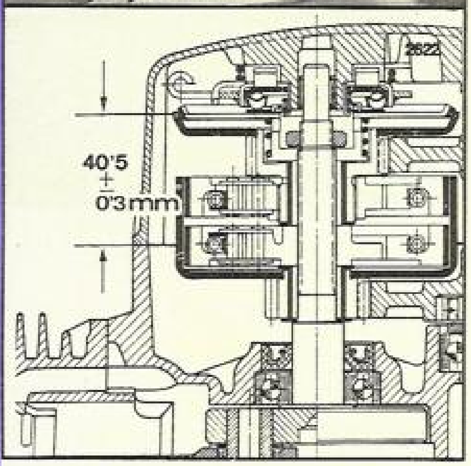
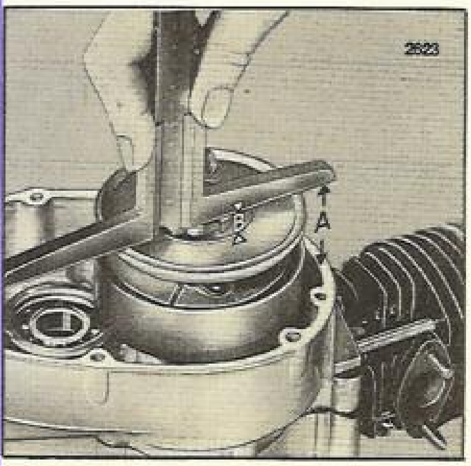


Fig. 8 ▲ Fig. 9 ▼



The result is the distance which, if below 1.5827 in (40.2 mm) has to be compensated to 1.5945 + .0118 in (40.5 + 0.3 mm) by adding shims part no. 320.1.12.351.1 under washer part no. 320.1.12.337.1 (both washers are .0197 in = 0.5 mm thick).

For example

Length from driving disc to engine (figure 9 length A)	1.7323 in	(44.0 mm)
Length from driving disc to washer (figure 9 length B)	– .1339 in	(3.4 mm)
equals	1.5984 in	(40.6 mm)

Test measurements	new	wear limit
Diameter of centrifugal clutch in neutral	3.7244 in (94.6 mm) dia	3.6220 in (92 mm) dia
Diameter of clutch drum	3.7401–3.7480 in (95–95.2 mm)	–

MAXI-Automatic

The automatic consists of a centrifugal clutch in line with a single-speed gearbox. The clutch takes over during starting, the rider need only operate the throttle. The machine starts to move progressively without jerking at a crankshaft speed of 1200 to 1500 rpm. Full clutch engagement commences at 2600 to 3000 rpm. Reduction of engine speed — smaller throttle opening or braking causes the clutch to disengage at 1400 to 1150 rpm, transmission from engine to gearbox is interrupted and the machine will stop. To start the engine, a separate starting clutch in the transmission between gearbox and rear wheel connects the gearbox to engine temporarily. The starting clutch is controlled by a manual lever on the handlebar (see scheme of power transmission, page K 5).

Adjusting and assembling of centrifugal clutch

Clamp crankshaft including both bearing, circlips and sealing rings in a bench vice using aluminium or plastic jaws. Clamp clutchend of the crankshaft web only (figure 10).

Fit lower circlip, bush clutch drum and upper circlip. Add centrifugal clutch, spring washer and hexagonal nut. Tighten nut to 19.53 ft/lb (2.7 mkp).

Note: The two shim washers must not be fitted for measuring.

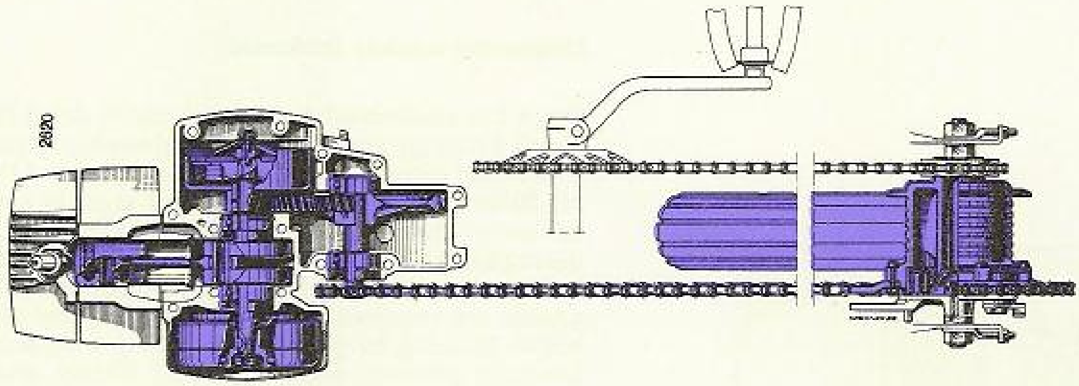
Fit clutch cover including pressure bolt, needle bearing, washer and circlip and lick with spring.

1st Edition

Automatic gearbox — Maxi

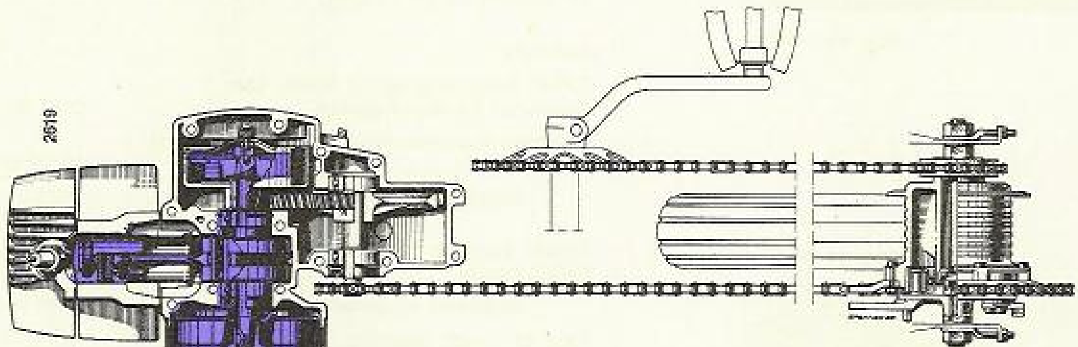
Riding

2620



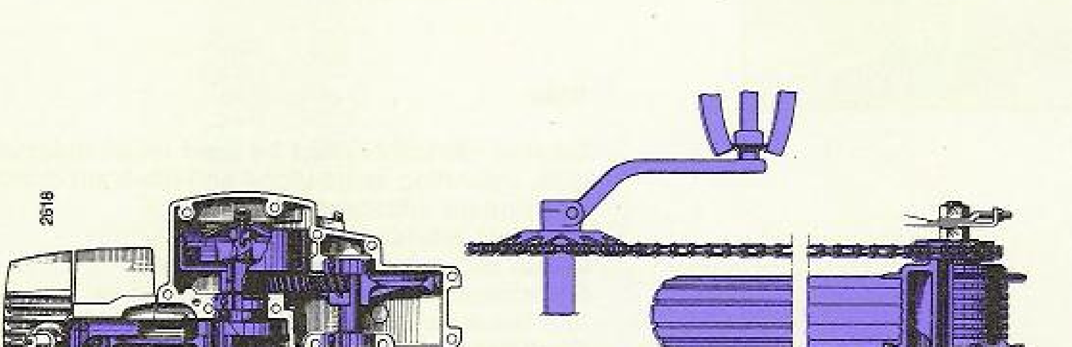
Idle run

2619



Cranking

2518



Power transmission
Kraftflußschema

Automatic gearbox — Maxi

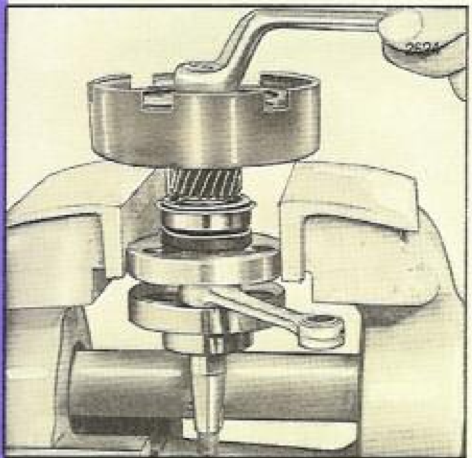
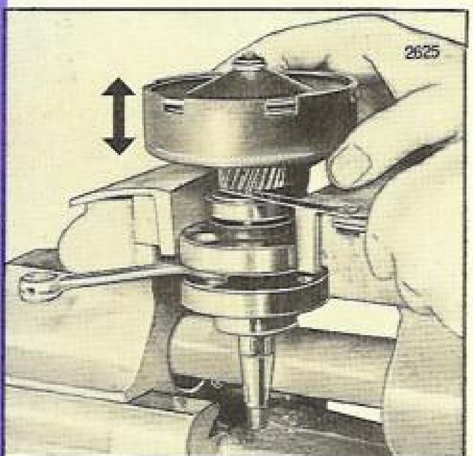


Fig. 10

Fig. 11



Measuring washer thickness

Press the assembled centrifugal clutch down (towards crank bearing) and check gap between primary gearwheel and circlip with feeler gauge (figure 11). A gap of .00787 to .0157 in (0.20 to 0.40 mm) is necessary between clutch cover and clutch lining for proper disengagement. Therefore, add .00787 in (0.20 mm) to the gap measured by the feeler gauge. This width equals the required thickness for the lower shim. Lift clutch housing to give the longest possible distance between primary gearwheel and circlip and check again with feeler gauge (figure 11).
Deduct .00787 in (0.2 mm) for clutch housing play from the gap to now-required thickness of upper shim (smaller hole diameter). Shims are available in steps of .00878 in (0.2 mm), the smaller size .866/.591 in (22/15 mm) from .0433 to .0748 in (1.1 to 1.9 mm) and the larger size .945/.669 in (24/17 mm) from .0433 to .0669 in (1.1 to 1.7 mm). If the calculation calls for a thickness between two available sizes (e. g. .0472 in = 1.2 mm) reduce the axial play of the clutch housing to .00394 in (0.1 mm).

Example

Clutch housing pressed down, gap measured by feeler gauge	.0512 in (1.3 mm)
Distance between clutch cover and clutch lining	+ .00787 in (0.2 mm)
thickness of lower washer	.0591 in (1.5 mm)
Clutch housing lifted, gap measured by feeler gauge	.1417 in (3.6 mm)
thickness of lower washer	− .0591 in (1.5 mm)
Play of clutch housing	− .00787 in (0.2 mm)
thickness of upper washer	= .0748 in (1.9 mm)

Wear limits

Minimum thickness of clutch lining .0394 in (1 mm).
Centrifugal clutch is serviceable until the metal parts begin to touch. Grooved clutch drums and linings must be replaced.

Note

Correct lubricants must be used on all automatic models. Operating instructions and lubricant charts quote appropriate lubricants.
Incorrect lubricants can cause:
Clutch slipping or late engagement.
Centrifugal clutch failing to engage or engaging too late because linings are sticking.
Centrifugal clutch not disengaging because linings have expanded.
The last-mentioned fault can also be caused by petrol mixing with the lubricant, i. e. because of a faulty sealingring.

Crankcase

The crankcase must be visually inspected prior to assembling. Note particularly damage to sealing faces and bearing parts and check for possible loose bearing bushes. Caulking or soldering of bearing bushes is not permitted. Exchange housing or refit bush with loctite according to manufacturer's recommendations. Pressing on and off of crankshaft bearings and sealing rings is described in detail under the group 'F crankshaft'. All bearings and seals except those in dead-end holes, can be pressed in or out with suitable mandrels (make yourself). Do not apply pressure to inner ring of ball and roller bearings since this would damage the bearings and make them noisy. Needle bearings, for instance crankshaft bearings on models MSA, must be pressed home with suitable mandrel (part no. 905.6.33.104.1 or make yourself) or the bearings will be damaged. To remove bearings from dead-end holes, we recommend using commercially available extractors (e. g. Kukko or Nexus). Their application is shown in figure 1 and 2.

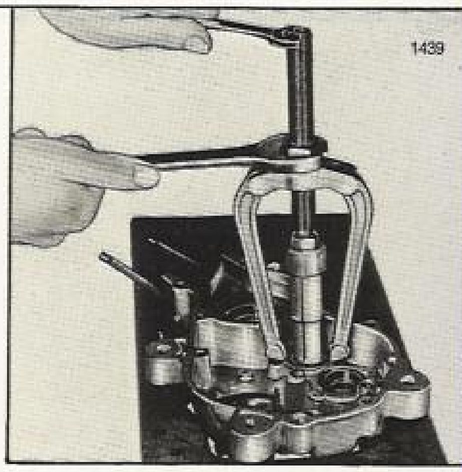
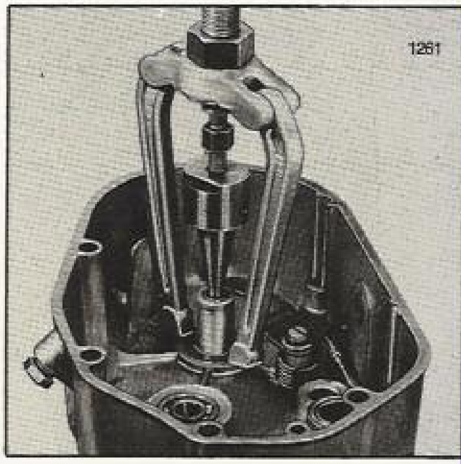


Fig. 1

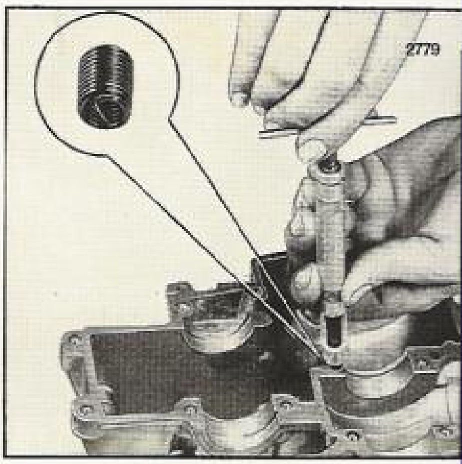
Fig. 2



Extractors suitable for our engines are as follows:

Bearing bush on layshaft	Kukko holder	22-1
(all engines)	Kukko insert	21/3
Bush for starting layshaft	Kukko holder	22-1
(models MSV, VSD and R)	Kukko insert	21/1
Crankshaft needle bearing in	Nexus	
housing cover	Part no. 905.0.14.005.0	
(MSA and X 30 A) – see figure 2		

Fig. 3



To repair damaged threads use Helicoil inserts. Do not weld or tap larger threads. Welding distorts the housing and there is either insufficient space for larger threads or a possibility of weakening housings. Stay bolts are best removed by two counter nuts or special tool. On broken bolts, drill hole in centre and remove with screw extractor. The two crankcase halves are produced and matched together. Therefore, both must be replaced together.

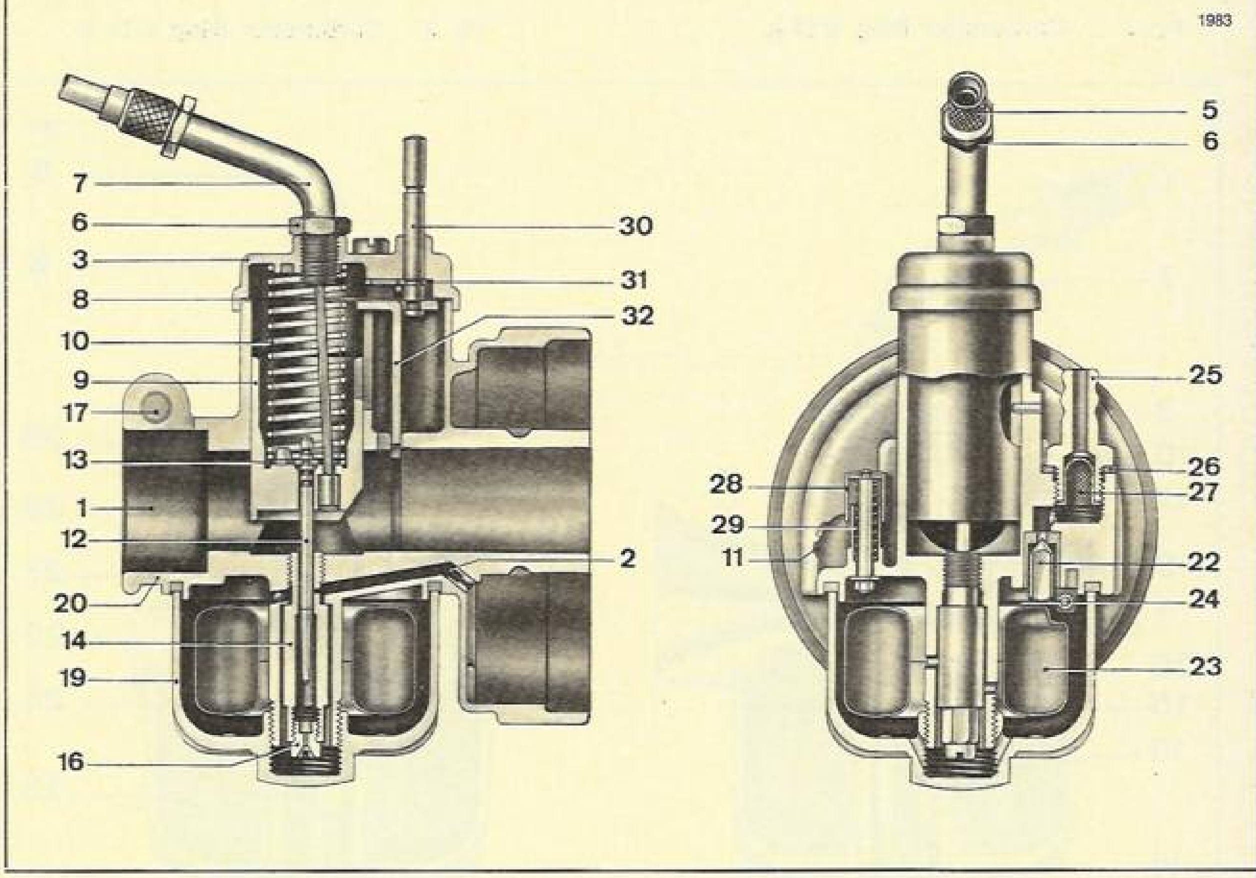
Carburettor

Sectional views of carburettor

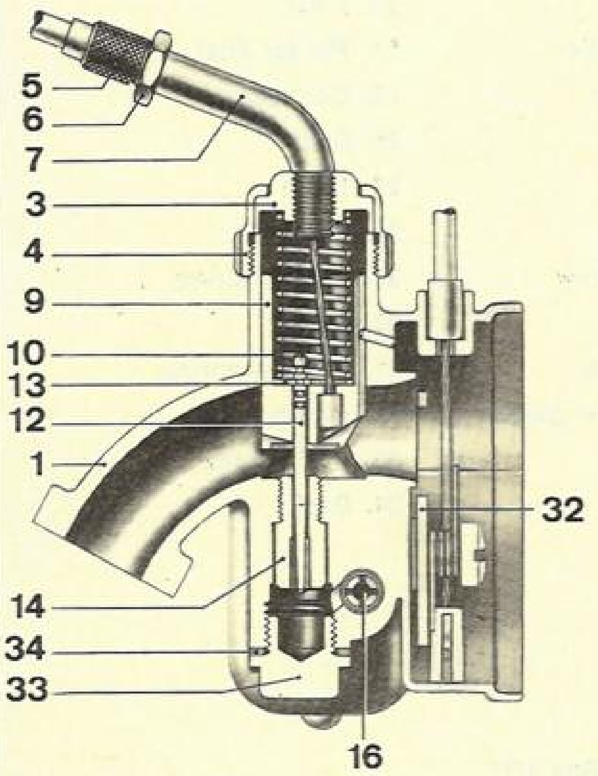
Explanation:

1. Carburettor body
2. Air hole
3. Cover
4. Cover fixing
5. Screw
6. Nut
7. Connecting tube
8. Gasket
9. Throttle valve
10. Throttle spring
11. Valve screw
12. Throttle needle
13. Holding plate
14. Needle jet
15. Mixing tube
16. Main jet
17. Clamping screw
18. Filter
19. Float chamber
20. Float chamber gasket
21. Float cover
22. Float needle
23. Float
24. Pin for float
25. Connector
26. Seal
27. Sieve
28. Tickler
29. Tickler spring
30. Pin
31. Holding spring
32. Choke
33. Drain screw
34. Seal

Fig. 1 — Carburettor **Bing 1/17**



Carburettor



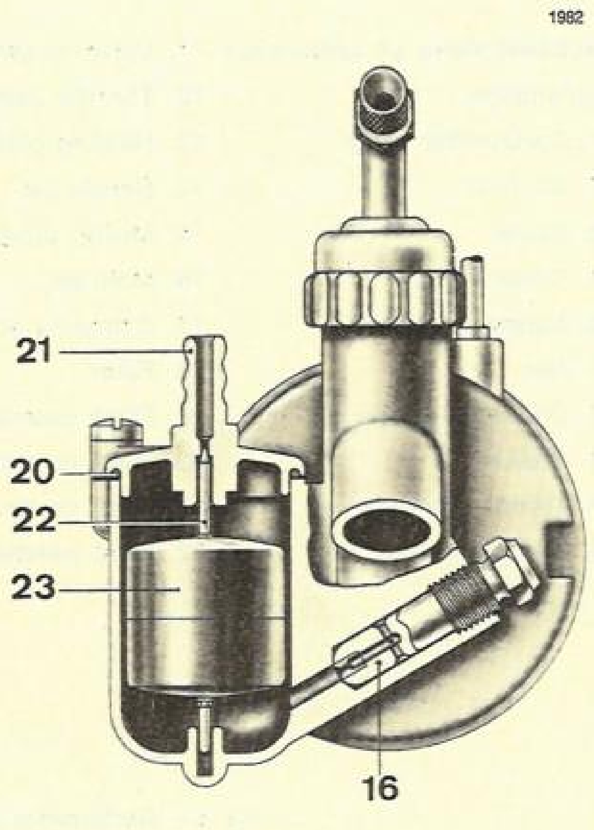
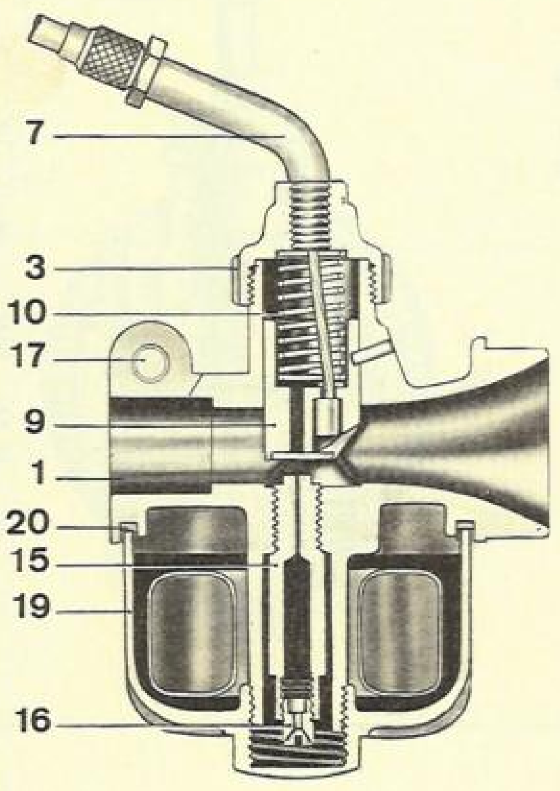
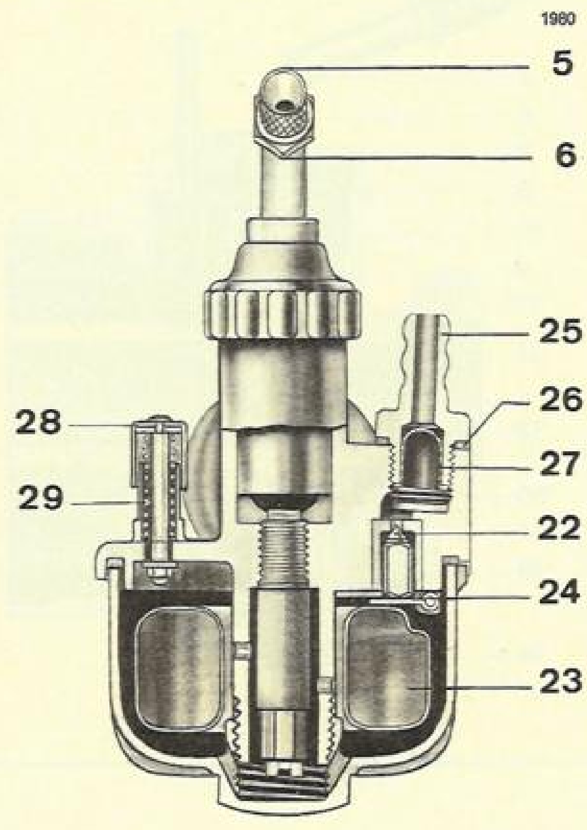


Fig. 2 Carburettor **Bing 1/12** ▲

Fig. 3 Carburettor **Bing 1/11** ▼





1st Edition

Carburettor

Carburettor general

The carburettor provides the engine under all load conditions with the proper and correctly balanced air-fuel mixture. This task is assisted by the appropriate inlet and exhaust system. Final adjustments are the result of extensive tests on test beds and under various operating conditions. Legal requirements regarding noise, output and speed limits are another determining factor. Features have to be incorporated to comply with the law while maintaining a performance to satisfy customer's expectations. Such features are invitations to some owners – particularly younger ones – to increase engine performance. Since a number of related factors must be considered to comply with the law, such do-it-yourself hotting up efforts are usually failures, producing nothing more than noise and always higher fuel consumption. We must mention that although many people are ignorant of the fact, legal requirements must be adhered to and violation is punishable. Any such modifications should be noted on all repair or servicing jobs.

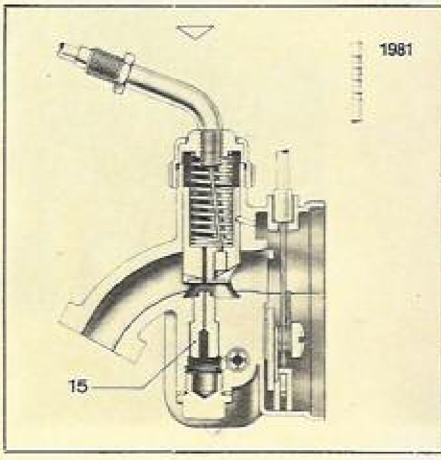
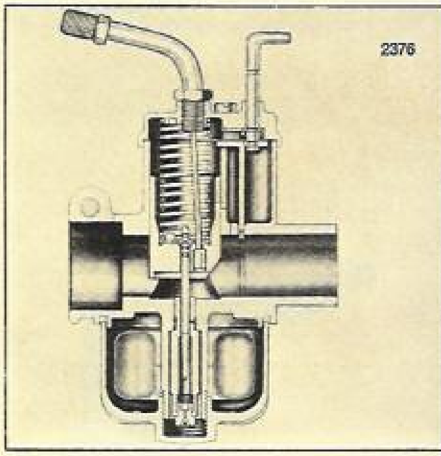


Fig. 4 ▲
Carburettor **Bing 1/9.5**

Carburettor **Bing 1/12, 1/14 (Maxi)**
Fig. 5 ▼



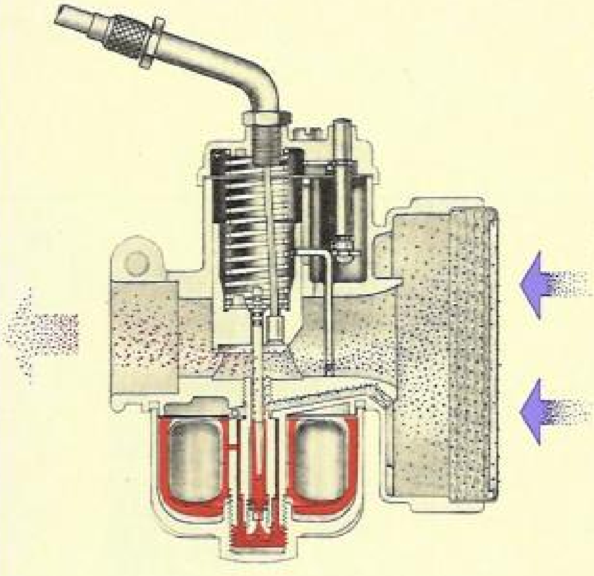
Operating principle

Figure in brackets ( ) refer to sectional diagrams figure 1 to 5. Figures 6 to 8 demonstrate the various operating phases. Fuel is marked red and air blue.

A nozzle system (14, 15, 16) produces a fuel / air mixture. Control element is a valve (9) passing correct amount of mixture to the engine depending on required output. On miniature carburettors Bing 1/9.5 and Bing 1/11, the valve (9) and the mixing tube (15) with jet (16) control the full speed range. The idling and partial-load range on 1/12, 1/14 and 1/17 Bing carburettors is controlled by the jet system consisting of needle type jet (14) and jet needle (12). The fuel reaches the mixing chamber through the nozzle outlet (14) or the mixing tube (15). Here, the fuel mixes with air to feed the engine with correctly proportioned fuel / air mixtures (approx. 1 : 15). It is more difficult at larger carburettor capacities to produce correct mixtures for all speed ranges with valve and jet only.

Therefore, some carburettor models such as the Bing 1/17 are mixing air with the fuel in the jet (14) and mixture is entering the mixing chamber.

Carburettor



◄ Fig. 6

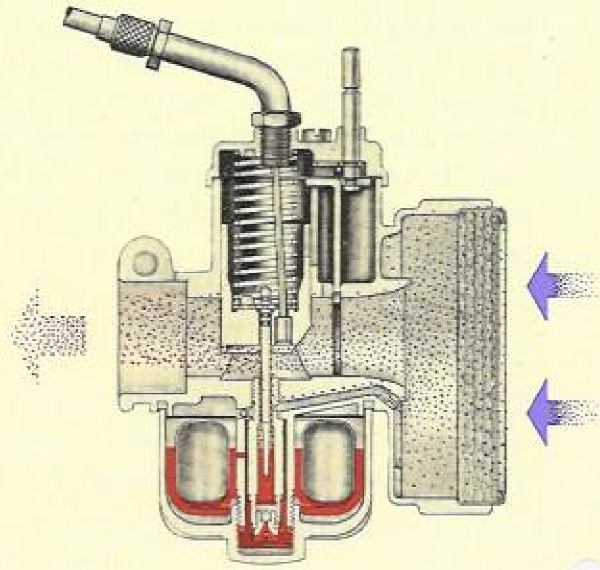
Starting

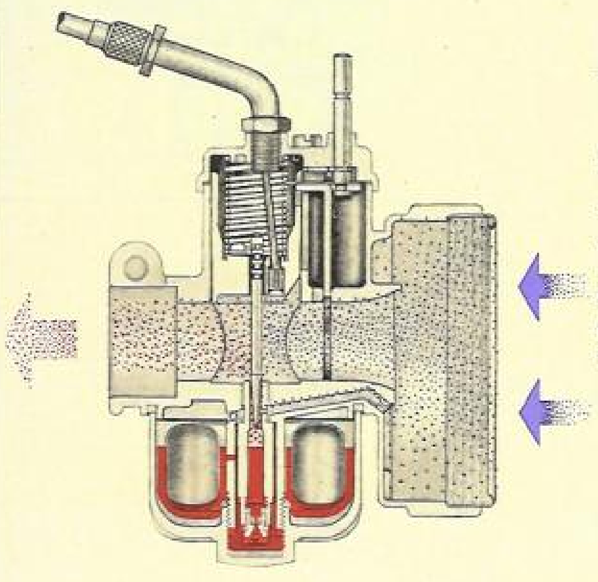
Starting valve closed, throttle maximum ¼ open. Closing of starting valve increases. Vacuum in mixing chamber – fuel level increasing. Result rich mixture necessary for cold starting.

Fig. 7 ►

Partial load

Throttle partly opened. Correct amount of fuel by free opening between jet and jet needle, air proportion depending on valve position. The air hole permits premixing of fuel with air in jet (mixing tube) and a mixture is passed through. The air hole reduces the fuel proportion in proposition to the carburettor vacuum. Vacuum highest at partial load. The air hole is not featured on carburettors 1/9.5 to 1/14.





◄ Fig. 8

Full Throttle

Throttle completely opened. At full throttle, the mixture is determinated actively by the jet and the carburettor capacity. The controlling action of jet needle is cancelled because free opening between needle and outlet is already larger than the jet bore. Action of airhole is greatly reduced due to low vacuum in mixing chamber.

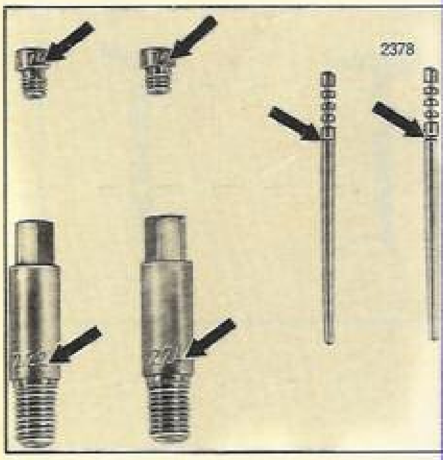
Carburettor

Furthermore, shape and size of valve – figure 9 – also determines the mixture because it alters the vacuum according to requirements. Size of jet (16) and taper of needle (12) are also related and marked appropriately. Figures or notches are used for marking – see figure 10 – and can be established from operating instructions and type charts. The quoted basic adjustments are not always suitable and must be corrected by exchanging jets (16) and adjusting the needle (13). A number of grooves on the needle-shaft are used to hold the needle in position with a spring (13). By inserting the spring in a different groove, the position of the needle in relation to the valve is altered. Allowing the needle to move into the jet (lowering it) gives a weaker mixture. Raising the needle gives a richer mixture.

Fig. 9 ▲

Needle (12) controls fuel consumption at partial load only since at full throttle the main jet takes over. The float (23) and the float valve (22) steady the fuel level in the chamber – important for proper functioning of the jet system. A partially rich mixture is required to start a cold engine and therefore carburettors have starting devices. All such devices function properly only if the throttle is closed or up to maximum ¼ open on starting. Different carburettors use different starting devices for richer mixtures. Sometimes, for instance on the Bing 1/11 the starting device is not fitted to the carburettor but to the air filter.

Fig. 10 ▼



Starting devices are:

a) The tickler: The tickler (28) cancels for a short time the functions of the float (23), causing flooding of carburettor and giving a very rich mixture.

b) The starting valve: Controlled by Bowden cable, lever (31) or the like, depending on carburettor type. Closing the starting valve (32) reduces the air proportion and the resulting increased vacuum increases the fuel level – the mixture is richer. An even richer mixture is achieved by operating the tickler (28) at the same time.

Carburettor-adjusting

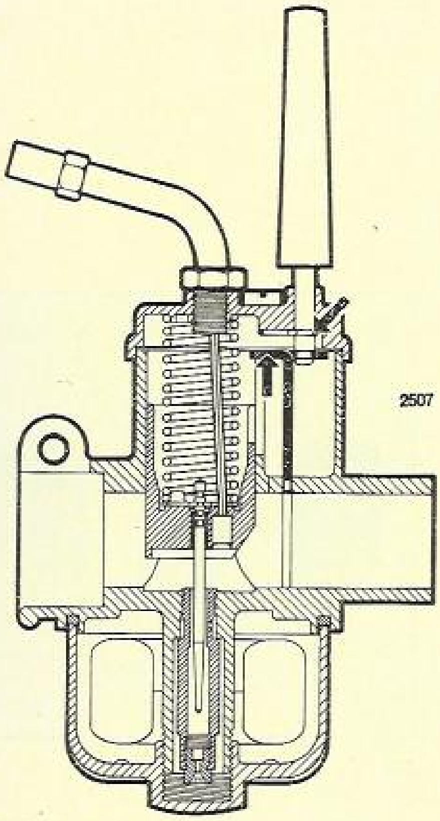
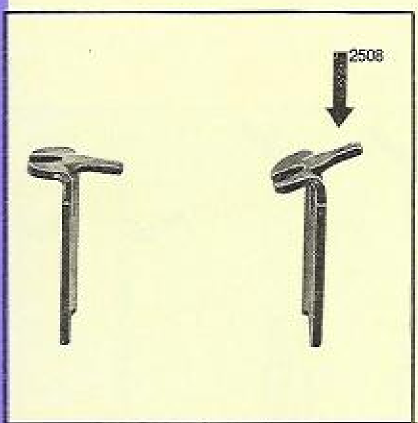


Fig. 11 ▲

Fig. 12 ▼



The starting valve must be opened as soon as engine is warm (running regularly and responding to throttle). On Bing 1/14 and 1/17 carburettor opening of throttle (9) opens starting valve (32) automatically (full throttle). If throttle is not fully opened, the starting valve is not locking properly (figure 11, latch and starting valve) and closes again during travelling. This often causes inexplicable difficulties such as flooding engine or oiled plugs followed by starting trouble.

Adjusting

A carburettor can be adjusted correctly only if its functions are known. The cause of too weak or too rich a mixture is usually not the carburettor as such but carbonisation, dirty filter leaking seals, gaskets etc., or bad adjustment by untrained personell.

Adjustments quoted by the manufacturers should normally be kept. However, new adjustments may be necessary because of climatic conditions or different altitudes. Before readjusting commences it is necessary to establish that no difficulties are caused by faults other than the carburettor. However, there are so many possibilities it is not feasible to list every one. For instance, on scooter models, an over-rich mixture could be caused by cleaning rags stored below the seat reducing the air inlet at the air filter. First move is to establish whether the mixture is too rich or too weak. A weak mixture is indicated by:

engine pinking constantly or when accellerating, overheating of engine.

White plug electrodes (this can also be caused by petrol or oil additives).

Plug having bubbles (lead) or is very shiny and having badly burnt electrodes.

Engine having no power in higher rev ranges.

A rich mixture is indicated by:

Engine running irregularly and jerking.

Engine overheating.

Black sooty plug electrodes.

Plug being wet and having streaks.

Engine having no power and accelerating poorly.

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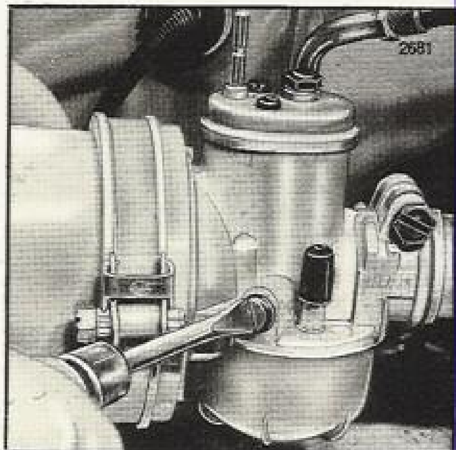
Carburettor – adjusting

Causes outside carburettors	mixture too weak		mixture too rich	
	partial load	full load	partial load	full load
Carbonization			X	X
Air filter dirty			X	X
Sealing ring, oil end, leaking			X	X
Sealing ring, mag-end, leaking	X	X		
Cylinderhead or cylinder flange leaking	X	X		
Crankshaft housing leaking	X	X		
Air filter	X	X		
Gasket on air inlet leaking	X	X		
Fuel tap blocked	X	X		
Air inlet flange nut flat	X	X		
Wear of cylinder, piston, piston ring	X			
Causes on carburettor				
Main jet too large				X
Main jet loose			X	X
Idling jet too large or loose			X	
Main jet too small		X		
Main jet dirty		X		
Idling jet dirty	X			
Float leaking			X	X
Float too heavy			X	X
Float needle or sealing leaking or worn			X	X
Needle jet worn			X	
Needle jet loose			X	X
Needle too low	X			
Needle too high			X	
Carburettor flange leaking	X	X		
Air hole blocked			X	
Starting valve partially opening or not opening			X	X

Adjusting Tick Over

Warm up engine, adjust idling speed with throttle screw figure 13 to 800–1200 rpm. The Bowden cable must have sufficient play or the throttle sticks to cable and adjusting screw is not effective. Readjust play of Bowden cable after idling adjustment – approximately .00787 in (0.2 mm).
Note: Excessive gaps on points or plug cause irregular tick-over or prevent low idling speeds. Note also that engines such as those of the M and R models require higher idling speeds than engines having a lower capacity.

Fig. 13 ➤



Adjusting under operating condition

Use specified main jets and take next smaller and next larger size on a test ride, checking top speed from speedometer or using stop watch. Test ride on a track permitting full speed without change of throttle. The engine temperature should remain constant.
Select the jet giving second best top speed on an engine having completed a few miles at approximately 2/3 top speed.
Adjust medium speed range by lowering or raising throttle needle (on groove each time).

Carburettor – adjusting

Use position giving best results on the actual test run.

Note: the position of the needle affects the mixture at lower and medium speeds only, but not at top speed.

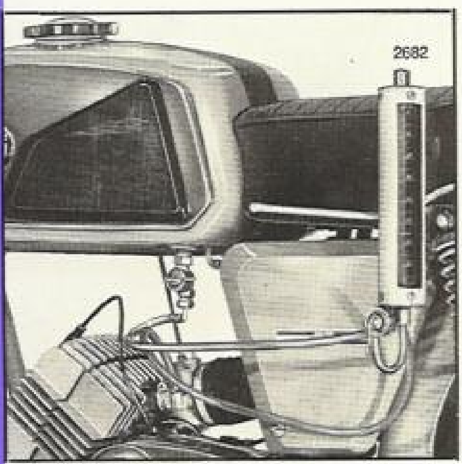
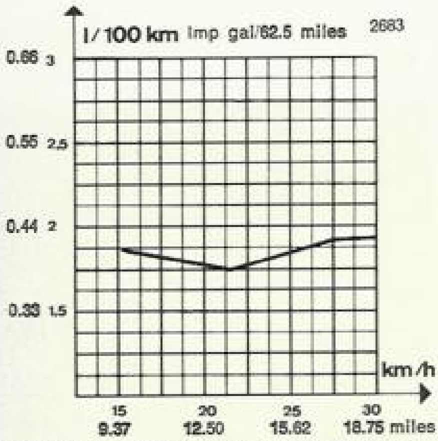


Fig. 14

A brown plug face in every speed range indicates too rich a mixture and bright or white plugs indicate too weak a mixture. However, additives in oil or petrol can sometimes cause such discolouring. If output is not correct after adjusting carburettor check engine timing, carbonisation, plug, wear of cylinder, piston, etc.

Fig. 15



Fuel consumption curve – MAXI 2,2 hp

Carburettor maintenance

The carburettor must be dismantled at regular intervals and cleaned with petrol or a suitable carburettor cleaning fluid. Clean out all holes with compressed air. This is the opportunity to check all components for wear. Worn needles, jets, needles and valves affect the output and fuel consumption of the engine and must be replaced. Furthermore, check carburettor flange for distortion and leaks. Replace all seals and gaskets.

Carburettors of the type Bing 1/12–1/17 featuring automatic opening of starter valve must be checked for proper functioning. If valve is not opening completely (view) or is not locking, mixture will be too rich. Incorrect assembling can cause driver (figure 11) to be distorted and this has the same effect. Bending back the driver cures this fault.

If a lot of dirt is found in the carburettor, check petrol tap and tank and clean as necessary.

Checking fuel consumption

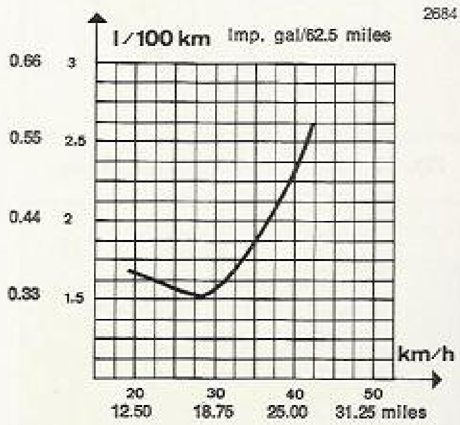
Standard fuel consumption. This test is worthless to establish actual fuel consumption but is suitable for comparing various makes under the same conditions. We are mentioning this in the service manual only because the question of consumptions mentioned in leaflets not corresponding to reality is often raised. Since all such data refer to standard fuel consumption such differences can be easily explained because the standard fuel consumption is established as follows.

Carburettor—adjusting

Test commences on a flat track in top gear at 2/3 top speed. The track length of 6.2 miles (10 km) is used either way and may have very short upward and downward gradients of a maximum of 1.5 %.

The vehicle must be adjusted to specification and tyres must have correct pressure. The rider must not weight more than 143.32 lb (65 kg). The testing instruments used must be controlable to measure the point of passing start and finishing posts. The measured consumption is increased by 10 % to take into account unfavourable conditions. The result is the standard fuel consumption.

Fig. 16



Fuel consumption curve – V-engine 2.6 hp

Average fuel consumption

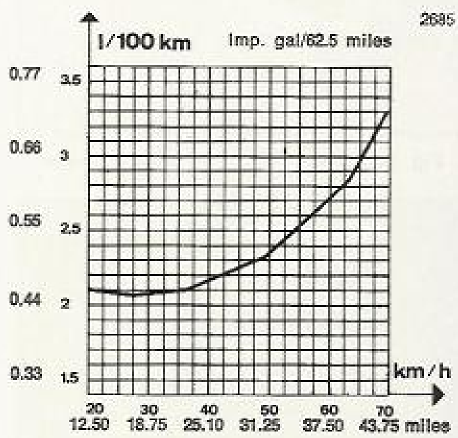
To establish an average fuel consumption for riding longer distances in traffic it is best to use a minimum 30 miles (50 km) of normal roads. Tests on shorter distances are of little value because traffic conditions and road conditions affect the test results too much. The test length must be known or be measured, of course. The route should be ridden in normal traffic as consistently as possible and the time taken must be recorded. The average speed should be 2/3 of top speed.

The consumption is calculated from	used quantity of fuel track length in miles.
the average speed is calculated from	track length in miles, time in minutes taken to complete track length.

Consumption is best established by filling empty tank with a known quantity of fuel which is removed after completion of test and measured. Difference equals consumption.

In order to get reasonable comparisons the same rider should be used for all tests.

Fig. 17



Fuel consumption curve – M-engine 4.8 hp

Establishing a fuel consumption table

A test unit (commercially available or make yourself) must be adjustable to change from unit to tank and vice versa at beginning and finishing posts of test track (figure 14).

Drive in top gear at lowest speed. Increase speed in steps of 3 miles (5 km) the test track must be 1 mile long and accurately marked.

Inlet silencers

Fig. 18 ▲ Fig. 19 ▼

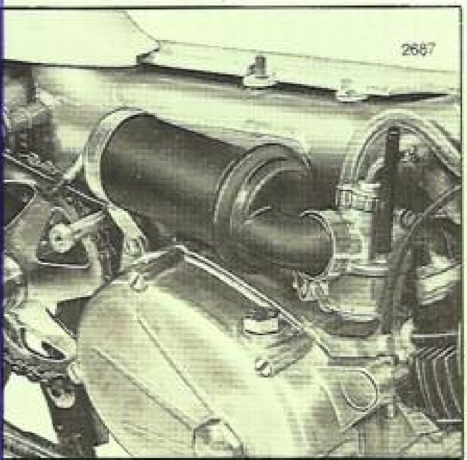
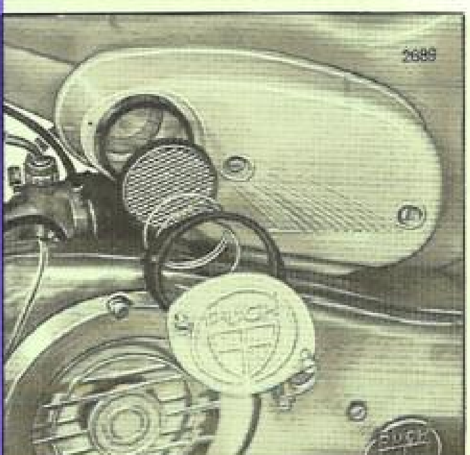


Fig. 20 ▲ Fig. 21 ▼



The actual speed must be reached 109 to 219 yd (100 to 200 m) prior to passing the starting mark of test track. The actual speed is measured by time (X 100) required to complete test track (1 mile) and the fuel consumption by switching on test unit during that time.

The results of all tests are transferred to a diagram as illustrated (figure 15, 16 and 17) and the fuel consumption chart is ready.

Inlet silencers

Silenced air filters are a compromise to comply with legal requirements and to reduce noise of the modern fast running high performance engines. Inlet silencer and air filters are combined in most cases. Inlet silencers reduce the engine output a little and designers have to make considerable efforts to balance the whole engine system. It is definitely not true that removing the intake silencer alone increases engine performance because carburettor, airfilter and silencer are related. In fact, any modification reduces the output and increases the noise level. Such attempts often weaken the mixture and cause damage to the engine, e. g. piston seizure etc.

As already mentioned, inlet silencers must not be modified. Neither must anything be modified to the intake hose (see figure 18). Maintenance work is restricted to cleaning of silencer and filter and perhaps checking for leaks. Filter and silencer are mostly one unit.

The life of an engine depends largely on the cleanliness of the intake air. Our models are fitted with dry or wet filters and maintenance depends on the filter system used. The dry filter (paper element) can be cleaned only by shaking and blowing of compressed air against normal air flow. This should only be done once or twice and the filter element should be replaced after approximately 3750 miles (6000 km). Wet or oily paper filters loose all efficiency and must be replaced.

The wet filter has an oil-covered metal web. The inlet air leaves any dust particles on the oil so dry filters are useless. The filter is cleaned with petrol or a similar non-acid cleaning liquid and blown out with compressed air.

Inlet silencers

Cleaning of air filter

Maxi (figure 18)

Remove left panel after unscrewing the three fixing screws. Loosen clamping screw holding inlet silencer to carburettor and pull silencer out of openings in frame and off the carburettor. Remove the two screws from inlet silencer and extract silencer. Take out filter, clean as described and wipe out filter housing. If difficulties occur in assembling the two housing halves, insert into warm water first for easier assembly.

X 30 models (figure 19 and 20)

Remove both fixing nuts and the fixing screw from the right-hand panel and take off holding bracket. Lift off motor panel. Loosen screw of clamp on carburettor. Unscrew inlet silencer fixing and extract silencer from carburettor. Lift off front part of inlet silencer. Unscrew starting valve and remove filter insert carefully. Clean filter and assemble in reversed procedure.

MS-, VS-, DS-Models (figure 21)

These models use a similar filter but in different positions. To clean air filter remove both screws and take off cover with seal and spring. Remove filter insert and rubber seal. If very dirty, remove filter housing after loosening the two fixing screws. Pull filter housing out of inlet rubber.

Dismantle filter housing and wipe out. Some older models use screwed bakelite housings. After cleaning, assemble filter.

Model DS 50 V (figure 22)

This model and some other models with R-engines are equipped with rubber intake silencers. To remove the air filter of model DS 5L V remove first the right covering. There after undo wire clip from carburettor and after pulling of the intake silencer the filter is accessible.

VZ 50 M Model

To clean air filter, loosen clip of inlet hose and remove hose from panel and carburettor. Loosen fixing screws on panel and filter. Push back end of panel downwards and remove by pushing backwards.

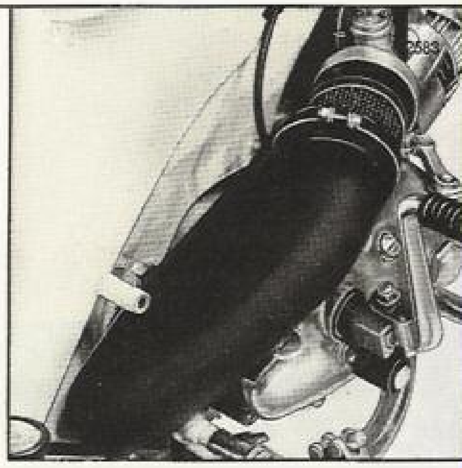
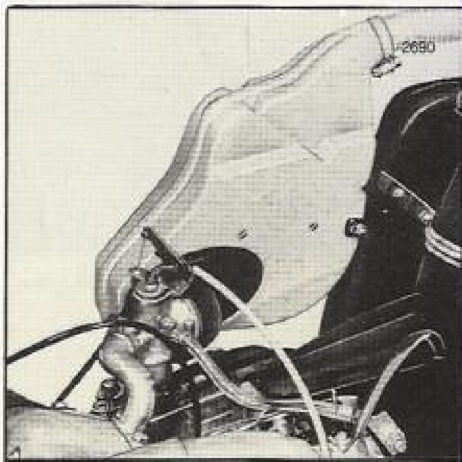


Fig. 22 ▲ Fig. 23 ▼



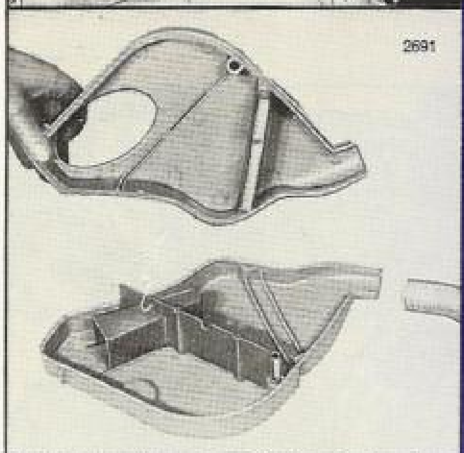
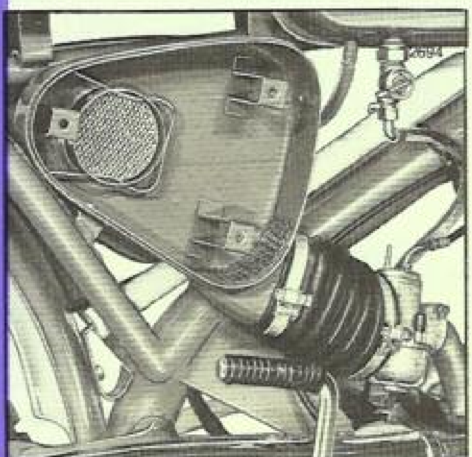


Fig. 24 ▲ Fig. 25 ▼

Inlet silencers

Fig. 26

Fig. 27



Remove filter housing on right side of vehicle, at the same time pull hose out of filter housing.

Dismantle filter housing. The paper filter insert is located in a guide in the filter housing (figure 23 and 24). Clean filter and housing as described previously. If there is difficulty in assembling the two plastic housing halves, dip in warm water to increase flexibility.

Model R 50 (figure 23 and 24)

Some R 50 models use the same paper filter as models VZ 50 however, to clean air filter on R 50, remove motor panels first.

Model M 50 and M 50 SE (figure 25 and 26)

Unscrew both screws from left hand filter housing and take off cover. Pull out inner cover held in four grooves of filter housing (figure 25). Press filter insert upwards toward the spring and remove (figure 26). Take care or spring will jump out. To assemble put filter insert on top of suction tube in suction box, push-on spring holding disc and fix tensioned spring between filter housing and filter insert. Press inner cover into the four grooves, add outer cover and fix with the two screws.

MC models (figure 27)

The filter is in a housing located opposite the tool bag. The filter can be reached after removing the three fixing screws and taking off the cover. The filter is extracted after taking out the holding spring.

1st Edition

Exhaust system

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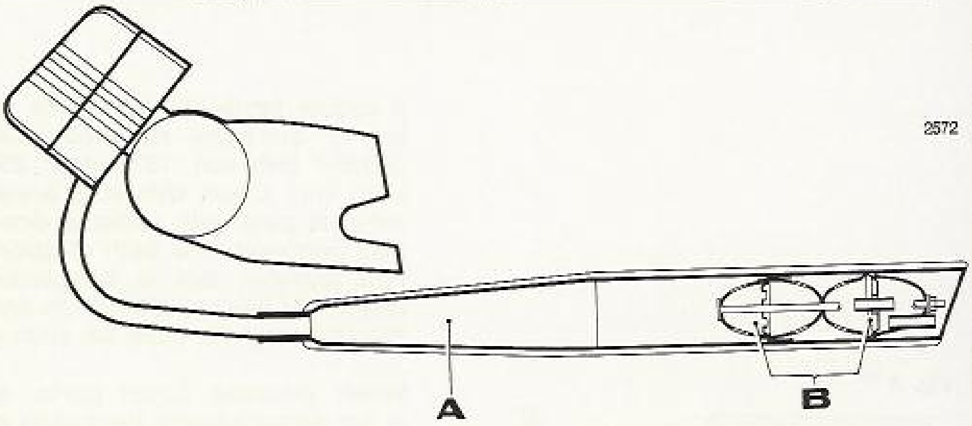

Fig. 1

Type and positioning of exhaust silencers are an important factor in determining the characteristics of present high-performance two-stroke engines. Exhaust outlet, pipe diameter and length, position of reflectors and holes in silencer are established during practical and test bed trials. Success depends on the availability of engine test beds and necessary test instruments. Without them, modifications to exhaust systems to increase engine output (hotting-up) must fail and will only increase noise and reduce output. Hotting up for certain purposes (e. g. racing) is possible but only to manufacturer's specifications. It is not possible to give details in this manual but the manufacturer should be contacted in such cases.

The following description may show how much output depends on correct silencer. The pressure wave leaving the outlet slots is reflected in the exhaust (figure 1). Negative as vacuum in the difuser (figure 1/A), positive as pressure in the reflectors (figure 1/B). The reduced pressure wave returns to the outlet slot.

Appropriate selection of tube, difuser and reflectors ensures that the return time is such that inlet suction into cylinder is improved by the build up of a limited vacuum through an open outlet slot. On the other hand, the return time can be selected to reduce engine output to comply with legal requirements. Maintenance work on exhaust systems is therefore limited to correct assembly and regular decoking.

Fig. 2

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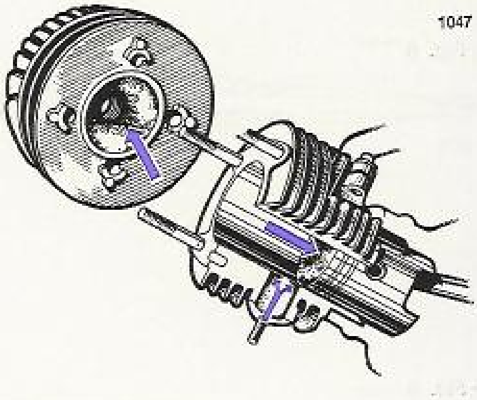

Decarbonising

In two-stroke engines, part of the lubricating oil is burnt and carbon is deposited on all parts of the exhaust system, particularly on outlet slots, exhaust pipe and silencer. Carbon must be removed at regular intervals but definitely if engine output is reduced or

Exhaust system

if engine tends to four-stroke although the carburettor is correctly adjusted. Cleaning intervals are usually between 1875 and 2500 miles (3000 and 4000 km). Clean with wire brush and scraper. Clean exhaust pipe with suitable decoking liquid. Coke is also removed in a bath of strong caustic soda solution (careful, this is dangerous to skin) but most chemicals destroy aluminium and paintwork and must therefore not be used on such parts.

When cleaning outlet ports, ensure that the piston is not damaged-with the piston at bottom dead centre. Do not use any sharp tools for cleaning (see figure 2). The piston face is cleaned only if the deposit is more than .00787 (0.2 mm) or if called for by ignition troubles such as pinking.

Removing of deposits from piston ring grooves and cylinder head is described under the appropriate paragraphs.

When fitting exhaust systems to engines having light-alloy heads care must be taken not to apply too much tension to the head.

Arrows pinpoint all parts of silencers, figures 3 to 9, to be cleaned thoroughly because small deposits affect the output considerably.

Fig. 3

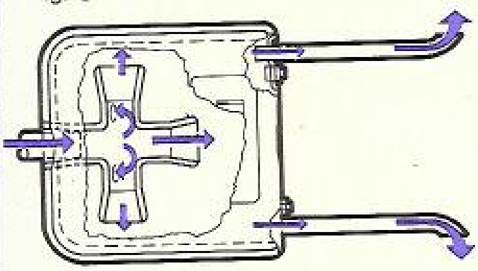

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Fig. 4

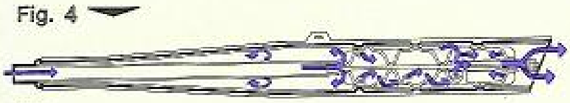

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Fig. 5

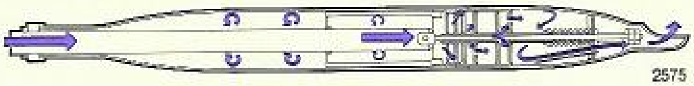

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Fig. 6

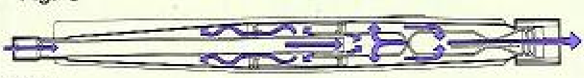

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Fig. 7

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Fig. 8

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Fig. 9

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Assembling the engine

In section "engine" group E–L and in section "electrics" we have described in detail all adjusting and assembling instructions related to the various engines. In the following pages we will quote general instructions and also summarise important points.

Before assembling, check all parts visually after cleaning. All wear parts – for instance, clutch components, bushes, bearings etc. – must be checked. Method of checking, dimensions and wear limits are quoted in the relevant sections. Sealing rings, circlips and lockrings must always be replaced. Paper gaskets must be oiled only. Do not seal housings with sealing compound. Such compounds must be used only if sealing surfaces are lightly damaged and cannot be straightened. Use grease to locate paper gaskets during assembly. Do not replace or change single rollers of bearings. Always fit rollers back to the original bearing. Do to varying speeds and loads of different bearings, rollers wear at different rates. Do not replace rollers but change complete sets only. To aid assembling, stick rollers with grease into bearing rings.

Never apply pressure to inner rings of bearings. Incorrect pressing-in damages bearings and causes noise. Press-in tools must be designed to press outer ring only or both rings together. Bearings requiring pressure to inner ring for extraction must always be replaced. If bearing sealings are worn due to repeated pressing in and out, use "Loctite" to fit bearings. Note manufacturers instructions. Use "Loctite" too for any damaged threads in housings and the like. Do not tap larger thread. Completely damaged threads can be repaired with "Helicoil" inserts as described in group L. Fit gearshaft, gearbox components, crankshaft, etc., as described under the appropriate sections. Check functioning of all parts during assembly, for instance after fitting gearbox, after fitting second housing half, after fitting cylinder etc. All bearing points and sealing rings must be oiled. Turn engine after fitting cylinder to line up cylinder and piston. Turn over engine after tightening cylinder or cylinder head to check proper sealing of gaskets. Use the specified special tools for assembling. All special tools are listed in group B, page 1 to 8.

A torque spanner must be used. Required torque values are quoted in group "various" page A 1. Pages A3 and A4 show general torque charts indicating permissable torque values for all screws.

After assembling, check function of all parts again. Adjust timing as mentioned in group "electrics" pages B1 to 8.

Finally add oil quantities as follows:

MAXI	150 cc	Automatic oil
X 30	200 cc	Engine oil SAE 40–50*
X 30 A	250 cc	Automatic oil **
MS hand control . .	180 cc	Engine oil SAE 40–50*
MS foot control . . .	300 cc	Engine oil SAE 40–50*
MSA	300 cc	Automatic oil**
VSD hand control . .	180 cc	Engine oil SAE 40–50*
VSD foot control . . .	300 cc	Engine oil SAE 40–50*
R hand control . . .	180 cc	Engine oil SAE 40–50*
R foot control . . .	300 cc	Engine oil SAE 40–50*
V	250 cc	Engine oil SAE 40–50*
M	350 cc	Engine oil SAE 40–50*

* For temperatures below 10° C use engine oil SAE 20–30. For temperatures below 0° C use engine oil SAE 10.

** Automatic models must be filled all year with automatic oil. Do not use engine oil.

Assembling the engine

Engine fitting

Before fitting: Check all Bowden cables for damaged wires and easy movement; replace if necessary. Lubricate all Bowden cables. Clean carburettor and air filter and check carburettor adjustment – see group M carburettor. Check and replace if necessary all connectors such as rubber sleeves and seals. Clean exhaust system – see group N – exhaust.

fixing screws M 8 . . .	18.8 ft/lb (2.6 mkp)
fixing screws M 8 x 1 . .	23.1 ft/lb (3.2 mkp)

Insert engine in frame. Fit engine fixing screws, nuts, spring rings and locking rings. Tighten to correct torque values.
Fit chain and tension, fix chain connector correctly – see figure 1. If chain can be lifted as illustrated in figure 2, chain is worn and must be replaced. Fit selector Bowden cable or drawrod as applicable. Note correct adjustment and fitting – see page 5–7, group I, controls.

Fit clutch Bowden cable and adjust correct play – see group G – clutch. If necessary, move clutch lever on engine by one tooth.

Adjust decompressor on X 30 standard type as following specified under heading X 30 A.

Fit carburettor and carburettor Bowden cable. Check carburettor flange.

Flanges of carburettor type Bing 1/12 on MS/VS models are sometimes distorted; correct by filing. Always use new gaskets if possible. Connect inlet silencer to carburettor. Check connections for leaks.

Fit kickstarter lever or pedals as applicable. At lefthand motor panel. For detailed assembly instructions of kickstarter see group "J – starter mechanism". Fit selector lever on foot controlled models. Check whether oil has been filled into the gearbox, start engine and have short test drive. Adjust tick over speed on warm engine – see group "M-carburettor".

Automatic models only

Automatic models are fitted with a separate starting clutch connecting pedals or kickstarter accordingly during starting. Maxi and X 30 A models have starting aid and decompressor combined.

Maxi

Correct adjustment of decompressor and starting clutch elements is most important for proper starting and stopping of engine.

Starting clutch Bowden cable:

Hook nipple of Bowden cable to starting lever. Insert cable into holder on frame and screw adjusting screw completely into holder. Insert open cable end into operating lever, tension cable and fix with clamping screw. Final adjustment commences after fitting of decompressor Bowden cable.

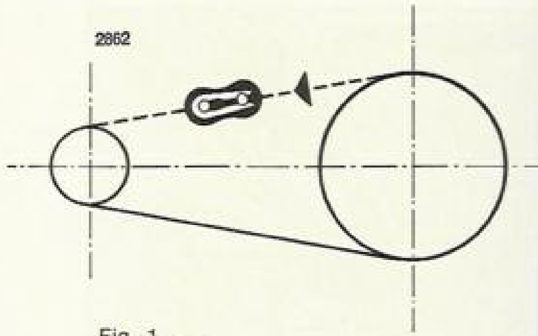
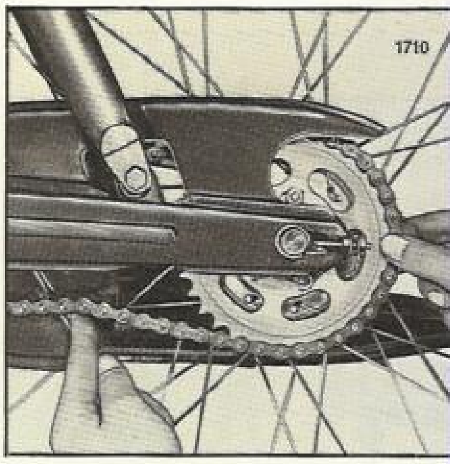


Fig. 1

Fig. 2



Engine fitting

Decompressor Bowden cable:

Screw the loose Bowden cable with adjusting screw completely into holding bracket and hook nipple into starter lever. Push other end of cable into leafspring of decompressor, add slotted washer at nipple and insert tensioned cable sleeve into holder on cylinder.

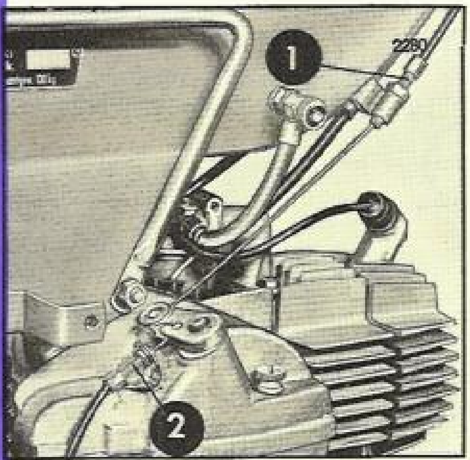
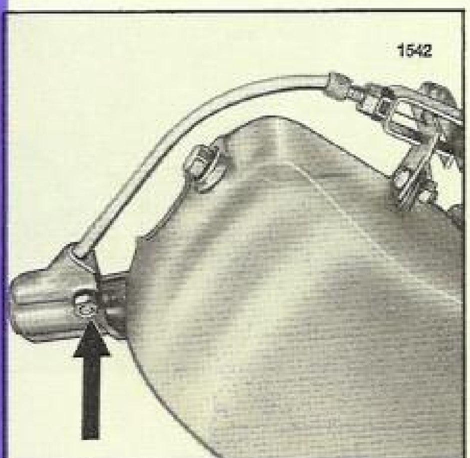


Fig. 3

Adjusting:

Tension starter Bowden cable fig. 3/1 until operating lever has approximately 1.575 in (4 mm) movement before connecting starting clutch to crankshaft. A too-tightly adjusted clutch acts as brake (evident when pushing the vehicle). Too much play and the clutch will slip on starting. After adjusting the starting clutch, adjust the decompressor controls common to the starting clutch. Adjust screw of decompressor Bowden cable fig. 3/2 so that light movement of operating lever causes the leafspring to press decompressor valve into combustion chamber. However, at resting position the lever must not tension cable with spring and valve or starting difficulties will occur. Note, that when pulling entirely the start- and decompression lever, the decompressor must not open as far as to the buffer (Bz-washer), in which case the start clutch might be disturbed. After cable adjustment is completed, tighten counternuts and start vehicle.

Fig. 4



X 30 A

Accurate adjustment is possible only if clutch disc is adjusted as described on page 3, group K. On the actuating lever the Bowden cable must have a play of .0787–.1575 in (2–4 mm). This play is adjusted with screw on clutch cover. Insufficient play causes the clutch to act as brake (when pushing the vehicle); too much causes slipping at starting. After adjusting the starting clutch, proceed to adjust the common decompressor controls. Maximum play of decompressor Bowden cable is .0197 in (0.5 mm). To adjust, remove decompressor hood with the Bowden cable hooked on. With engine running, push hood home until decompressor opens. Push hood back until decompressor closes and fix hood at this position (figure 4).

MSA and R 50 A

These models require starting clutch cable adjustment only. Adjust play of Bowden cable with screw as already described. .0787 to .1575 in (2–4 mm) movement on actuating lever is correct.

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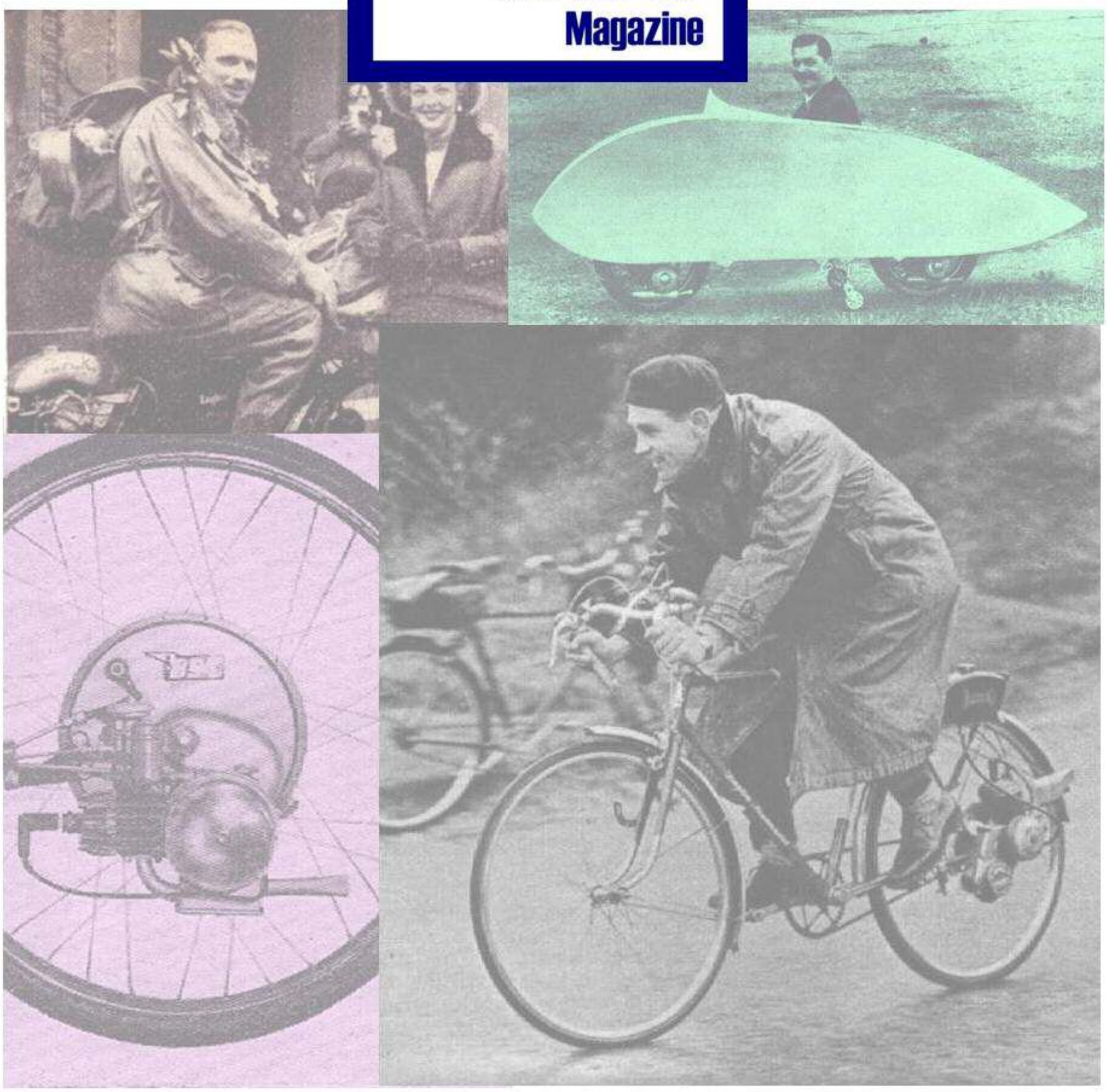

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