



*Isetta*

**MAINTENANCE MANUAL**

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## REFERENCE INDEX

Special tools

Technical Data

### Group M Engine

- M 1 Removing and refitting engine
- M 2 Removing and refitting engine with transmission
- M 3 Removing and refitting clutch
- M 4 Readjusting clutch
- M 6 Basic adjustment of clutch
- M 9 Dismantling and reassembling engine
- M 10 Replacing breather valve
- M 12 Replacing connecting rod bushing
- M 14 Installing new cylinder
- M 20 Adjusting valves
- M 22 Overhauling cylinder head
- M 24 Overhauling crankshaft
- M 26 Overhauling oil pump
- M 30 Adjusting ignition timing

### Group G Transmission

- G 3 Dismantling and reassembling transmission
- G 5 Adjusting gear control linkage

### Group H Rear axle

- H 1 Removing and refitting rear axle
- H 2 Dismantling and reassembling rear axle
- H 4 Adjusting Chain
- H 6 Replacing chain

### Group 3 W Rear axle

### Group V Front suspension

- V 1 Removing and refitting front suspension assembly

### Group L Steering

- L 1 Removing and refitting steering assembly
- L 2 Removing and refitting steering wheel and steering column
- L 10 Basic adjustment of steering

### Group F Springs and shock absorbers

- F 10 Removing and refitting rear spring
- F 15 Removing and refitting rear shock absorber

### Group B Brakes, Wheels, Tyres

- B 1 Adjusting brakes
- B 10 Replacing brake linings
- B 13 Adjusting brake master cylinder
- B 20 Mounting a tyre

### Group A Body

- A 1 Removing and refitting body
- A 5 Replacing a glass panel

### Group R Chassis frame

- R 1 Measuring frame after an accident

### Group E Electrical system

Description of the electrical system  
Wiring diagram

- E 5 Replacing contact breaker points
- E 6 Replacing springs of automatic advance unit, greasing cam
- E 7 Replacing carbon brushes
- E 9 Testing carbon brushes for circuit and ground (earth)
- E 10 Testing field coils for circuit and ground
- E 12 Testing armature of dynamo starter
- E 13 Testing ignition coil
- E 15 Testing condenser
- E 19 Replacing a Bilux lamp

### Group W Maintenance

Lubrication and maintenance chart

## I N T R O D U C T I O N

With this Workshop Manual of the B.M.W. Isetta we hand over to our dealers a workshop aid, enabling them to provide their customer with the most satisfactory work of service.

The Isetta, with its outstanding characteristics and its reasonable price, opened a new market for people who perhaps start motoring for their first time, and therefore have to manage to drive and maintain the vehicle with the lowest possible amount of money. It is in the interest of the Service Station to give first-class service and good advice to the car owner to get regular customers and to keep the value of the vehicle. To enable the Service Station to do this, this Manual has been carefully worked out and explains both the special tools and service work in the best possible way.

Special tools and specialist knowledge used together keep down the dealer's working costs and bring him the confidence of his customers.

In case of alterations in design, we will supply the holder with additional explanations in the form of news-letters which can be added to this book.

# Special tools for BMW-ISETTA

- 1 M 299 a Puller, ball bearing (with modification) (Matra device)
- 2 M 527 Puller screw, blower wheel (Matra tool)
- 3 M 528 Puller spindle, dynamo starter armature (Matra tool)
- 4 M 355 a Puller, camshaft (Matra tool)
- 5 M 467 Puller, bearing cover plate (Matra tool)
- 6 M 357 a Clamping screws for clutch installation (Matra device)
- 7 M 529 Arbour for centring of clutch (Matra tool)
- 8 M 498 Locking fixture for fly-wheel (Matra device)
- 9 M 311 Puller, Flywheel, with two sets of screws (Matra device)
- 10 M 530 Arbour for adapting protection tubes of rocker arm push rods (Matra tool)
- 11 W 5002 Drift punch, gudgeon pin (to be made in the dealer's shop=shop-made tool)
- 12 M 368 Holder, for grinding-in valves with 7 mm stem diameter (Matra tool)
- 13 Valve guide reamer (commercial type)

No.: 13, to be supplied by

Messrs. Ludwig Hunger,  
Werkzeugfabrik  
Munchen-GroBhadern  
Grafelfinger StraBe 146

- 14 Gauge for entering transmission shafts (shop-made tools)
- 15 Gauge for checking castor 12° (shop-made tool)
- 16 Gauge for checking king pin inclination 5° (shop-made tool)
- 17 Special tool for inserting weatherstrip retainers (commercial type) Order No.: 36 943

- 18 Special tool for installation of glass panels (commercial type) No.: 36 941

No. 17 and 18 made by

Messrs. Happich G.m.b.H.  
Wuppertal-Elberfeld.

- 19 Steering wheel extractor



Technical data of the Motocoupe  
BMW Isetta

Transmission

BMW four forward speed and  
reverse gearbox  
1st 2nd 3rd 4th Reverse  
Gear ratios  
10.05 5.17 3.54 2.70 12.15  
Overall gear ratios  
23.21 12.15 8.17 6.2 30.0  
Oil capacity transmission  
.96 Imp pints = 1.1 U.S pints  
(trade-mark oil SAE 40)

Final drive:

Type

Short rigid axle driven by chain  
in oil-bath case forming unit  
with the axle housing

Power transmission

through transverse resilient  
mounted drive shaft and totally  
enclosed, fully adjustable chain  
drive in oil bath.

Final drive ratio

2.31 : 1 (30/13 teeth)

Overall gear ratio in 4th gear

$i = i_1 \cdot i_0 = 2,70 \cdot 2,31 = 6,25; 1$

Chassis frame: by Rubery-Owen

Trapeze form

Type

Rigid tubular chassis frame

Steering:

Type

Steering screw and nut

Steering gear ratio 16 : 1

Turning circle diameter

approx. 8 m (24 feet)

Suspensions:

Front

Independent (swing arm damped  
by coil spring and hydraulic).

Rear

Two quarter-elliptic leaf springs  
and telescopic shock absorbers

Wheels and tyres:

4 Wheel Wheel rim 3.00 x 10

Tyre size 4.80 x 10

Pressure p.s.i.: -Front 15 Rear 14

3 Wheel Wheel rim front 3.00 x 10

Wheel rim rear 3.50 x 10

Tyre size front 4.80 x 10

Tyre size rear 5.20 x 10

Pressure p.s.i.: -Front 16 Rear 24

Camber 1 1/2°

King-pin inclination 5°

Toe-in

approx 2mm = .07, measured on  
the rim borders, front and rear.

Castor 12°

Brakes:

Type

Hydraulic (Girling)

Engine:

Make and type

BMW Isetta 250 cc or 300 cc

Cycle Four-stroke Otto

Number of cylinders and arrange-  
ment

1 cylinder with blower cooling

Valves

Overhead, in V-arrangement

Camshaft drive

Roller chain

Valve operation

Tappets, pushrods and rocker arms

	<u>250 cc engine</u>	<u>300 cc engine</u>
Bore:	68mm(2.67in)	72mm(2.83in)

Stroke	68mm	73mm
--------	------	------

Piston	247cc	295cc
displace-	(15.07cu.	(18.61 cu.
ment	in.)	in.)

Compres-	6.8 to 1	6.8 to 1
sion ratio		

Power	12 bhp at	13 bhp at
	5800 rpm	5200 rpm

Medium piston speed

13.3m/sec. = 43.6ft./sec.  
at n = 5800 rpm

Valve clearance (with engine cold)

Intake = 0.15mm (.006in.)

Exhaust = 0.20mm (.008in.)

Lubricating system

Force feed lubrication

Oil pump

Gear-type oil pump

Oil capacity, engine

3.1 Imp.pints = 3.6 U.S.pints

Lubricant

Trade mark HD oil SAE 20 in winter  
SAE 40 in summer

Carburettor: 250cc 300cc

Model "Bing" 1/22/97 1/22/98

Adjustment:

Passage 22mm=.86in.22mm

Main jet 130 125

Needle jet 1310/6 1308

Jet needle 2023 2023

Idling jet 35 35

Starter jet 55 55

Needle position 1 2

Weight of float 7grams 7gr.  
=.25oz.

Pilot air screw 1 to 2 1 to 2  
opened turns turns

Fuel supply by gravity

Air cleaner Micronic filtering  
element in air  
silencer

Clutch

Single-plate dry  
clutch

Foot brake  
operates on all four wheels  
Hand brake  
operates on the rear wheels

Brake design  
Internal shoe brakes, (floating)  
Brake drum diameter 7.1

Total brake lining area  
49.9sq.in

Fuel tank:  
Capacity  
2.8 Imp.gal. = 3.4 U.S.gal.  
with reserve fuel supply of  
.65 Imp.gal. = .8 U.S. gal.

Electrical system: 12 volts  
Battery Lucas  
12 volts/31 ampere hours

Dynamo (generator) starter  
12 volts/130 watts (combined)

Designation: Dynamo starter  
Noris LA 12/130 3R

Regulator type  
Voltage regulator (F) RS/A  
12/130 combined with starter  
relay

Starting RPM  
approx.1,200

Rated continuous output  
130 watts at 1,800 RPM

Drive ratio  
1 : 1

Starter operation  
combined with ignition switch

Ignition: Battery-ignition 12 volts

Ignition timing  
automatic, with governor  
control on blower wheel

Initial ignition timing  
7° before T.D.C. at idling  
speed

Maximum advance  
7°+35° = 42° before T.D.C.

Contact breaker  
Breaker gap 0.4 mm = .016 in.

Sparking plug  
Lodge H.H.14 (electrode  
gap 0.6 mm = .024in.)  
Lodge H.H.13 for excessive starting  
and stopping.

Electric horn: Lucas

Radio unit: (optional item)

Installation intended for  
medium-waves wireless sets  
only

Main dimensions:  
Track (tread), front 47.2 in.  
Track (tread), rear 20.4 in.  
Wheelbase 58 in.

Overall dimensions:  
Length 89.9 in.  
Width 54.3 in.  
Height (unladen) 52.6 in.

Weight:  
Kerb weight  
approx. 770 lbs.  
Carrying capacity  
507 lbs.

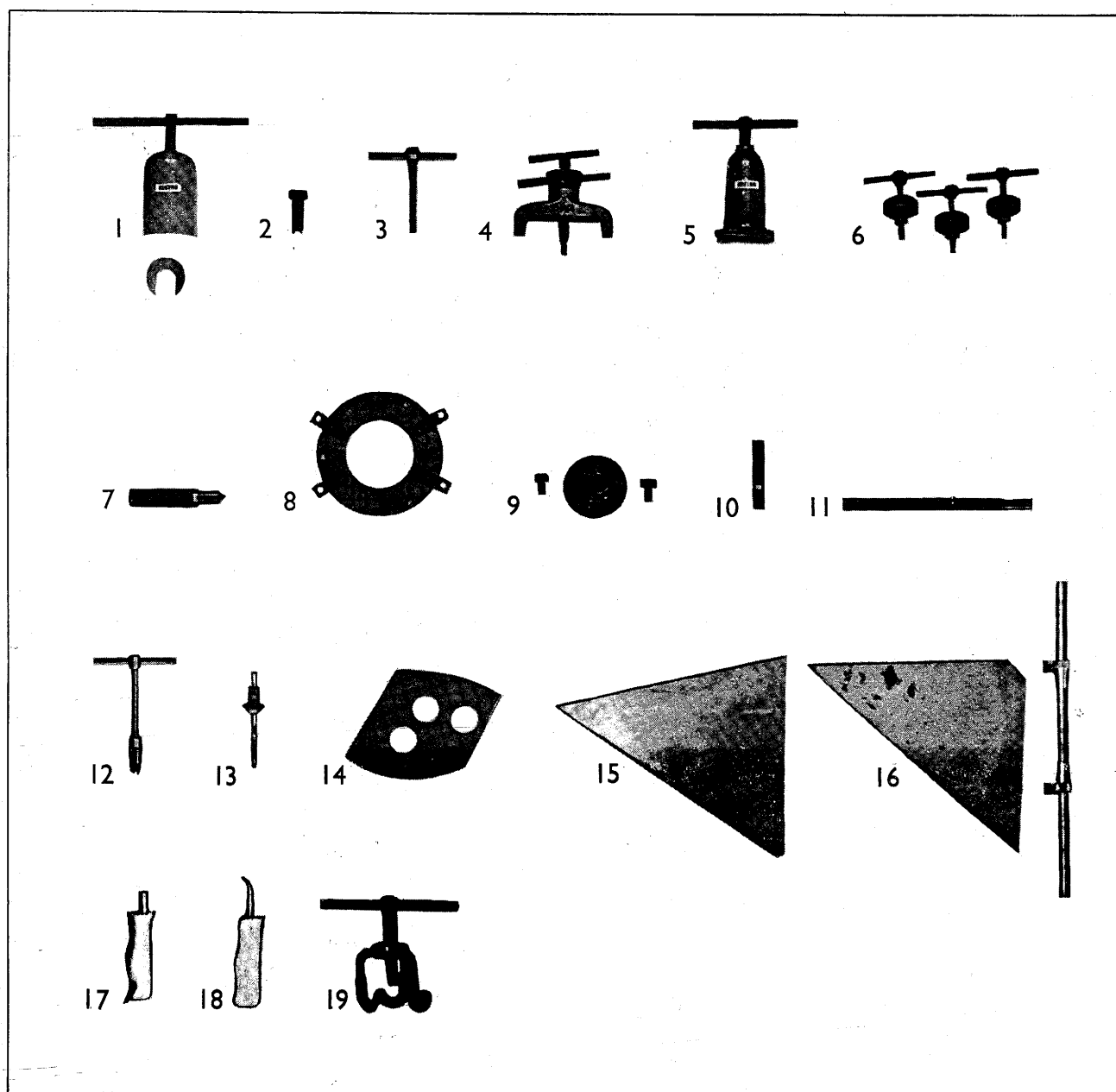
Road performance:  
250 c.c. engine 300 c.c. engine  
Maximum speed  
53 m.p.h. 56 m.p.h.  
Climbing ability  
First gear 1 in 3

Running-in speeds for the first,  
1,200 miles:

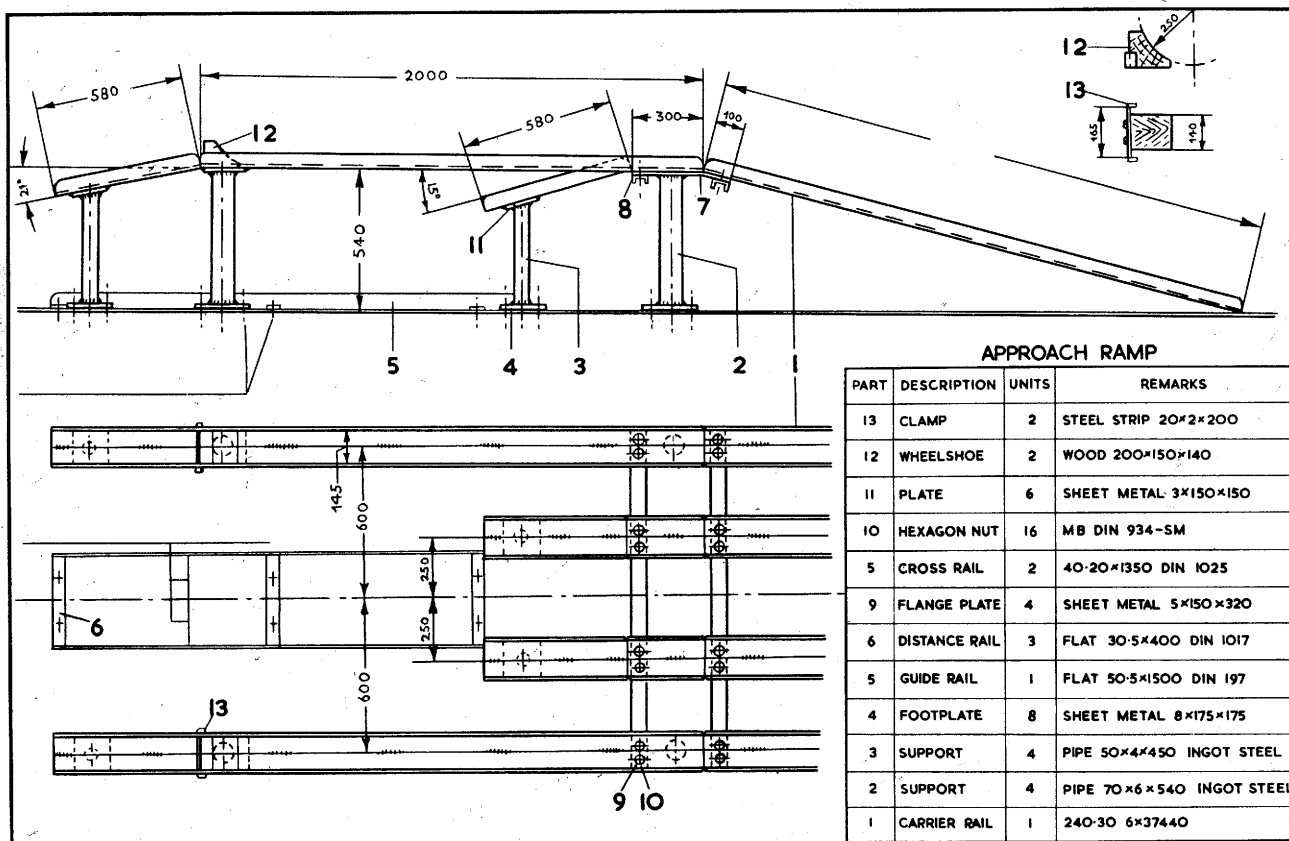
Miles registered on speedometer:

Miles per hour in  
1st gear 2nd gear 3rd gear 4th  
gear  
0 to 600 not over  
10 18.5 31 40  
600 to 1200  
Increased speeds for short  
distances  
over 1200  
15 30 40 53  
(56 with  
300 c.c.engine)

# SPECIAL TOOLS FOR BMW ISETTA



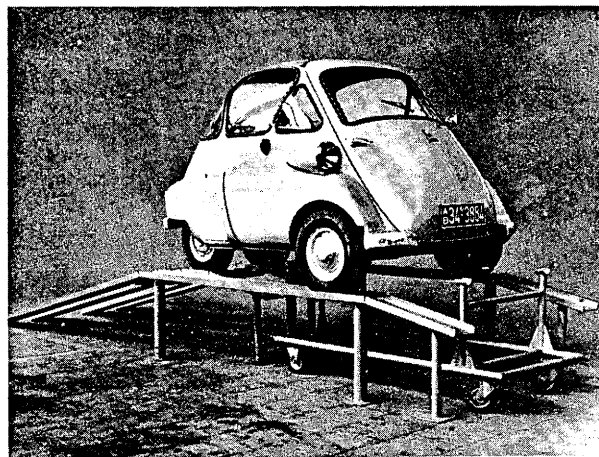
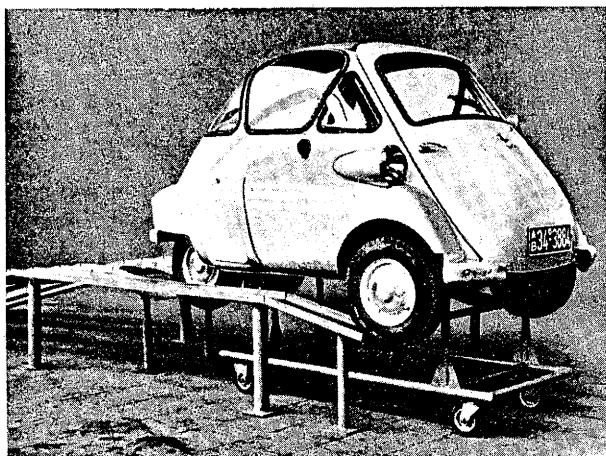
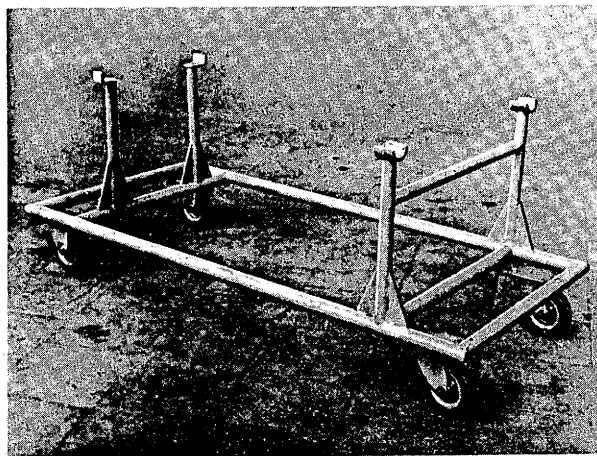
The numbers of the figures relate to the numbers of the list opposite. The drawings of guages 15 and 16 are in Group R - Underframe.

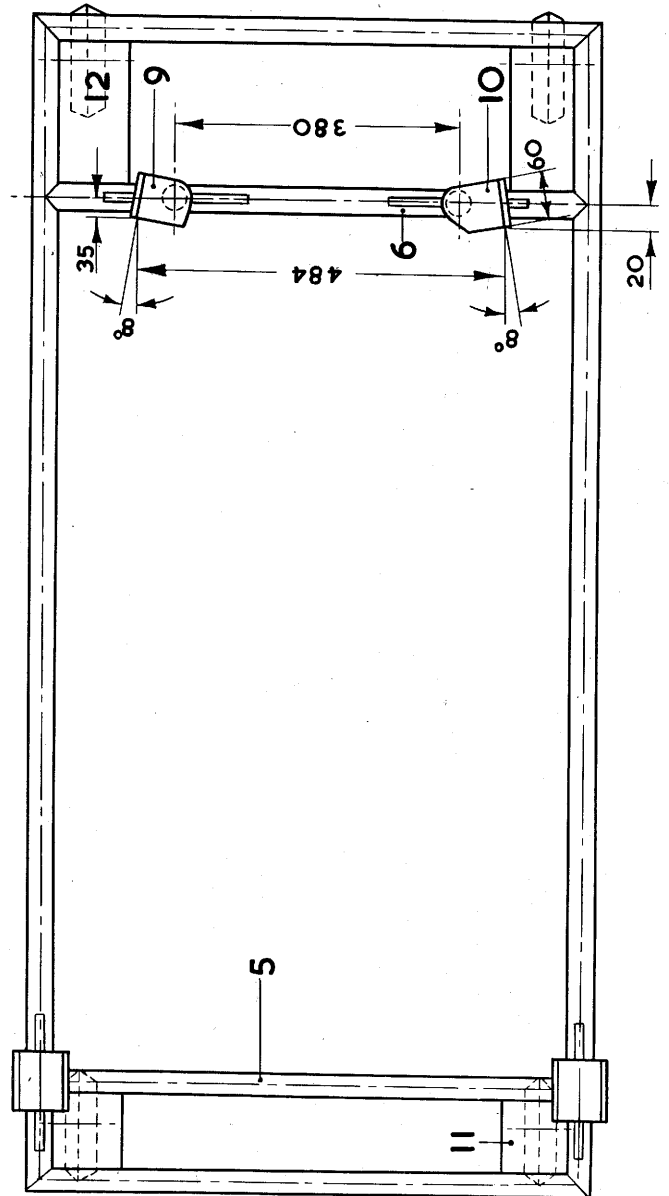
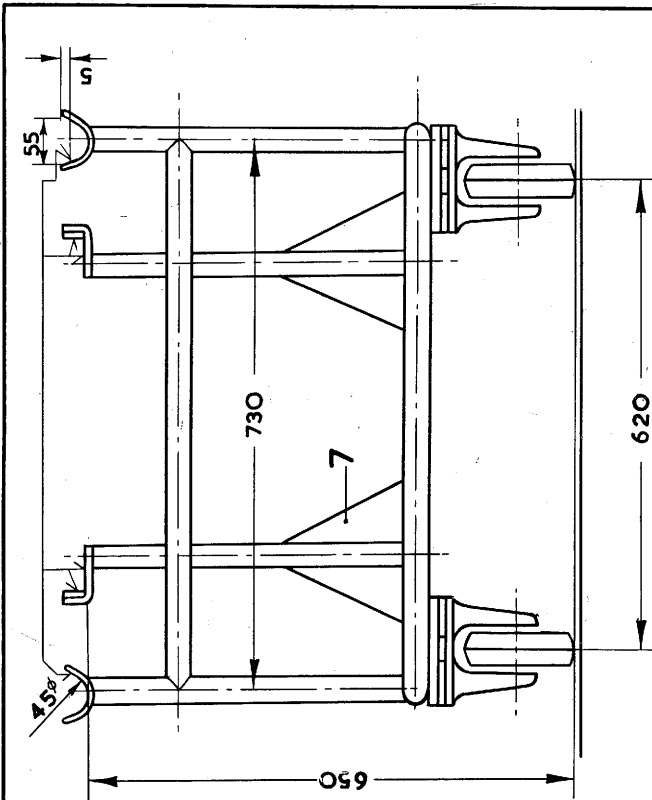
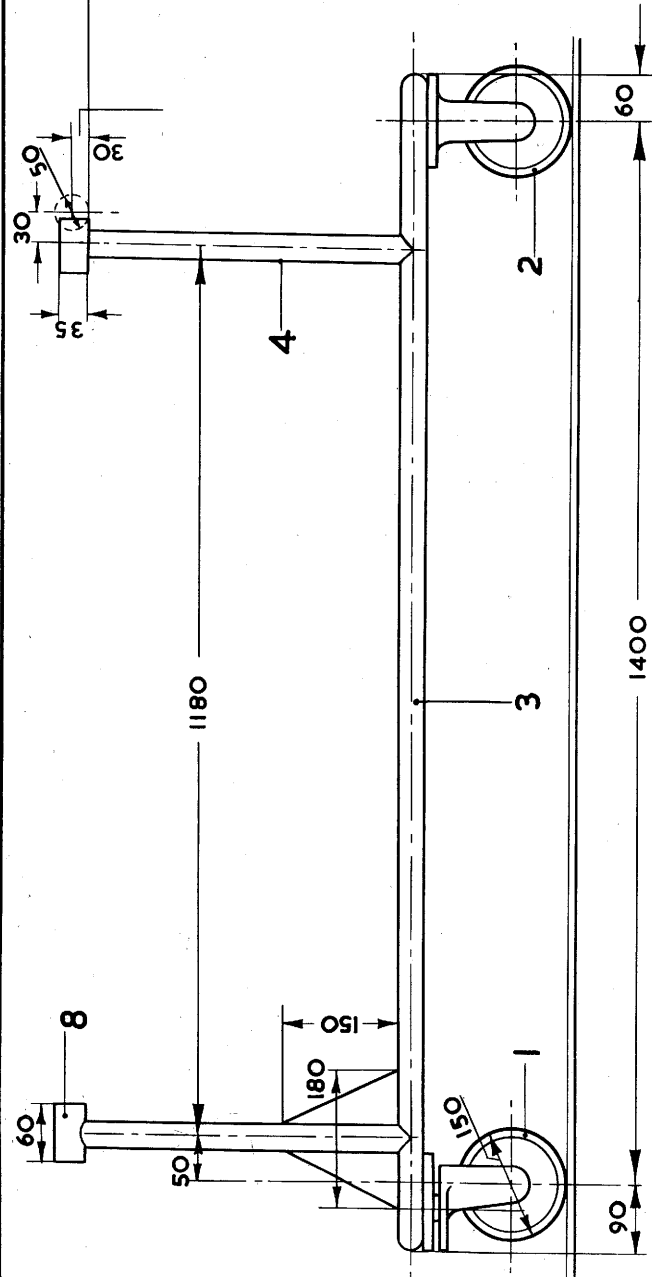


#### APPROACH RAMP AND TROLLEY FOR ISETTA

So that the "Isetta" can be worked on easily, the BMW Customer Service has designed a trolley on which the cars can be placed with the aid of an approach ramp. The engine, brakes, steering etc. are then at such a level that the mechanic can work sitting on a box. As these trolleys are fitted with casters, the mounted cars can be moved within the smallest conceivable space so that even in a restricted space convenience is assured.

The structural drawing of the trolley is on the next page.





12	PLATE	2	SHEET METAL 3x120x250
11	PLATE	2	SHEET METAL 3x120x150
10	SUSPENSION CLAW LEFT	1	FLAT STEEL 60x5x70
9	SUSPENSION CLAW RIGHT	1	FLAT STEEL 60x5x70
8	SUSPENSION BOWL	2	FLAT STEEL 60x5x100
7	STRUT	8	SHEET METAL 5x70x150
6	CROSS GIRDER REAR	1	STEEL TUBE 40x2.5x750
5	CROSS GIRDER FRONT	1	STEEL TUBE 40x2.5x750
4	SUPPORT	4	STEEL TUBE 35x2.5x450
3	FRAME	1	STEEL TUBE 40x2.5x4640
2	CASTER	2	150 DIAM. WITH RUBBER
1	STEERING ROLLER	2	150 DIAM. WITH RUBBER

DATA PECULIAR TO RIGHT HAND DRIVE THREE WHEEL ISETTA 300

ADDENDUM TO WORKSHOP MANUAL

Technical data

Wheels & Tyres - Rims 3,00 D-10  
Tyre size  
4.80 x 10 all vehicles.

Tyre pressures - Front 16 lbs.sq.in.  
Rear 28 lbs.sq.in.

Tyre rotation - Anti-clockwise, every 2,000 miles

Group E. Electrical System

Steering column trafficator and dip switch wiring is as per wiring diagram included in this manual.

Heating System -

Heater silencer is now situated immediately behind the battery under the seat. Care should be exercised in moving seat to avoid crushing the heater ducting.

ALL OTHER TECHNICAL DATA AS FOR LEFT HAND THREE WHEEL MODEL

Note: Equipment required for operation but in some cases not supplied in special tool kit as various items are universal garage equipment

## GROUP M ENGINE

### M 1 Removing and refitting engine

- Fig. 1 Tools: Wheel nut spanner, screw-driver, electrical screw-driver, socket spanners 10/12/14 mm with universal joint, 12-point ring spanner 10/14 mm, open ended spanners 7/11/14 mm, ratchet wrench, plastic mallet, flat pliers.
- Fig. 2 1. Turn off the petrol tap, remove seat and backrest. 2. Disconnect the negative lead from the body. (socket spanner 10 mm) 3. Disconnect the wires from the cable connector group. (blue, green and black-brown) (electrical screwdriver)
- Fig. 3 4. \*Remove wheel cover plates from rear wheels and slacken wheel nuts. (screwdriver, wheel nut spanner) 5. Support the vehicles on the rear. \*6. Remove the two rear wheels. (wheel nut spanner) 7. Remove engine covering panel and detach starter cable. (open ended spanner 7mm) 8. Detach ignition coil and withdraw high-tension cable. (socket spanner 10mm) 9. Draw the two disconnected wires (job 3) outwards. \*10. Remove the two mudguards (fenders). (socket spanner 10 mm)
- Fig. 4 11. Detach petrol pipe from carburettor. 12. Remove clamp securing the hose connection toward the air silencer. (flat pliers or screwdriver)
- Fig. 5 13. Unscrew carburettor cover assembly, withdraw throttle slide and envelop it in a cloth.
- Fig. 6 14. Remove carburettor starter slide (choke piston) and wrap it in a clean cloth. (open ended spanner 11 mm) 15. Detach exhaust flange from engine. (socket spanner with universal joint 12 mm) 16. Disconnect the silencer from its rear attachment. (socket spanner 10 mm with ratchet, ring spanner 10 mm for counteracting on unscrewing)
- Fig. 7 17. Slacken the two upper rubber mountings on carrier and clutch flange. (socket spanner 14 mm with universal joint, ring spanner 14 mm, open ended spanner 14 mm)
- Caution: When refitting the two upper rubber mountings after joining engine and transmission, engage them first on the gear-box flange and then on the engine carrier. Before connecting the earth (ground) lead polish the contact spots. 18. Remove the lower pair of the four screws fixing gearbox to engine. (ring spanner 14 mm)
- Fig. 8 19. Slacken the two lower rubber mountings, right and left. (socket spanner 14 mm with ratchet)
- Fig. 9 20. Support the engine on the knees for removal, remove the two rubber mountings and applying slight taps with a plastic mallet withdraw engine from transmission. Down transmission to the frame.
- Fig. 10 Caution: When refitting lift transmission correspondingly and engage engine on the four gearbox fixing screws. The refitting is carried out in precisely the reverse order.
- \*NOTE Paragraph 4, 6 and 10 refer to 4 wheel model only.

Note : Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

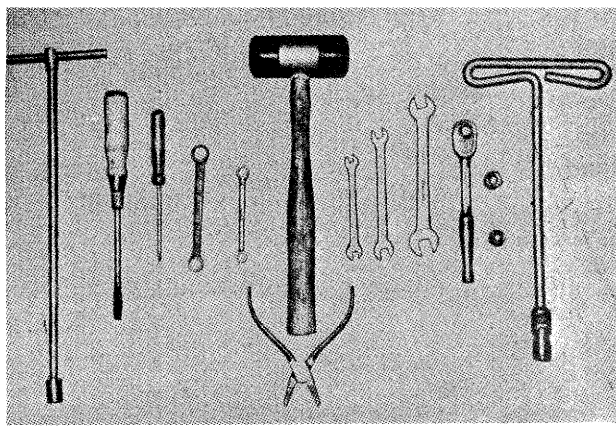
## M 2 Removing and refitting engine with transmission

The body is removed

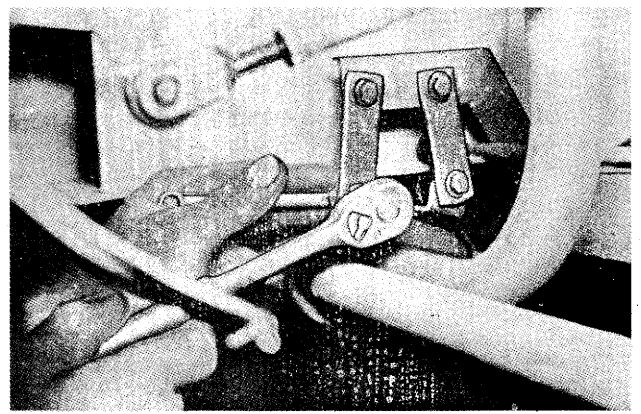
- Fig. 11 Tools: Open ended spanners 10/12/14 mm, socket spanner 14 mm with universal joint, ring spanner 14/17 mm, screwdriver 6mm, pliers for cotter pins.
- Fig. 12 1. Slacken clamp securing exhaust tube beneath the silencer, push exhaust tube rearwards. (open ended spanner 10 mm)
- Fig. 13 2. Remove cotter pin on both gear selector rods on transmission, remove bolts and take off selector rods. (cotter pin pliers) 3. Slacken lock-nut for clutch adjustment, turn adjusting nut fully in, press clutch lever on and unhook the Bowden wire. (open ended spanner 12 mm)
- Fig. 14 4. Adjust clutch, unscrew nut fully out of the lever, remove pressure spring on clutch lever. 5. Remove throttle slide from carburettor.
- Fig. 15 Caution: Wrap throttle slide in a clean cloth and tie it up on the frame by means of an insulating tape. Put a clean cloth in the carburettor. 6. Remove air duct rubber elbow from carburettor by loosening (screwdriver 6 mm).
- Fig. 16 7. Detach silencer from engine. Three nuts on cylinder head, two nuts on top and bottom of transmission. (socket spanner with universal joint 14 mm) 8. Remove nuts from three bolts on the universal joint at gearbox end. (ring spanner 17 mm and open ended spanner 17 mm for counteracting on unscrewing)
- Attention: These three bolts must be removed that secure the rubber ring to the treearm drive flange on gearbox shaft.
- Fig. 17 9. Remove the two lower engine fixing screws on the rubber mountings, right and left. (Open ended spanner 14 mm)
- Fig. 18 10. Slacken the four upper engine fixing screws at right and left. (ring spanner 14 mm)
- Fig. 19 Attention: One screw will be left on either side and not removed completely unless the assistant holds the engine for removal. On refitting don't forget the earth (ground) lead. Polish the contact surface. 11. Raise engine, remove the fixing screws from the upper carrier and withdraw the engine from the universal joint.
- Fig. 20 Attention: When installing engine have it raised by an assistant and enter the tree bolts on the universal joint. Then only screw in the two lower engine fixing screws on the rubber mountings and thereafter the four upper engine holding screws. The further refitting is carried out in reverse order to that indicated for removal.



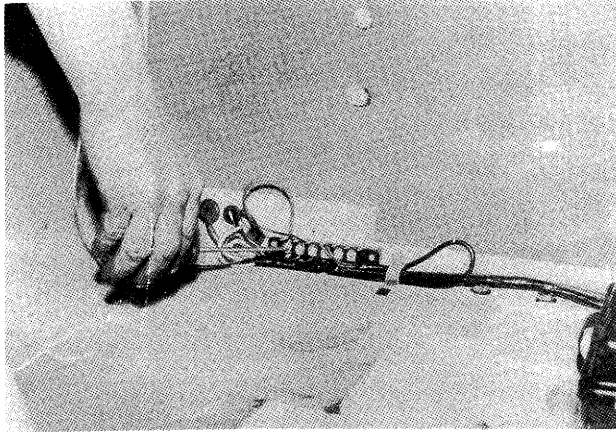
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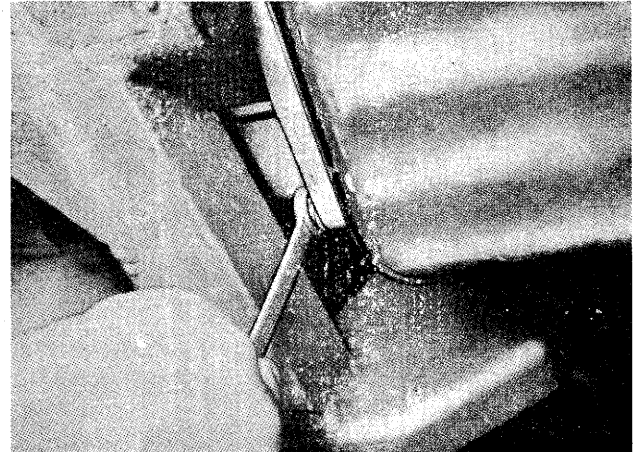
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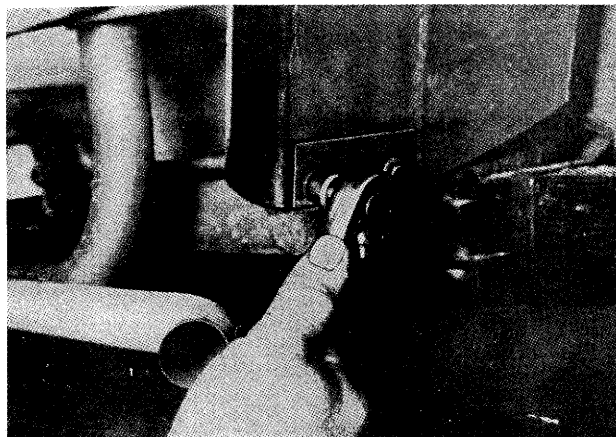
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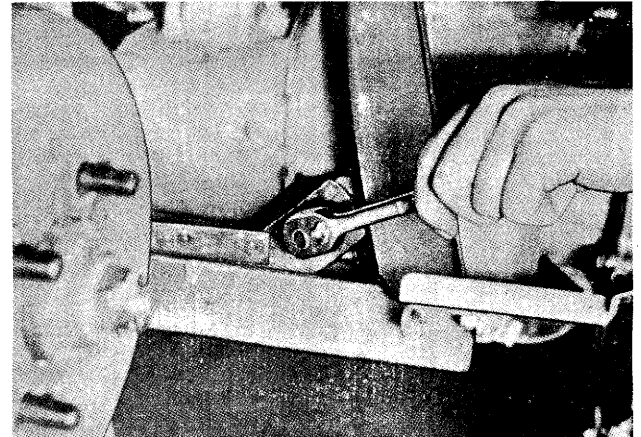
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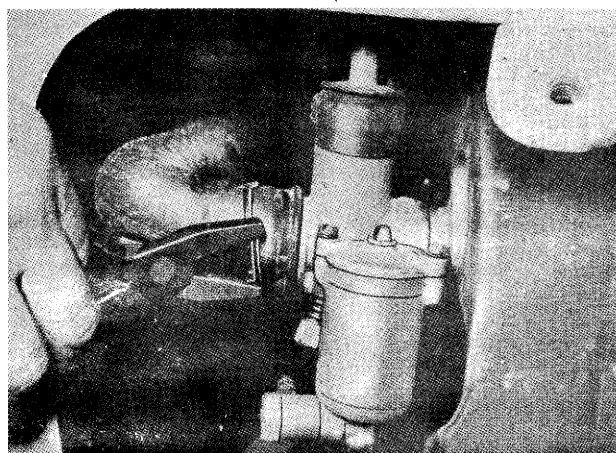
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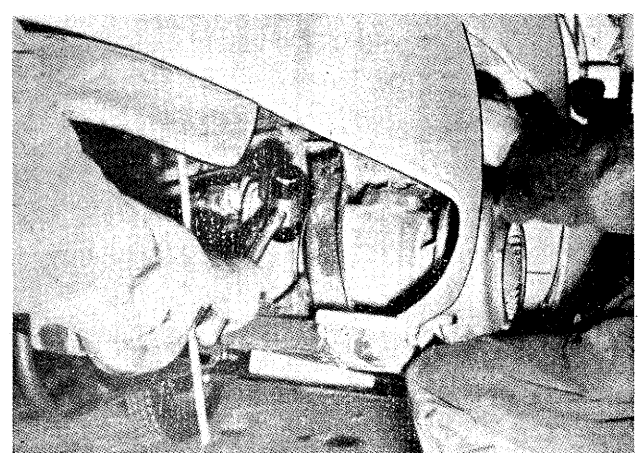
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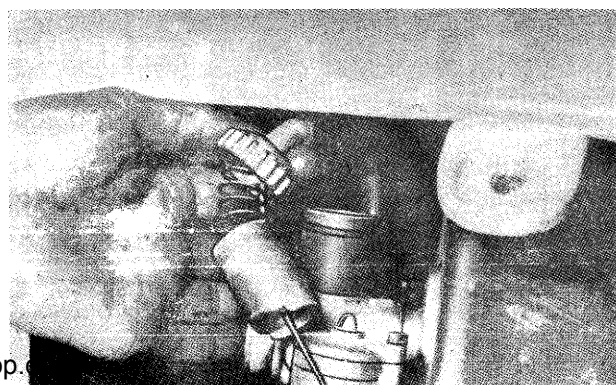
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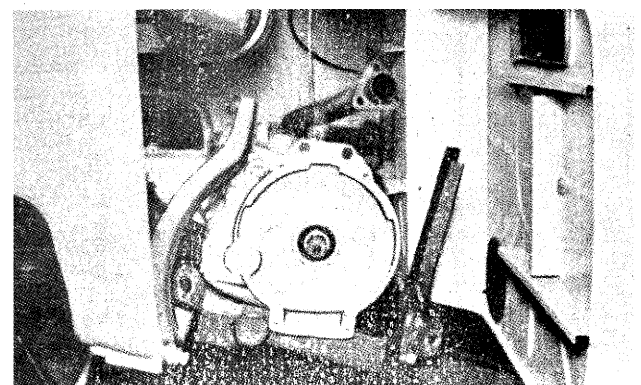
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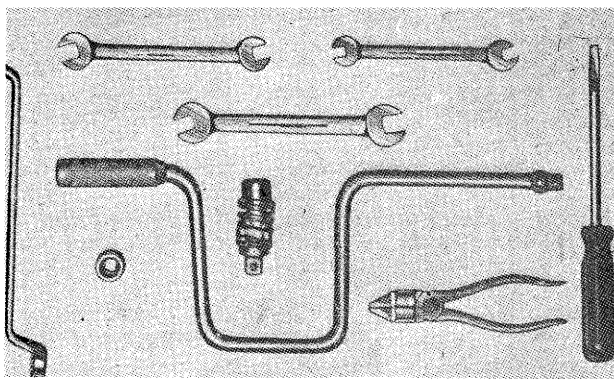


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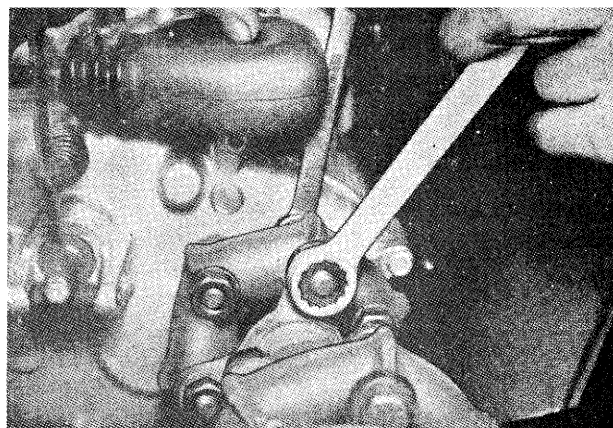




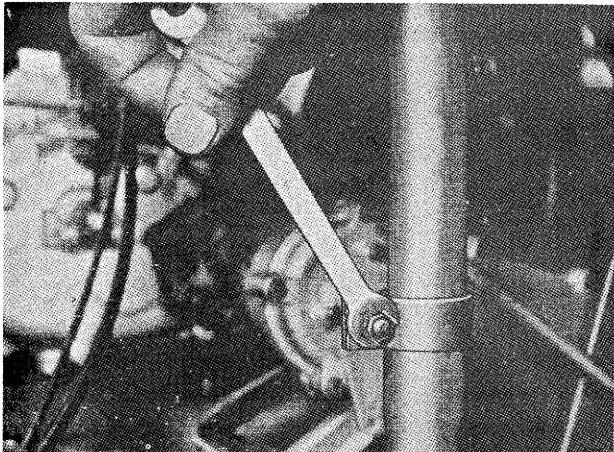
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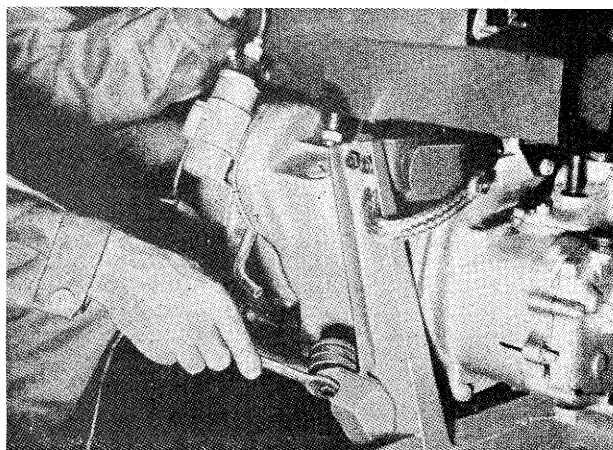
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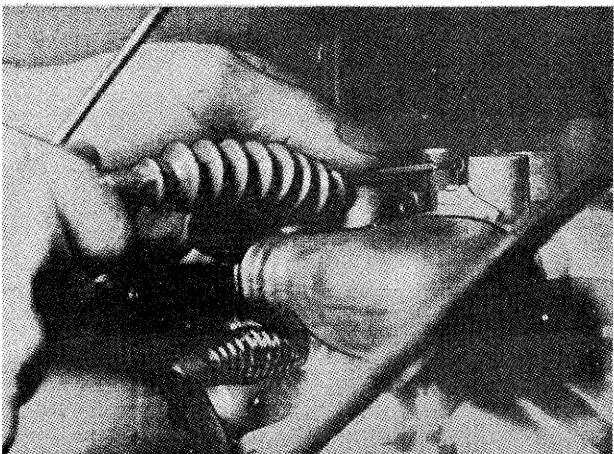
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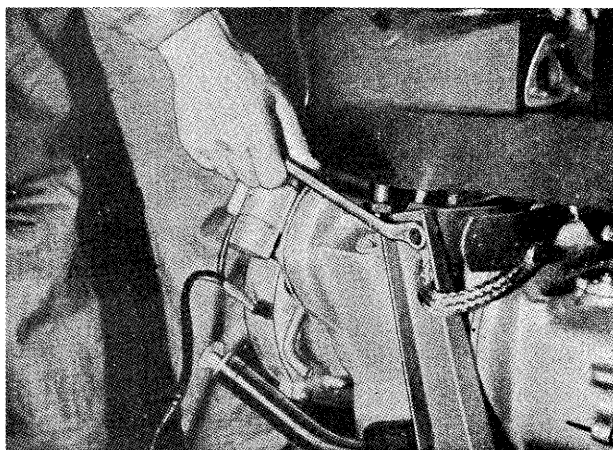
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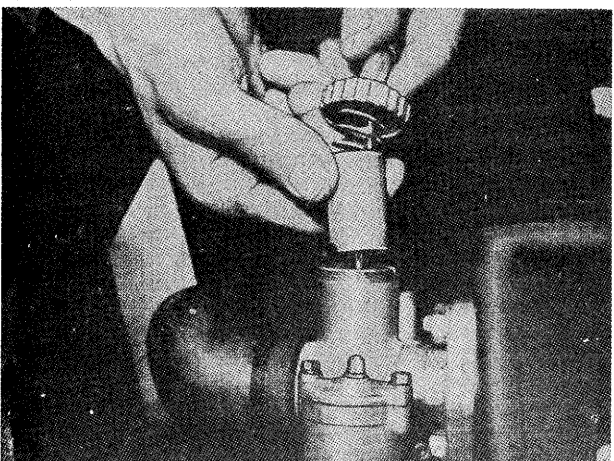
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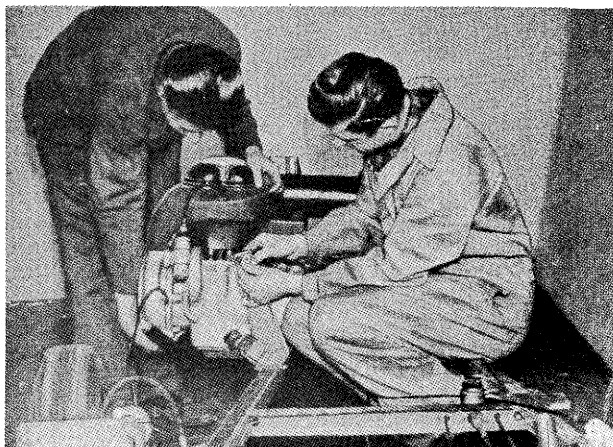
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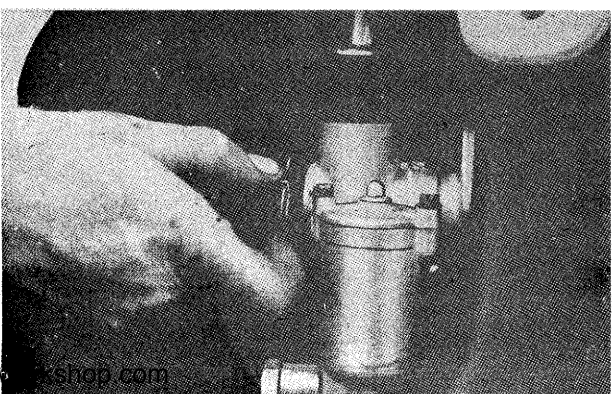
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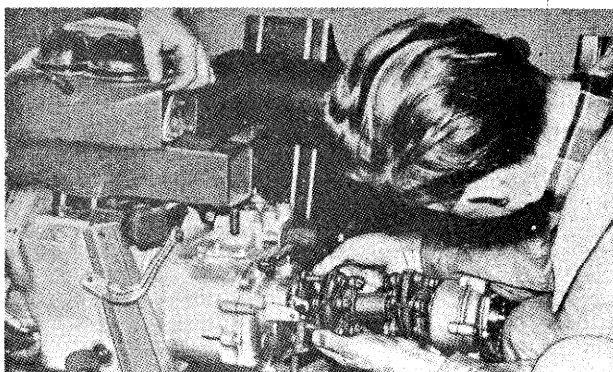
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15



20



Note : Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

### M 3 Removing and refitting clutch

Engine is removed following  
M 1 or M 2.

- Fig. 21 Tools: Socket spanners 10 and 14 mm, ring spanner 14 mm, two clamping screws for clutch, No. 357, centring arbour for clutch, No529.
- Fig. 22 1. Detach gearbox from engine housing. (4 nuts with socket spanner 14 mm and ring spanner).  
Caution: The two upper engine fixing screws must not be slackened.
- Fig. 23 2. Remove clutch unit. (socket spanner 10 mm)  
Caution: To release clutch unit and to compress it on refitting use two clamping screws for clutch reassembly Matra 357 from the tool set for motorcycles.  
Caution: For refitting clutch unit employ clutch centring arbour No. 529.
- Fig. 24 3. With the aid of a straightedge check driven disc and pressure plates for distortion.
- Fig. 25 Caution: If the clutch disc is worn or the pressure plates warped (blue coloured) replace the parts in question.  
Caution: On reassembly of clutch make certain that the protruding part of driven disc hub shows outwards. The plain (unchamfered) face of clutch pressure plate must press against the driven disc. Position of clutch parts.  
The reassembly is carried out in precisely the reverse order.

### M 4 Readjusting clutch

#### M 6 Basical adjustment of clutch

Note : Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

- Fig. 26 Tools: Two open ended spanners 12 mm, socket spanner 10 mm, feeler gauge 0.2 mm (.008")

### M 4 Readjusting the clutch (in vehicle)

- Fig. 27 1. Slacken locknut of clutch adjusting screw. (Two open ended spanners 12 mm) 2. Unscrew clutch adjusting screw out of the clutch lever until the free movement at the clutch pedal pad is about 15 mm (.6 in). (Clearance between clutch actuating screw and clutch rod about 0.2 mm = .008 in.).

### M 6 Basic adjustment of clutch

(engine and transmission are refitted upon the frame)

- Fig. 28 1. Adjust the clutch adjusting screw so that the clutch rod flushes with the surrounding plain cast portion of transmission case.
- Fig. 29 2. If this position cannot be reached with the adjuster, alter the shims behind the adjusting screw until the thrust unit of clutch actuating mechanism flushes correctly. (socket spanner 10 mm)
- Fig. 30 3. Adjustment of pedal clearance as per M4. (two open ended spanner 12 mm)  
Caution: The clutch being correctly adjusted and the adjusting screw completely screwed-in the clearance between the thrust unit and the clutch actuating screw must be 0.2 mm = .008 in. and the free movement at the clutch pedal pad about 15 mm = .6 in.

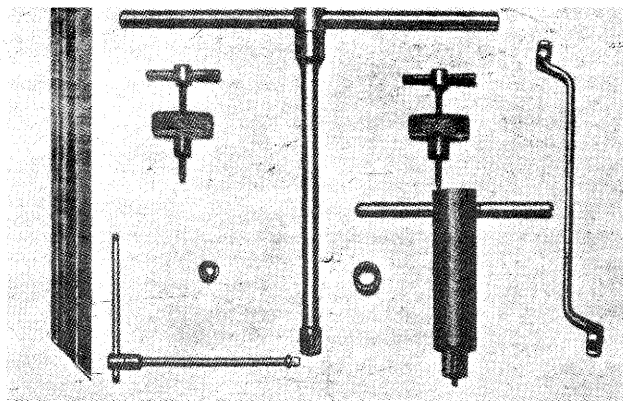
Note : Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

### M 9 Dismantling and reassembling engine

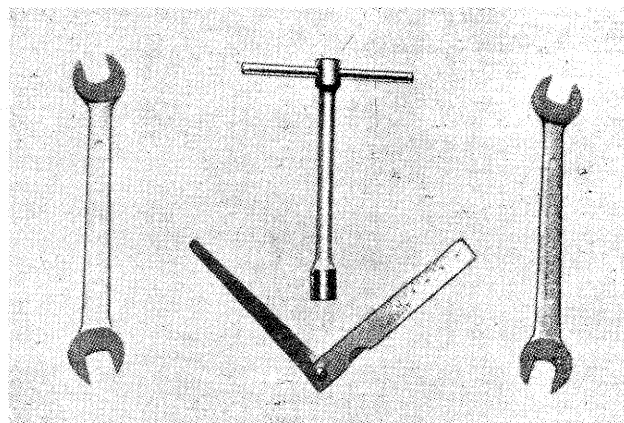
- Fig. 31 Tools: Open ended spanners 9 and 14 mm, ring spanners 19 and 27 mm, socket spanners 14/17/36 and 10 mm, screwdrivers 6/8 and 10 mm, torque spanner, hammer, chisel, pointed pliers wooden piece, plastic mallet, flywheel fixture No. 498, puller screw for blower wheel No. 527, puller screw for armature No. 528, puller No. 299 with compensating ring No. 299a, piston board, heating sleeve for piston, gudgeon pin drift No. W 5002, gudgeon pin puller, camshaft puller No. 355, Flywheel puller No. 311
1. Fit engine upon support stand. (open ended spanner 14 mm) 2. Drain engine oil. (ring spanner 19 mm) 3. Disconnect ignition coil connections from terminals. (open ended spanner 9 mm) 4. Remove ignition coil with holding bracket. (socket spanner 10 mm)
- Fig. 32 5. Remove carburettor. (open ended spanner 14 mm) 6. Remove rocker covers. (open ended spanner 14 mm) 7. Remove the baffle assemblies of air cooling arrangement. (a) three slotted head screws, front; (b) two slotted head screws bottom; (c) one slotted head screw, rear top (screwdriver 6 mm) 8. Remove cap covering the dynamo-starter assembly. (screwdriver 6 mm) 9. Remove blower housing, four slotted head screws. (screwdriver 8 mm) 10. Apply flywheel fixture No. 498. (open ended spanner 10 mm)
- Fig. 33 11. Remove blower wheel fixing screw. (socket spanner 17 mm)
- Fig. 33 12. Remove blower wheel with the aid of screw-type puller No. 527.
- Fig. 34 13. Remove frame and field coil assembly of dynamo-starter unit, four slotted head screws (screwdriver 8 mm)
- Caution: When assembling the generator and starter unit release the carbon brushes from spring pressure by withdrawing the springs and push brushes back to avoid damaging them. 14. Remove armature with the aid of screw-type puller No. 528.
- Fig. 35 15. Remove spring washer from crankshaft journal. (screwdriver 6 mm) 16. Unscrew nuts and screws securing camshaft drive covering unit. 3 screws 10 mm; 6 nuts 10 mm; 1 countersunk screw (open ended spanner and socket spanner 10 mm, screwdriver 8 mm)
- Caution: Don't forget the countersunk screw on right-hand border of housing.
- Fig. 36 17. Remove timing cover by tapping it off with the aid of a wooden tool  
Caution: The wooden tool must not be applied on the front flange of housing, but on the base of this unit (figure 37). At the opposite side apply tool upon the rib between flange and base of the casting. Never try to enter a screwdriver between the castings. if the housing is too tight to tap it apart, heat it slightly.
- Fig. 37 18. Withdraw ball bearing from crankshaft. (puller No. 299 with compensating ring No. 299a)  
CAUTION: When removing with compensating ring and refitting with tube piece grasp ball bearing inner race only. Before refitting heat ball bearing on a heating plate up to about 60°C=140°F. 19. Remove rotary valve on breather unit.
- Fig. 38 20. Open chain lock.  
Caution: When refitting chain make sure that the closed end of chain lock cotter faces in direction of chain rotation, so that the camshaft sprocket turns in a clockwise direction.



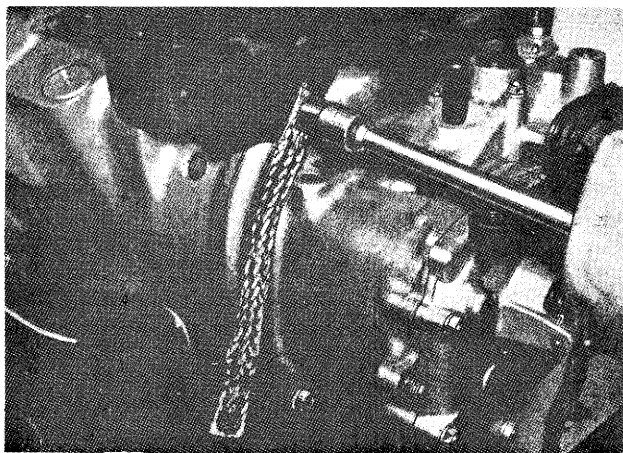
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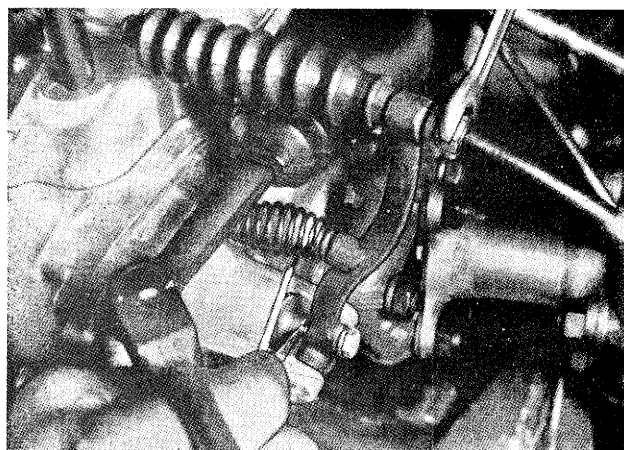
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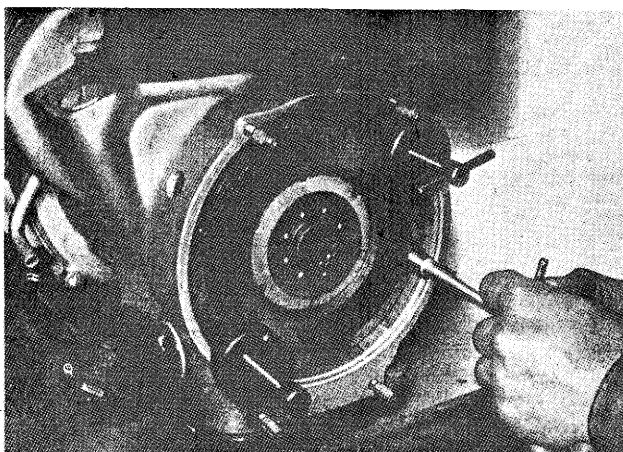
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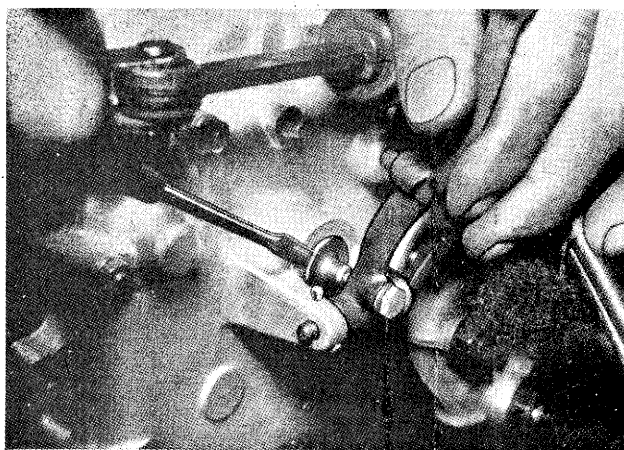
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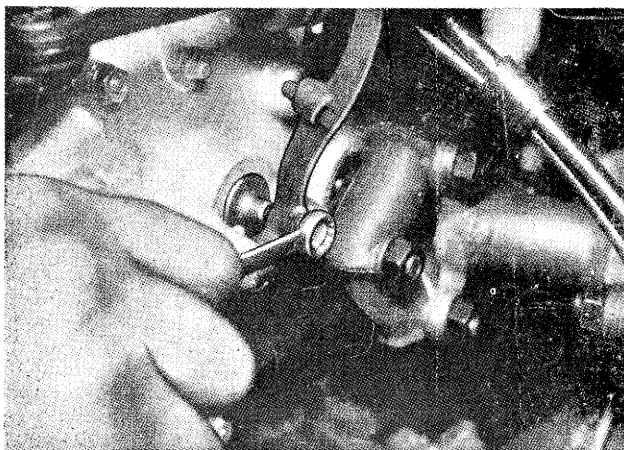
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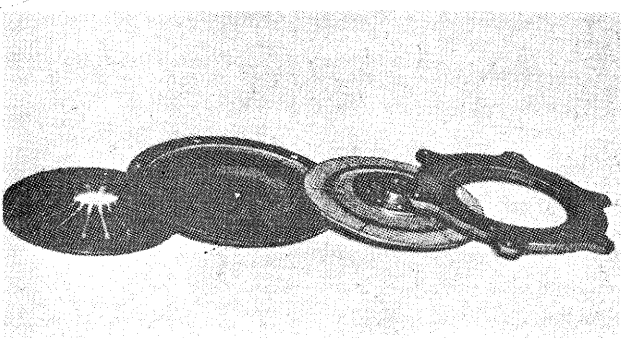
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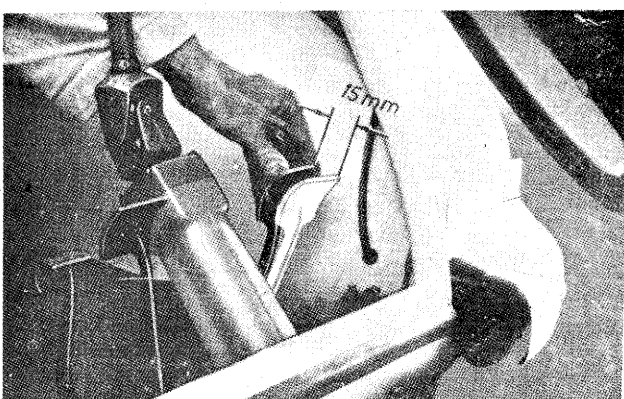
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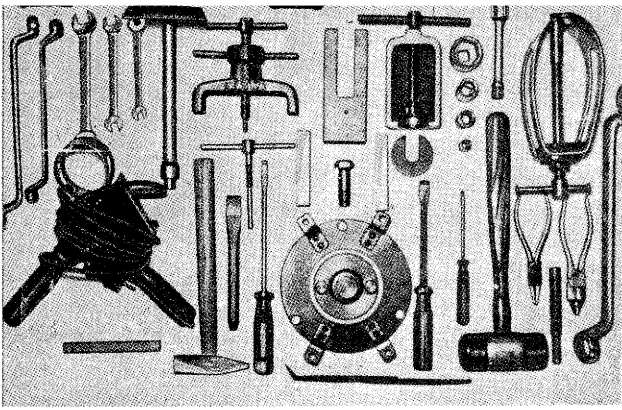


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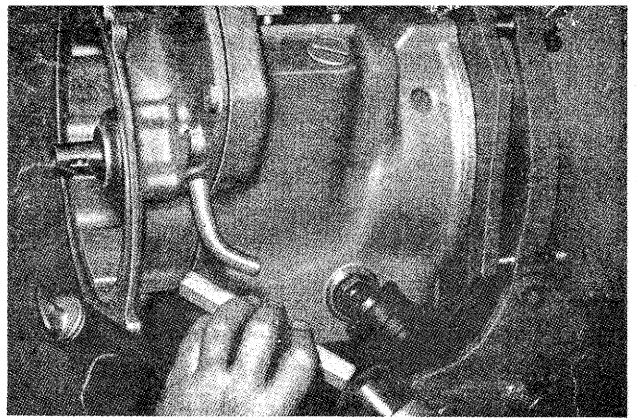




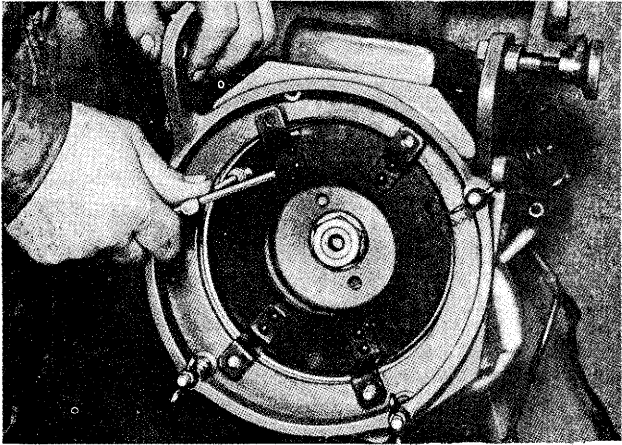
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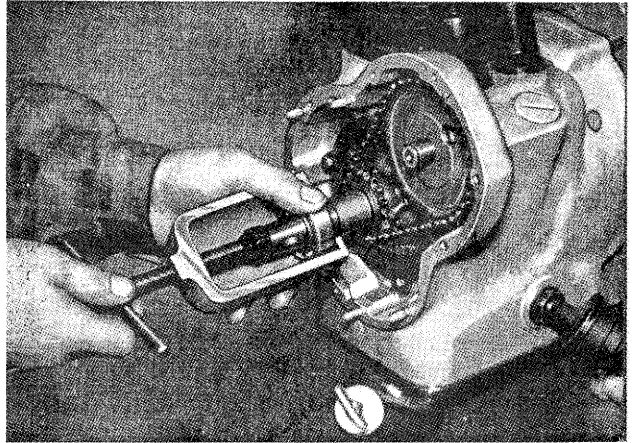
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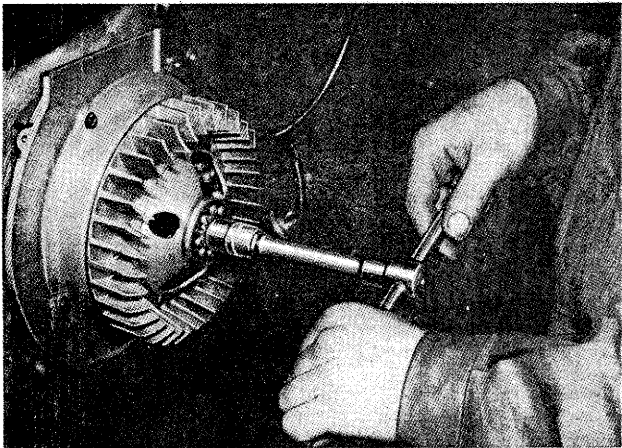
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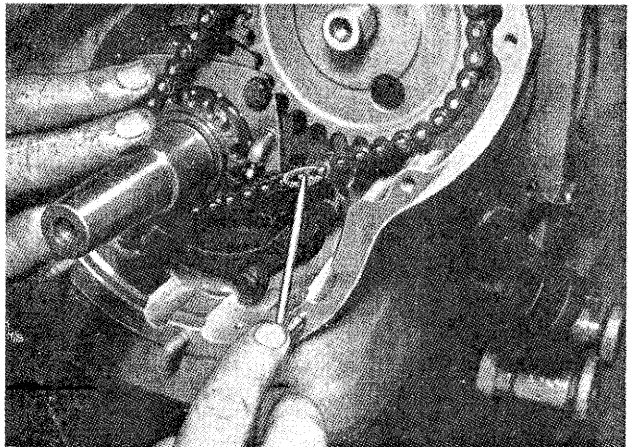
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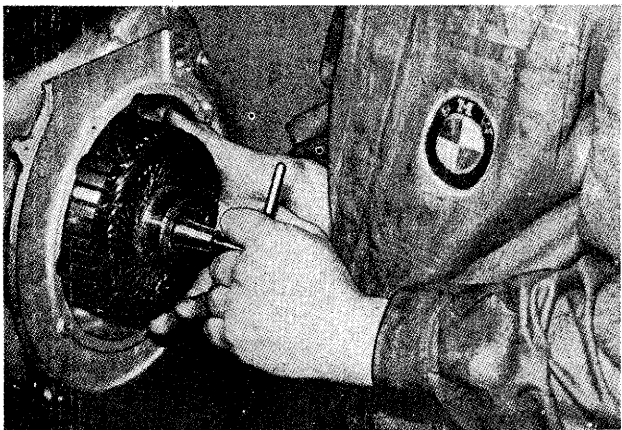
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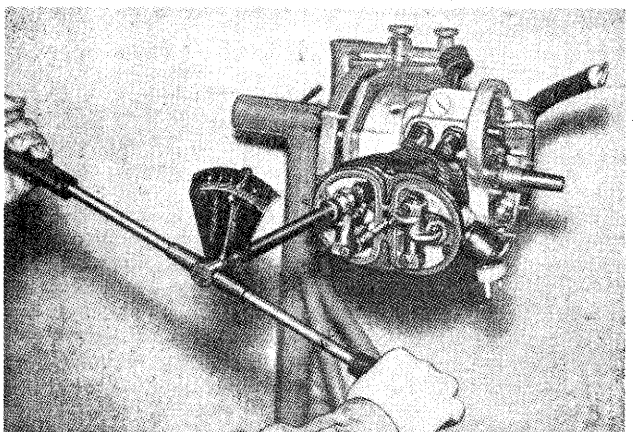
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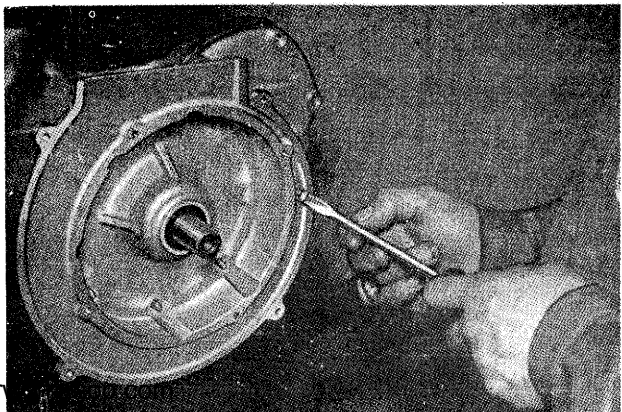
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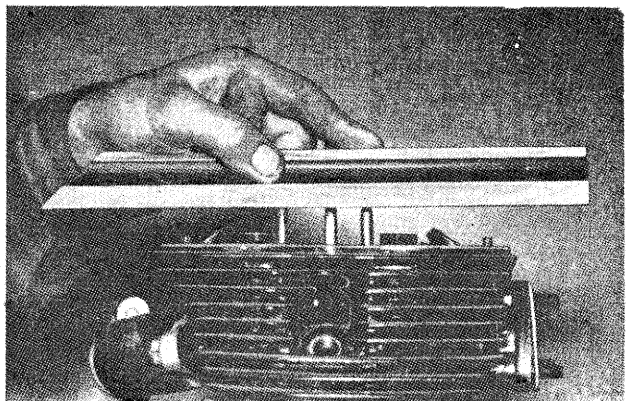
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- Fig. 21. Unscrew cylinder head holding down screws (4 through screws  
39 carrying the rocker assemblies) and remove cylinder head.  
(socket spanner 14 mm)

Caution: When assembling tighten cylinder head with the aid of a torque spanner to 3.5 m/kg = 25.3ft.lbs. Tighten screws evenly in a diagonal order.

### Assembling the engine

#### Fitting chain and adjusting camshaft drive

1. Set the piston on T.D.C.

Caution: To replace timing chain without engine removal set engine on T.D.C. through the inspection hole machined in engine crankcase. The arrow engraved in flywheel must register with the dash on housing.

- Fig. 2. Rotate camshaft to its overlap dead centre position. A straight-  
40 edge placed upon the pushrods must be parallel to the joint  
face of cylinder head.

- Fig. Caution: When refitting chain without engine removal apply a punch  
41 mark.

- Fig. 3. Return camshaft sprocket and engage chain on top.  
42

- Fig. 4. Rotate camshaft sprocket to the right and engage chain upon  
43 crankshaft sprocket in the punch marked position (T.D.C. position).

- Fig. 5. With the aid of an appropriated tool bring chain members together  
44 and push the free chain member upon the lock member. 6. Place  
chain lock in position. 7. Fit chain lock cotter with the closed  
end in direction of rotation.

### Further dismantling

- Fig. 22. Withdraw push rods. 23. Slacken cylinder base clamping nuts.  
45 (open ended spanner 14 mm) 24. Insert piston board. 25. Remove  
gudgeon pin retaining circlip. (pointed pliers) 26. Heat piston  
with heating sleeve up to about 60°C = 140°F and press out gudgeon  
pin (electric heating sleeve, gudgeon pin drift).

- Fig. Caution: If the piston pin does not come out by thumb pressure, do not  
46 tap, but apply piston pin remover device.

- Fig. Caution: Always assemble pistons and pins bearing the same colour  
47 marks for identification purposes. When assembling piston heat  
same upon heating plate or in oil up to 60°C = 140°F and warm  
gudgeon pin slightly. 27. Remove tappets.

Caution: Identify the tappets by tags so that they can be correctly  
reinstalled in the same position and location. 28. Unscrew plug  
giving access to the oil pump drive. 29. Remove oil pump drive

- Fig. 30. Enter screwdriver through the two holes in camshaft sprocket in  
48 order to remove the two screws fixing the camshaft bearing holding  
bush. (screwdriver 10 mm) 31. Remove camshaft with the aid of cam-  
shaft puller No. 355.

Caution: Handle camshaft carefully to prevent it from damage.

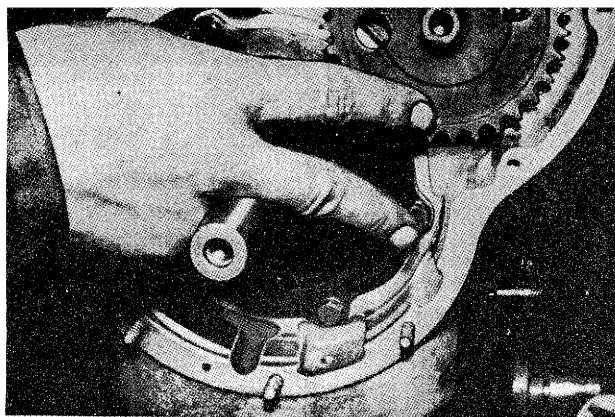
- Fig. 49 Caution: When refitting make certain that the camshaft sprocket aligns with the crankshaft sprocket so that the timing chain runs correctly. Eliminate any eventual misalignment by pressing camshaft sprocket a bit more inwards. 32. Remove two screws from crankshaft front bearing cover plate. (socket spanner 10 mm) 33. Remove crankshaft sprocket. (puller No. 299)
- Caution: To refit the sprocket heat it to about  $150^{\circ}\text{C} = 300^{\circ}\text{F}$ , tilt engine and slide sprocket on vertically standing shaft downwards. 34. Detach oil sump. (socket spanner 10 mm) 35. Remove oil pump, straighten bent ears of lock washer and remove two screws (hammer, chisel, socket spanner 10 mm) 36. Straighten locking lugs on flywheel nut lock washer. (Hammer, chisel)
- Caution: When refitting bend lock washer slightly before installation to facilitate completion of bending on the fitted washer.
- Fig. 50 37. Unscrew flywheel nut from flywheel blocked previously by fixture No.498 (see No. 10 to 23).
- Caution: To screw on the nut place turned surface towards the flywheel and check flywheel for tight fit by moving it to and fro. If the tapered shaft end does not fit well give it a short lapping treatment. After installation check flywheel clutch face squareness and out-of-round crankshaft end with the aid of a dial gauge. Max. out-of-squareness  $0.08 - 0.1 \text{ mm} = .0032" \text{ to } .004"$ .
38. Remove flywheel. (flywheel puller No. 311, ring spanner 27 mm).
- Fig. 51 Caution: When assembling make certain that the flywheel key does not sit upon flywheel. 39. Remove 5 screws fixing flange of front bearing cover plate. (socket spanner 10 mm)
- Fig. 52 40. Heat engine crankcase on a plate or in an oven up to about  $100 \text{ to } 120^{\circ}\text{C} = 210 \text{ to } 250^{\circ}\text{F}$ .
- Fig. 53 41. Place connecting rod so that the big end stands at the recess machined in right-hand border of crankcase aperture and remove crankshaft by turning it slightly upwards. 42. Immediately thereafter expel camshaft bearing by pushing the warm crankcase against a hard wood plate (work-bench).
- The reassembly is carried out in precisely the reverse order.  
For individual treatment of connecting rod, piston, valves, crankshaft and oil pump see under M 12, M 14, M 20, M 24, and M 26.
- Note : Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

#### M 10 Replacing breather valve

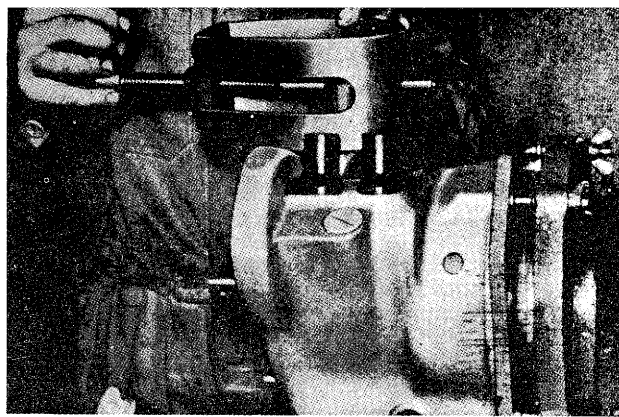
- Fig. 54 Engine in situ. Carry out instructions given in M 9, 1-9, 11-17 inclusive. The diaphragm breather is situated opposite the cam shaft sprocket and is visible after removal of the timing case cover. The timing case cover should be heated to  $140^{\circ}\text{F}$ , and the breather valve removed with the aid of two heavy screwdrivers.
- Fit new breather valve to a depth of approximately half of the annular groove machined in the outer circumference of the breather valve assembly. Apply four punch marks to regain valve in position.



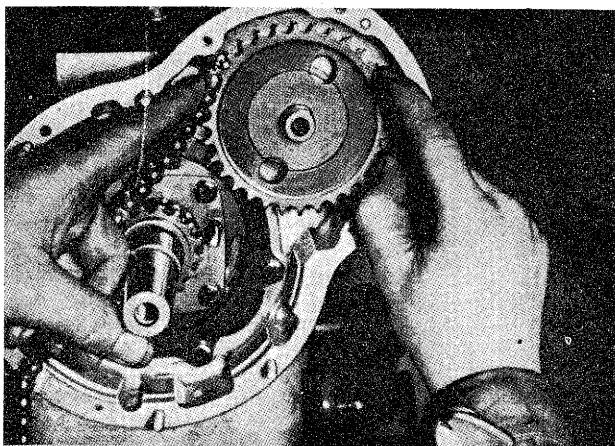
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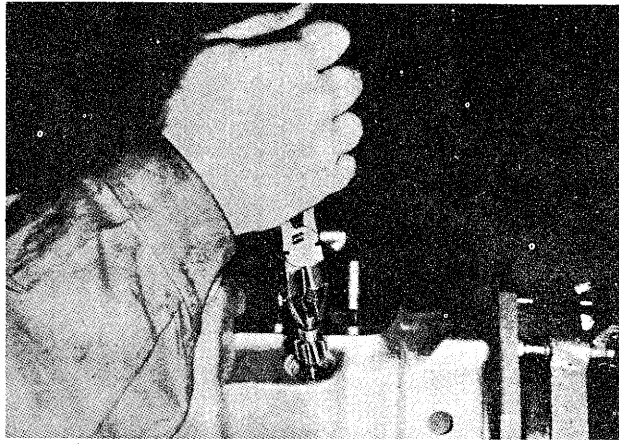
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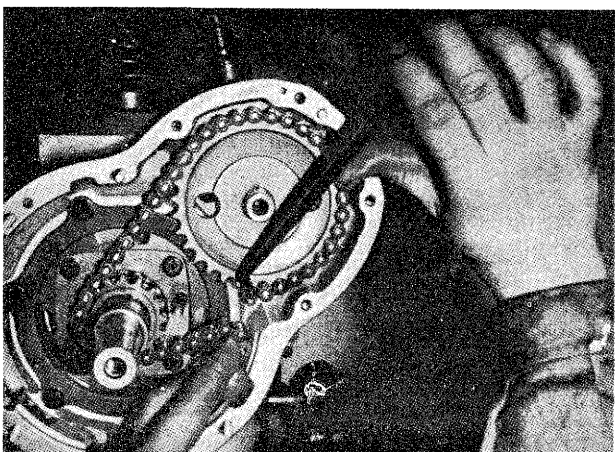
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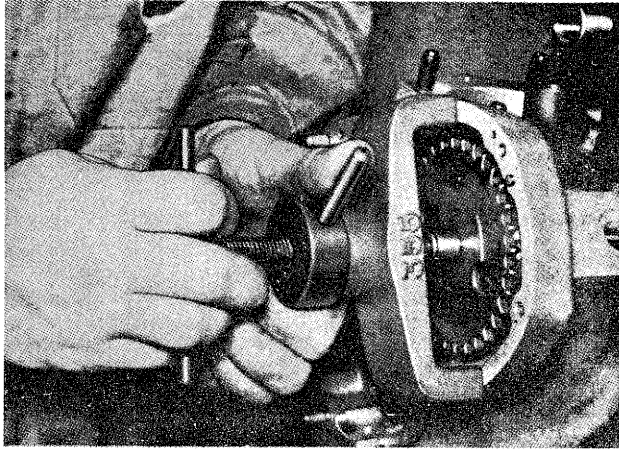
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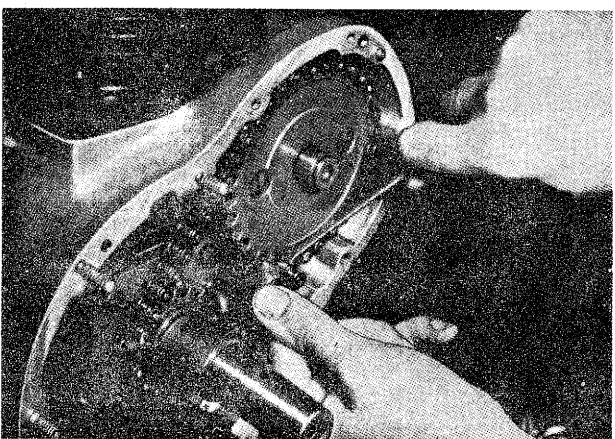
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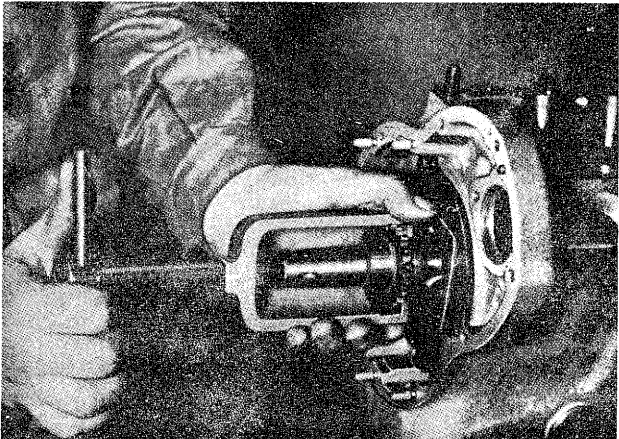
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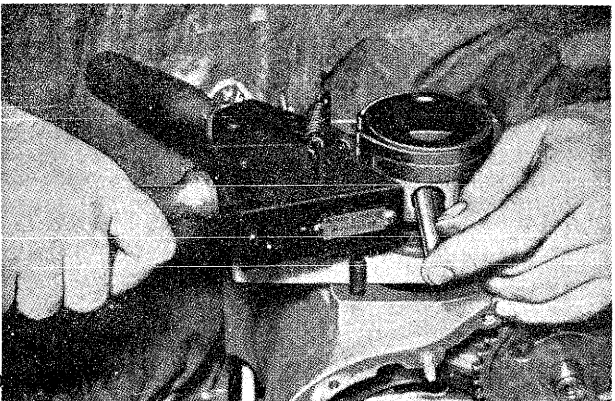
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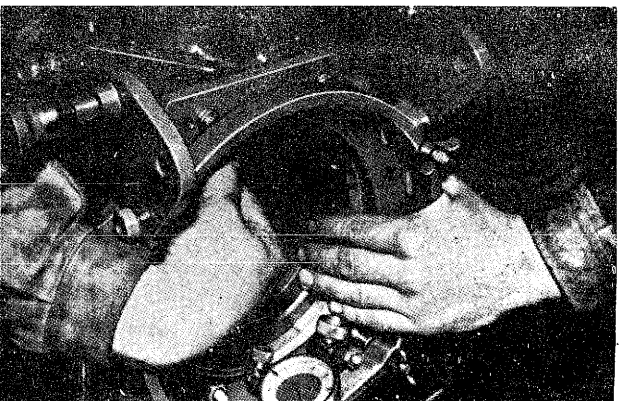
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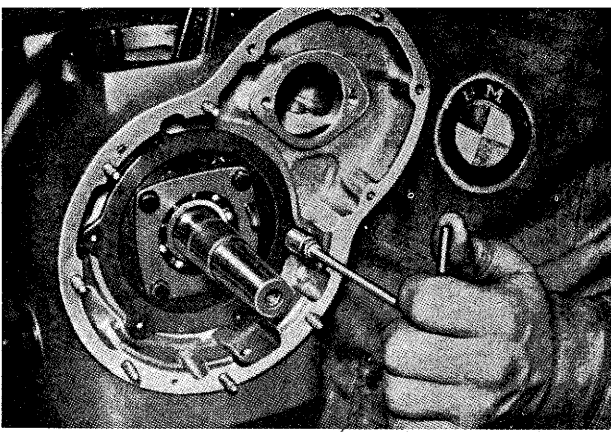


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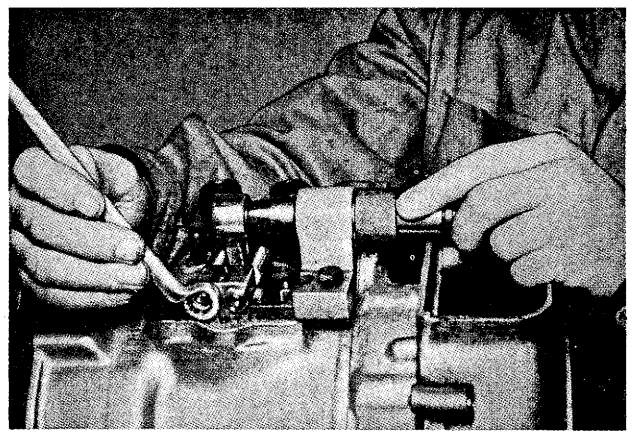




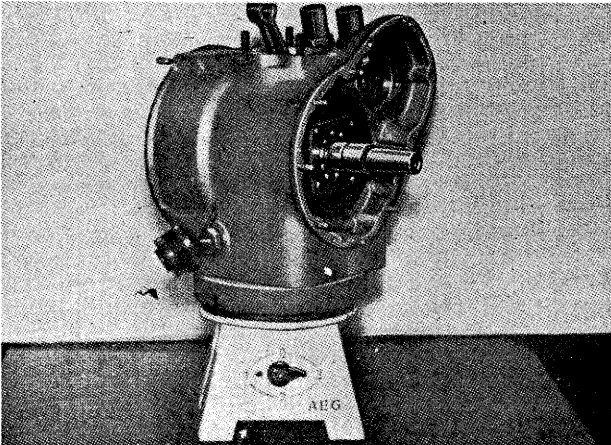
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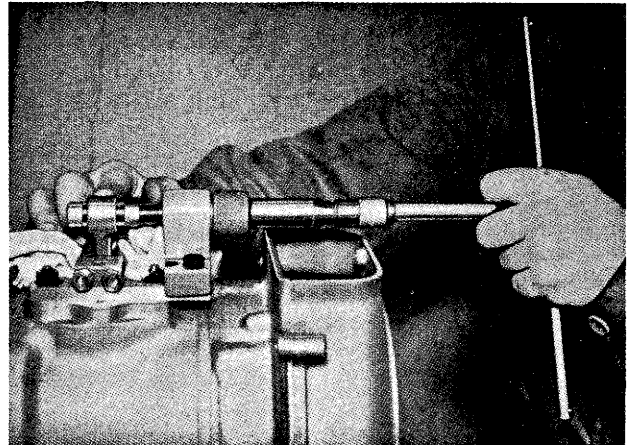
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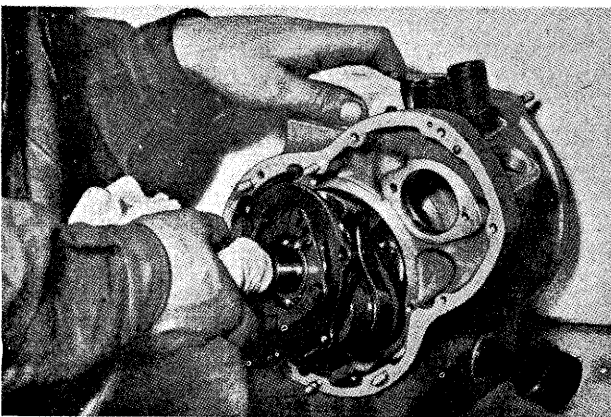
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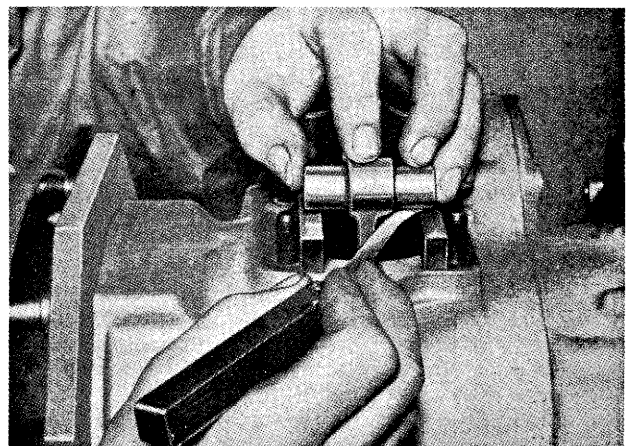
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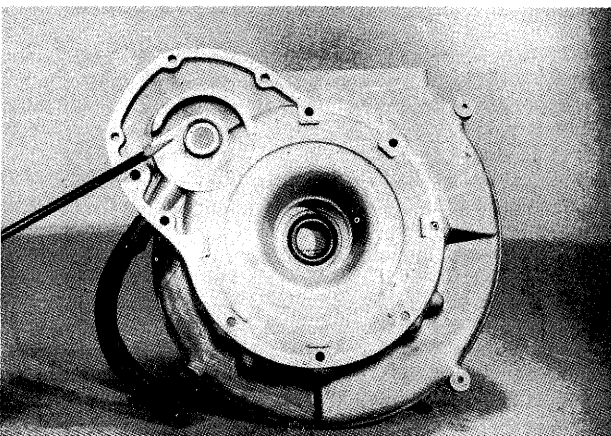
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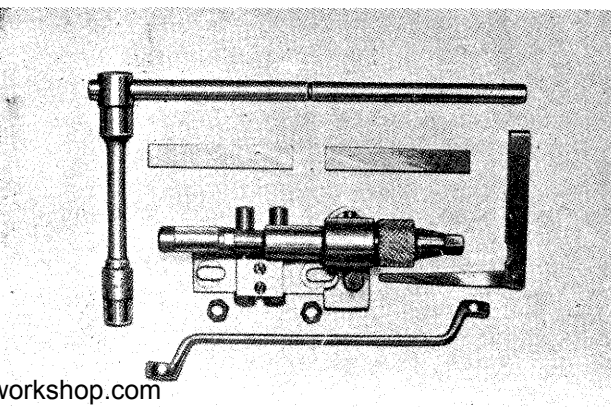
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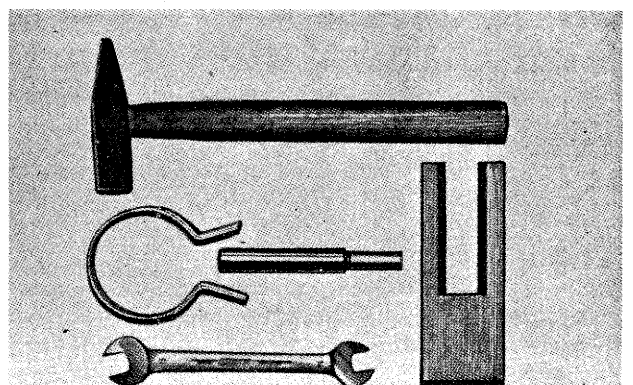
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### M 12 Replacing connecting rod bushing

(Engine is removed, cylinder and piston are dismantled from engine, gudgeon pin bushing is pressed in)

- Fig. 55 Tools: Hunger reaming tool for rod bushings, socket spanner 14 mm, ring spanner 14 mm, parallels for alignment of connecting rods L 5036, drift for gudgeon pin W 5002, feeler gauge.
- Fig. 56 1. Install Hunger reaming tool and fix it with two nuts 14 mm. (socket spanner 14 mm) 2. Slacken eccentric shaft and align small end with tapered end of reaming tool. (ring spanner 14 mm)
- Fig. 57 3. Tighten eccentric shaft. (ring spanner 14 mm) 4. Ream rod bushing with reaming tool. (socket spanner 14 mm)
- Caution: Seal crankcase well with rags.
- Fig. 58 5. Enter gudgeon pin and check position of connecting rod with the aid of two parallels and feeler gauge or by means of a visual test. (2 parallels L 5036, feeler gauge)
- Caution: If the connecting rod must be straightened, apply the two rod straightening tools only on the upper third of connecting rod. A correct and careful treatment of the rod bushing obviates any further alignment.
- Fig. 59 6. Heat piston on a plate or in oil up to  $60^{\circ}\text{C} = 140^{\circ}\text{F}$ , warming gudgeon pin slightly at the same time. 7. Enter piston pin with the aid of drift. (gudgeon pin drift W 5002)
- Caution: Place piston in correct position, arrow on top of piston must point in direction of the timing case.
- Caution: When fitting a new piston and pin assembly use always items bearing the same identification colour marks.

### M 14 Installing new cylinder

(Old cylinder is removed, new piston fitted)

Note: Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

- Fig. 60 Tools: Piston ring compressor, piston board, drift to adapt pushrod covering tubes No 530, open ended spanner 14 mm, hammer.
1. Place cylinder base gasket upon crankcase, rough side towards housing.
- Fig. 61 2. Protect piston by piston board and compress piston rings by means of the piston ring compressor. (piston board, piston ring compressor)
- Caution: Oil piston and rings around.
- Fig. 61 3. Adapt the cylinder and slide it down together with the piston ring compressor.
- Fig. 62 Caution: Make certain that the rubber grommets on the tappet guides engage well and fit evenly upon these units.
- Fig. 63 4. Replace cylinder base nuts and tighten them in a diagonal order to secure even tightness. (open ended spanner 14 mm)
- Caution: After a short operation period tighten the four base nuts again.
- Fig. 64 5. In case a gap is left between rubber grommet and tappet guide tap the the pushrod covering tube slightly down by means of the special drift No. 530.

Note: Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

### M 20 Adjusting valves

- Fig. 65 Tools: Ring spanner 14 mm, open ended spanner 11 mm - 12 mm, feeler gauge 0.15/ 0.20 mm, sparking plug spanner.
- Fig. 66 1. Remove screw plate giving access to sparking plug and valves. 2. Withdraw shielded terminal of high-tension lead and unscrew sparking plug.

(spark plug spanner) 3. Remove rocker covers. (ring spanner 14 mm)  
4. Set engine by rotating the blower wheel to T.D.C. compression, in which position the two valves are closed.

- Fig. 5. Slacken locknut of valve clearance adjusting screw. (2 open ended  
66 spanner 12 mm 11 mm)
- Fig. 6. Using feeler gauge check valve clearances, 0.15 mm = .006" for intake  
67 valve at left (timing case side), and 0.2 mm = .008" for exhaust  
valve at right (flywheel side). (feeler gauge)
- Fig. 7. To adjust the clearance, if it is found to be incorrect, screw adjuster  
68 pin up or down as required until the correct amount of play is felt.  
The feeler gauge must slide easily between rocker end and valve stem  
when being drawn for and aft. 8. Secure obtained position of  
adjusting pin by tightening the locknut. 9. When locknut is properly  
tightened, check the play again with the feeler gauge, to make certain  
that it has not been altered while tightening the nut. Rectify the  
play if necessary. 10. Check rocker cover gasket, and if it is found  
to be worn, discard it.
- Fig. 11. Replace rocker covers.  
69

#### M 22 Overhauling cylinder head

(Cylinder head is removed)

**Note:** Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

- Fig. Tools: Holding board for intake and exhaust valves No. 361a, valve spring  
70 lifter V 5034, Hunger valve reseating tool, valve grinding  
equipment, scribe, hammer, drift, heating plate.

- Fig. 1. Place cylinder head upon wooden block. (holding board No. 361a) 2.  
71 Install valve spring lifter. (tool V 5034) 3. Compress the valve  
springs until the split collets can be removed. (scribe)

- Fig. 4. Withdraw valve springs, raise cylinder head from the board and re-  
72 move the valves. 5. Remove valve guides.

**Caution:** Cut or turn valve guide on spring side down to the retaining circlip, remove circlip and with the aid of a drift expel the old guides towards the combustion chamber. To enter the new guides heat cylinder head assembly up to about 220°C = 425°F. Secure the new valve guides by means of the retaining circlips. 6. Using reaming tool ream each valve guide to 7 mm = .28 inch plus a maximum of 0.085 mm = .0034 inch of clearance. 7. Apply Hunger valve reseating equipment and rectify the seats.

- Fig. **Caution:** Valve seat width 1.5 to 2 mm = .06 inch to .08 inch, re-cut  
73 seatings with cutting tool 45 deg. Determine the width of seat by  
using a 15 degree cutter at the top, and a 75 degree cutter at the  
bottom. 8. Measure unloaded length of valve springs. Length of long  
spring 42.3 mm = 1.763 inch, length of short spring 37.5 mm = 1.48  
inch. Discard springs that do not meet the above requirements.

- Fig. **Caution:** When reassembling valve springs, make certain the closed coils  
74 are toward the cylinder head. 9. Grind valves with the valve re-  
facing equipment.

**Caution:** The application of the Hunger valve reseating and refacing equipment obviates the treatment with a grinding compound. 10. When the seat is properly positioned, it must contact the middle portion of valve face. To recondition the seat with respect to the face of valve apply cutters 15 degree and 75 degree, as shown in Figure 74.

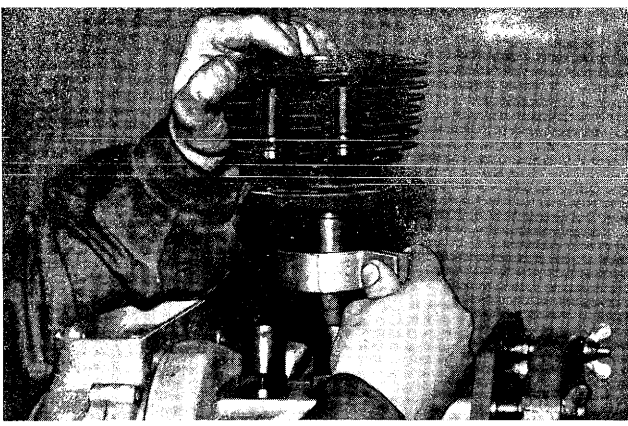
#### M 24 Overhauling crankshaft

Crankshaft assembly with bearings is removed.

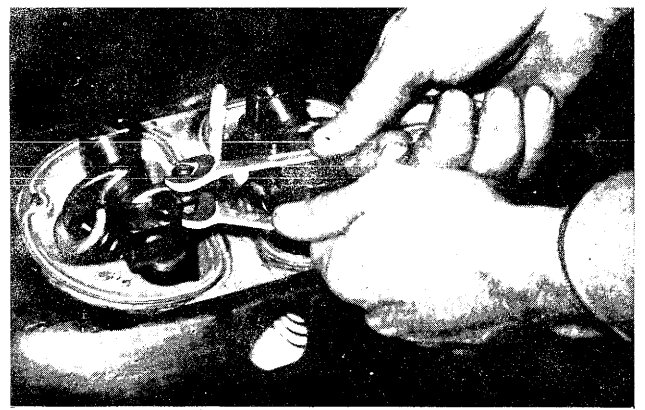
This job should only be carried out by those servicemen who possess the necessary special tools and the knowledge to apply them correctly. In all other cases install a replacement crankshaft assembly.



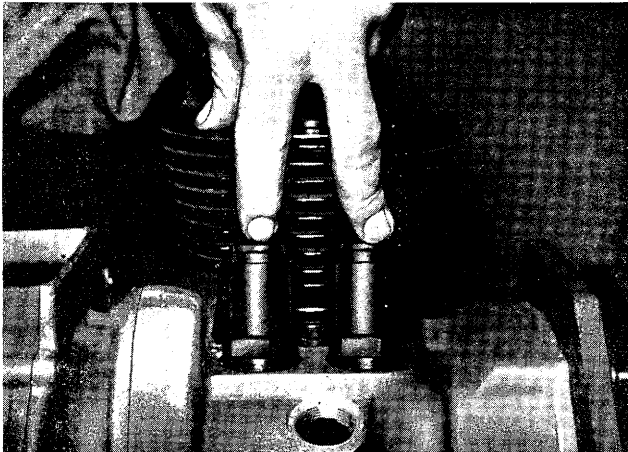
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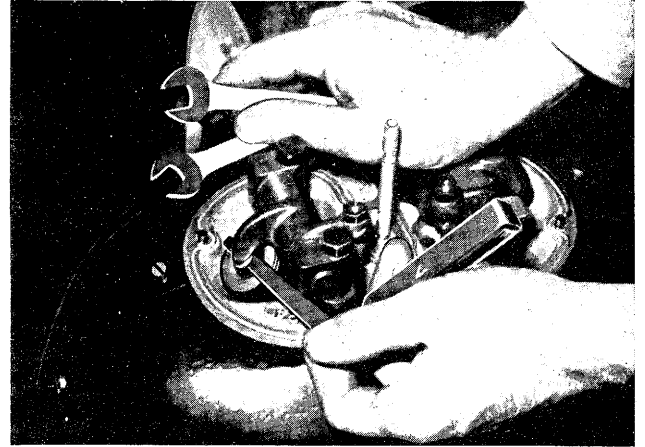
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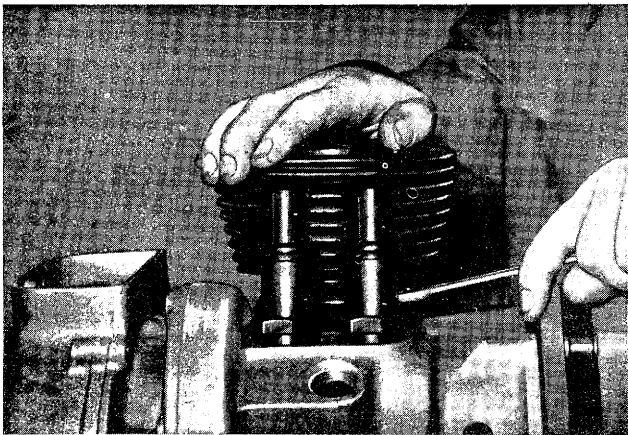
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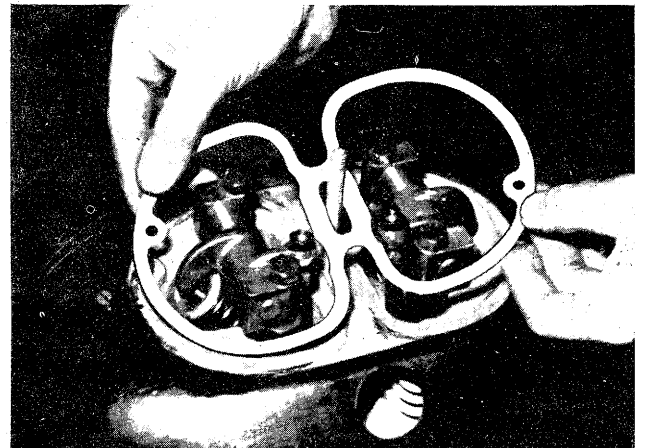
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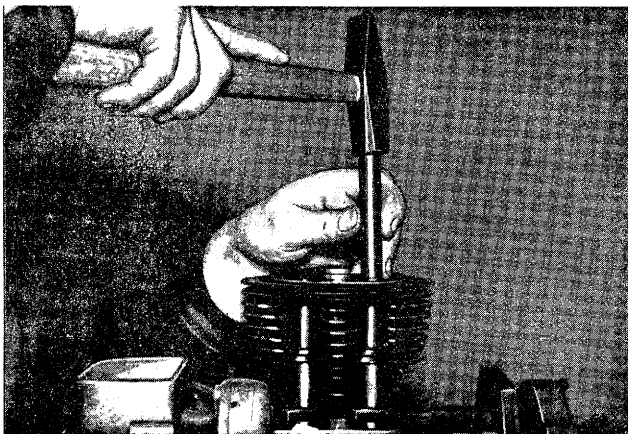
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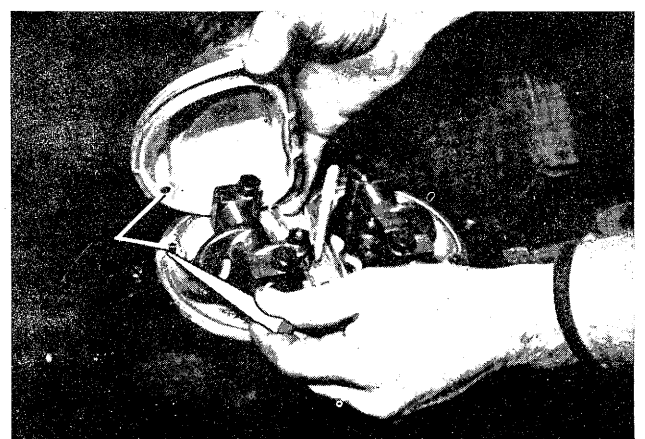
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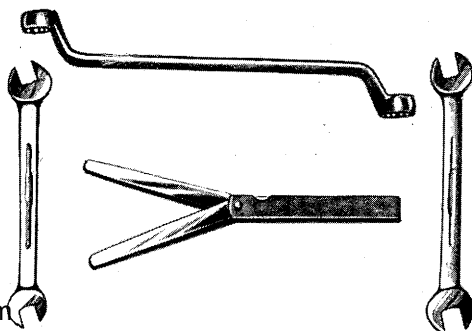
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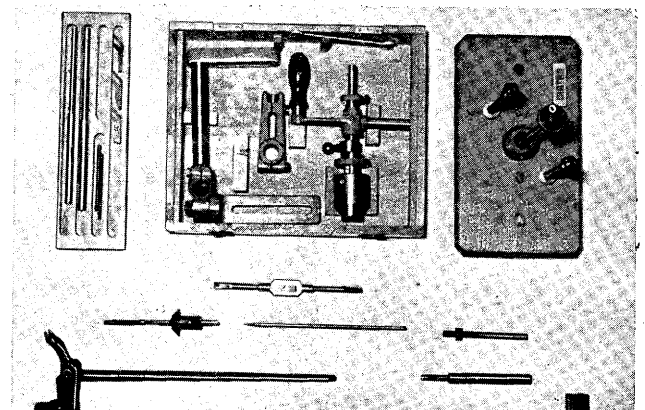
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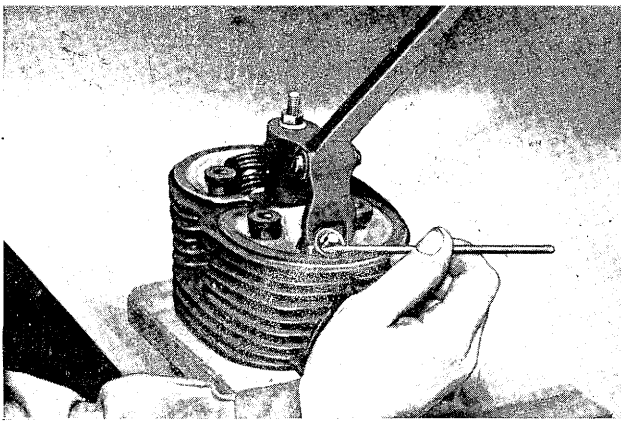
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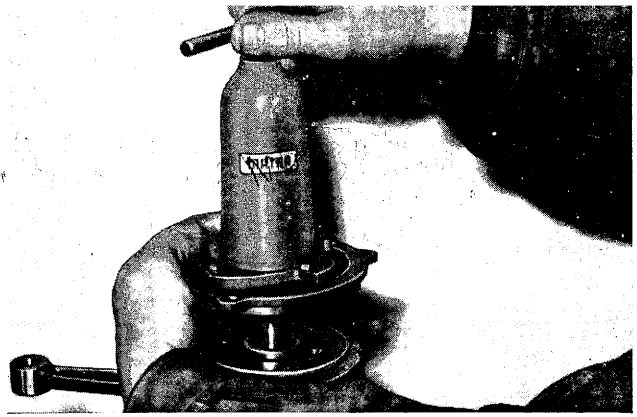
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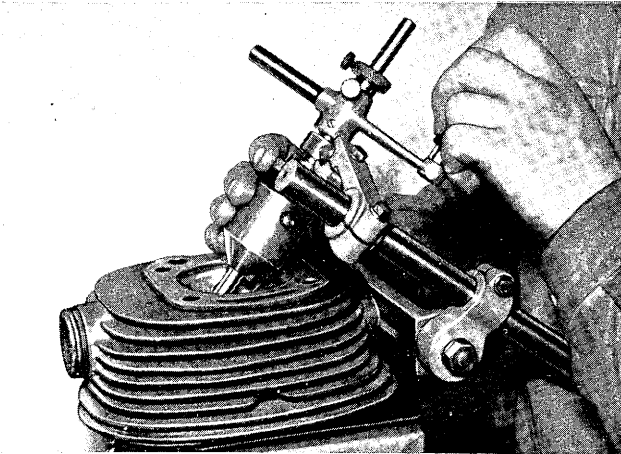
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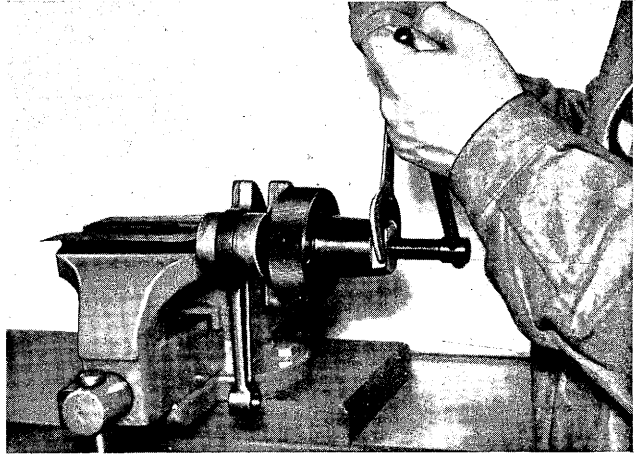
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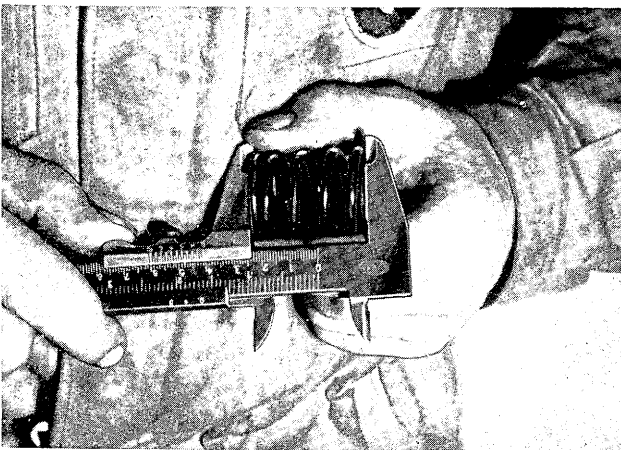
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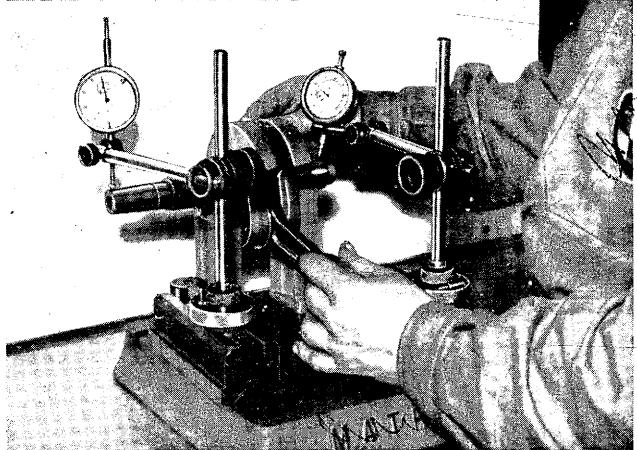
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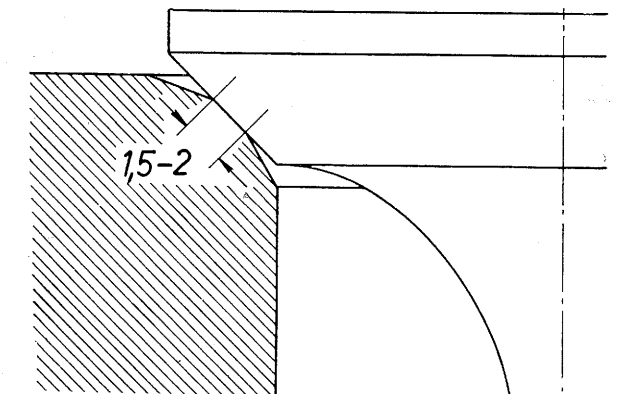
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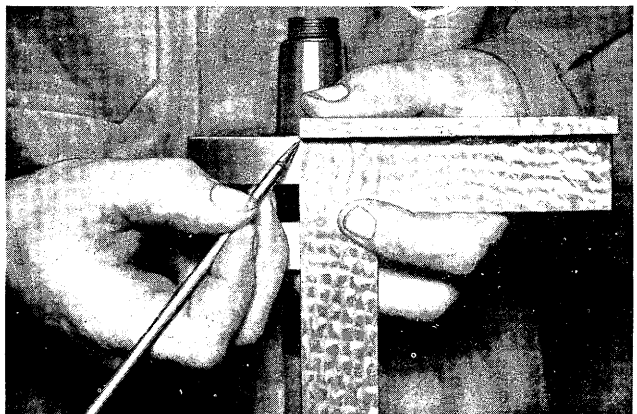
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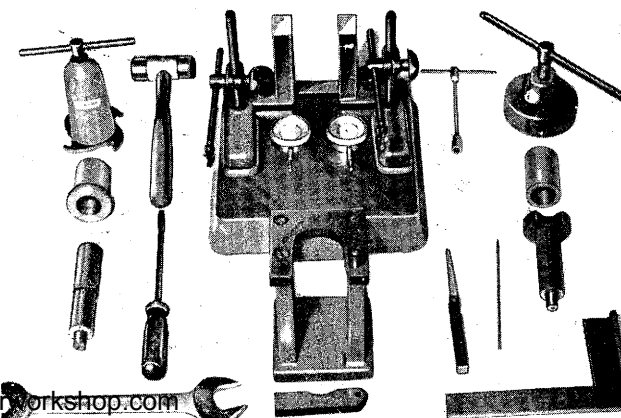
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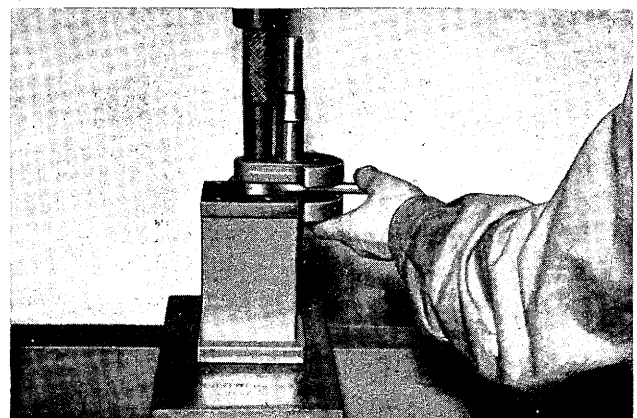
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Note: Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

Fig. 75 Tools: Socket spanner 10 mm, open ended spanner 32 mm, special tools for crankshaft overhaul 467, 282, 353 A-C, 493/1-4, 531, 524, feeler gauge, screwdriver 8 mm, square, scriber.

Fig. 76 1. Remove flange with oil pipe from front bearing over plate, four screws. (socket spanner 10 mm) 2. Install puller No. 467 and remove front bearing cover (socket spanner 10 mm, Matra puller 467)

Fig. 77 3. Unscrew slotted head screw from oil thrower disc. (screwdriver 8 mm)

Caution: When refitting oil thrower disc secure slotted head screw by a punch blow. The oil thrower disc must attach evenly on the counterweight face. 4. Remove oil thrower disc with slight blows of a plastic hammer. 5. Remove ball bearing from flywheel bearing cone. (puller No. 282, open ended spanner 32 mm)

Fig. 78 6. Install bushing compensating thickness of shaft. (bushing No. 531) 7. Place crankshaft upon test equipment and check tapered shaft ends for true rotation. Out-of-true limit on shaft ends is 0.02 mm = .0008 inch. (crankshaft testing equipment No. 353 A, two indicator dials with stand 353B and 353C).

Fig. 79 Caution: If the crankshaft is found to run out of true it can be recentralised. This job, however, should only be carried out by those servicemen who learnt it at the BMW Service Department's Training school. 8. Mark crankshaft cheeks to ensure their correct location when assembling. (square, scriber)

Fig. 80 9. Separate the two crankshaft halves by removing crankpin with the aid of a press. (press tool No. 493, intermediary piece No. 493/3, drift No. 493/1) 10. Check crankpin for trueness. Maximum allowable out-of-round 0.003 mm = .00012 inch.

Fig. 81 11. Remove connecting rod from crankpin. (holding bushing No. 493/2, plastic mallet)

Fig. 82 Caution: To replace con rod upon crankpin use replacer No. 524. For the sizes of connecting rods and big-end roller bearings see spare parts list.

Fig. 83 12. Lap connecting rod if necessary. (lapping arbour V 5046)

Fig. 84 13. Assemble crankshaft with hydraulic press.

Caution: Apply press tool No. 493/1 in reversed condition. Insert feeler gauge 0.05 mm = .002 inch between big end and counterweight. Compress until the feeler gauge just can be removed. Insert intermediary piece below counterweight to prevent distortion of crankpin. 14. Heat ball bearing to about 60°C = 140°F and slide it upon crankshaft end journal.

#### M. 26 Overhauling oil pump

Note: Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

Fig. 85 Tools: Hammer, socket spanner 10 mm, screwdriver 10 mm, feeler gauge 0.03/0.04 and 0.05 mm = .0012/.0016" and .002", straightedge.

Fig. 86 1. To check oil pump dip it in oil so that the gears are beneath the oil level and rotate it clockwise by means of the drive. When turning with the fingers oil must ooze out of the oil outlet orifice.

- Fig. 2. Straighten bent ears of oil screen lock washer. (hammer, chisel)  
 87 Caution: During all these jobs hold pump with the hand, do not put it in a vice. 3. Remove oil screen. (socket spanner 10 mm)  
Caution: When assembling place oil strainer assembly at the attachment flange, the strainer opening outwards, insert the connection washer.  
 4. Straighten bent ears of pump screws locking washers. (Hammer, chisel)  
 5. Remove pump fixing screws. (two screws, socket spanner 10 mm, one screw, screwdriver)
- Fig. Caution: After assembling secure slotted head screw by a punch blow. 6.  
 88 Measure clearance over pump gears. Maximum allowable clearance 0.0016 to 0.04 mm = .0012 to .0016 inch. (straightedge, feeler gauge)
- Fig. 7. Check clearance between gears (backlash) 0.03 to 0.05 mm = .0012 to  
 89 .002 inch. (feeler gauge)  
Caution: If the bottom plate is scored owing to rotation of pump gears, the bottom surface may be rectified until clearance below straightedge will disappear.

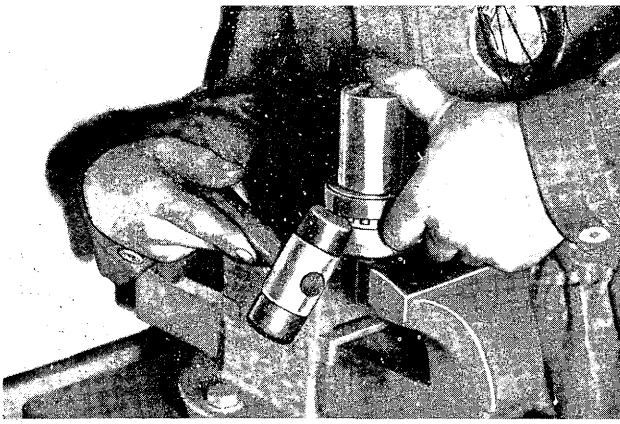
### M 30 Adjusting ignition timing

Note: Equipment required for operation but in some cases not supplied in special tool kit, as various items are universal garage equipment.

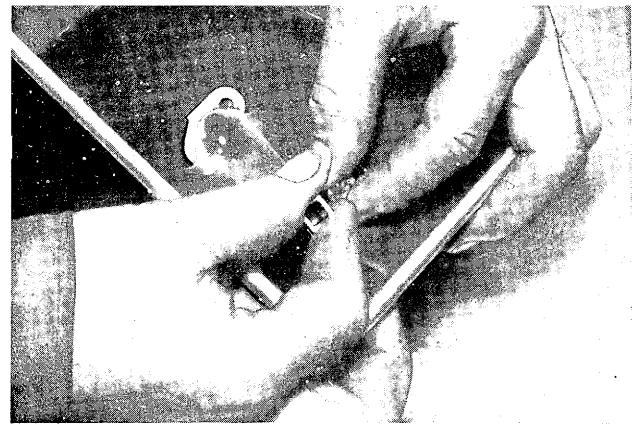
- Fig. Tools: Sparking plug spanner, sparking plug steel brush, screwdriver 6 mm,  
 90 feeler gauge 0.4 to 0.6 mm = .016 to .024 inch.
- Fig. When resetting ignition timing also clean sparking plug and re-adjust  
 91 electrode gap.
1. Remove screw plate giving access to sparking plug. 2. Withdraw spark plug connector and unscrew sparking plug. 3. Clean sparking plug and adjust electrode gap to 0.6 mm = .024". 4. Remove cover from blower wheel. (screwdriver 6 mm). 5. Rotate blower wheel in a clockwise direction until the colour-marked blade registers with the mark "S" on the housing of the blower unit. 6. Continue turning the blower wheel until the breaker contact points are fully opened. 7. Check contact breaker gap with the contact gauge (0.4 mm = .016").
- Fig. 8. If the gap is too big or too small, slacken the stationary point  
 92 locking screw (Fig. 92, 1) and turn the eccentric adjusting screw (Fig 92, 2) until the correct gap is obtained. Then tighten lock screw.
- Fig. 9. Slacken the two contact breaker plate securing screws and turn the  
 93 blower wheel until the colour-marked blade meets the mark "S" on the  
 and blower housing.  
 94 10. Disconnect black coloured contact breaker lead from terminal 1 of ignition coil and connect the test lamp with one pole to terminal 1 of ignition coil and the other to connector end of the disconnected black lead. 11. Push in ignition key to switch on ignition and move the contact breaker plate contrary to rotation direction (upwards) until the lamp lights up. Then move contact breaker plate carefully in direction of rotation (downwards) until the lamp just goes out. 12. Tighten the contact breaker plate in this position by means of the two locking screws (figures 93/94). 13. Remove test lamp, reconnect the contact breaker lead to terminal 1 of ignition coil and replace the blower wheel cover. (screwdriver) 14. Replace sparking plug, push cable connector upon sparking plug and reposition screw plate upon the inspection aperture.



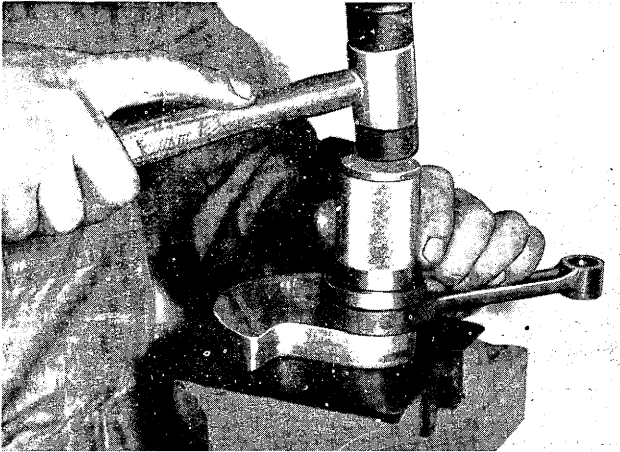
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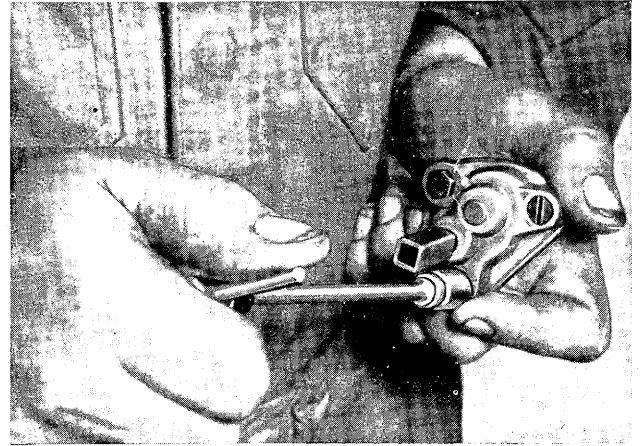
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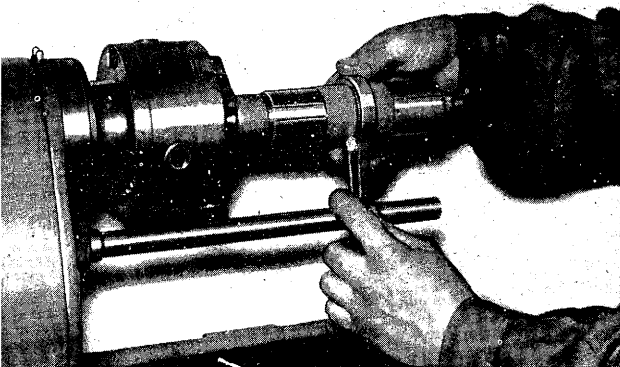
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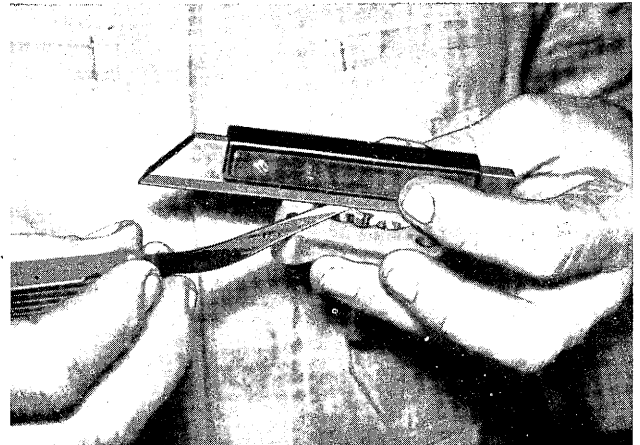
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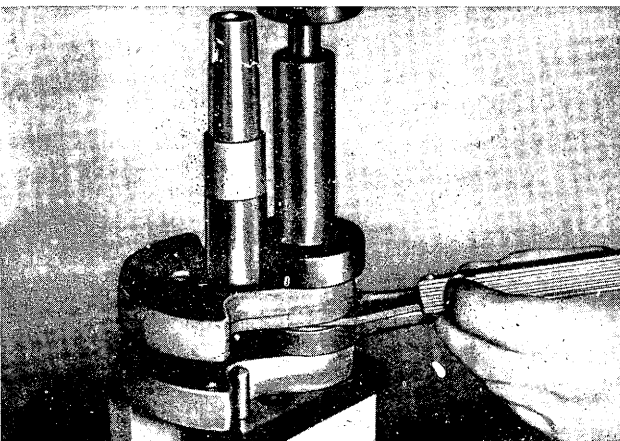
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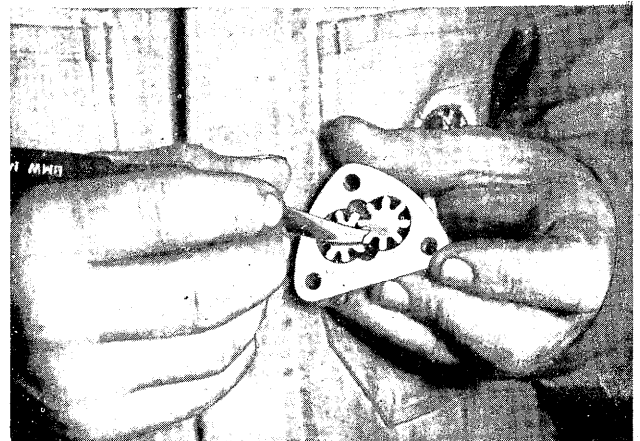
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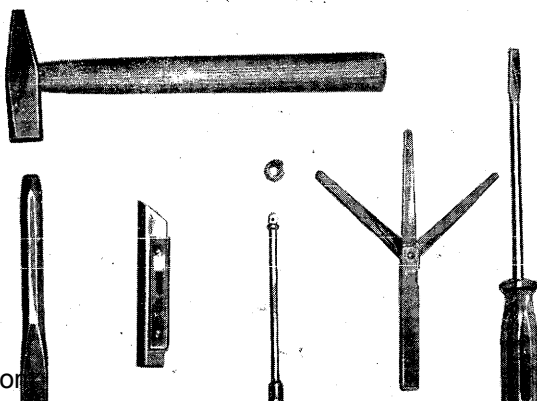
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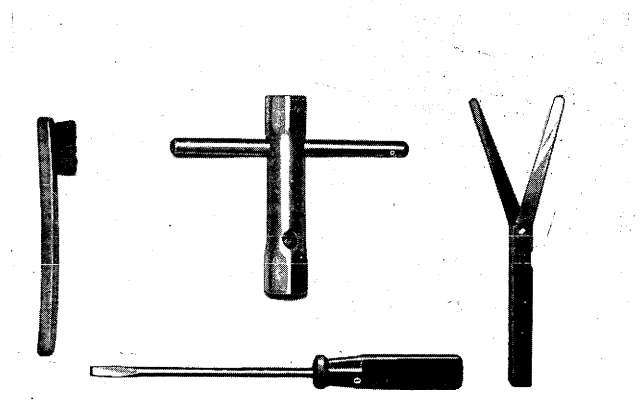
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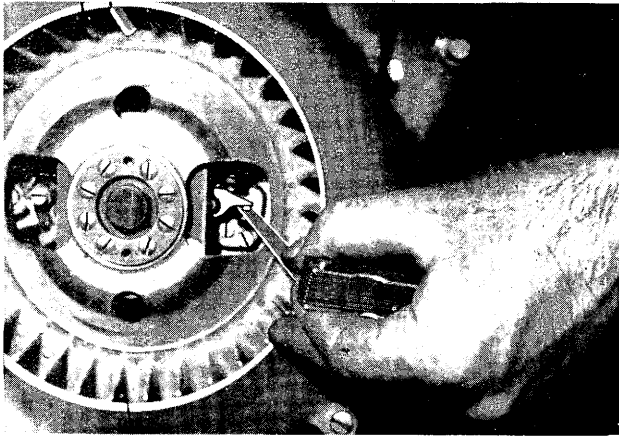


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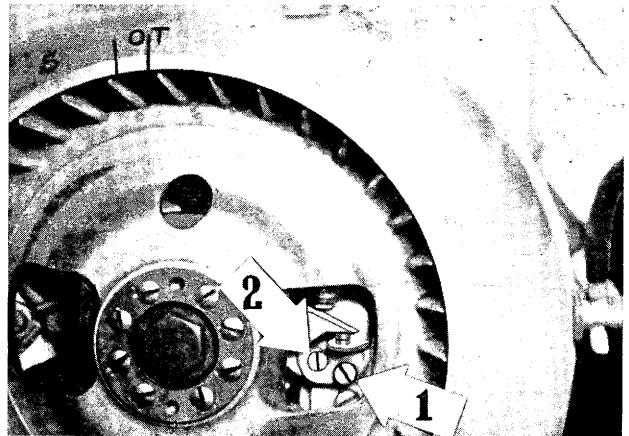


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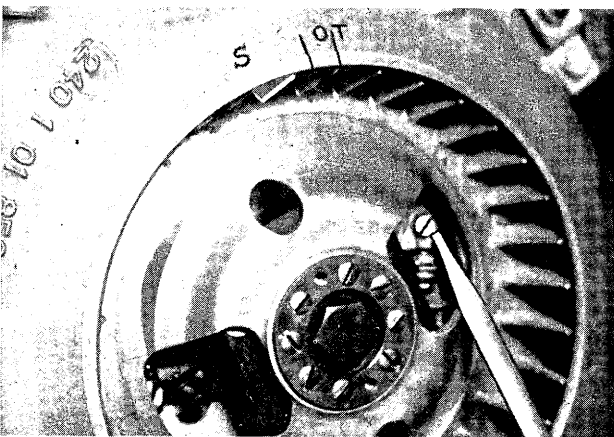




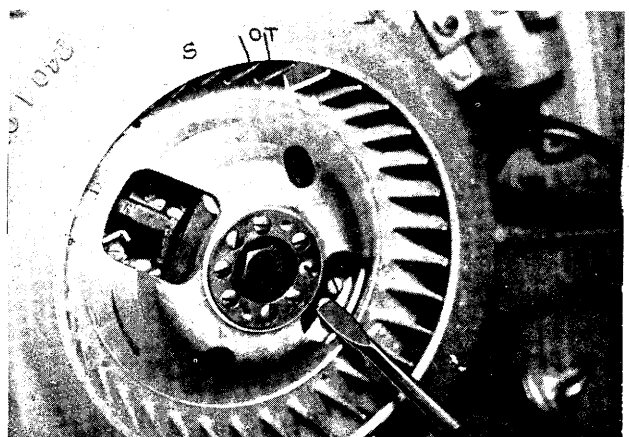
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