Department of Health and Social Security

WORKSHOP MANUAL FOR THE MODEL 70 THREE WHEELER

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and Social Security
by Industrial Marketing Services
Design, artwork and photography
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Amendment Sheet No1
Steyr Puch 500cc Engine

1. Servicing

The section of the workshop manual that relates to the Steyr-Puch 500 cc engine contains a number of references and instructions about servicing. Separate instructions have already been issued on this subject, together with a comprehensive set of servicing schedules (MHS 450A–F). Servicing of the Model 70 three-wheeler must be carried out in accordance with these servicing schedules and the instructions given in the following parts of the engine section of this manual should be disregarded:

Page 10 Section IV
Section V.A. – Top right of page – first 2 sentences
ie "change oil . . . . . 3,000 miles".

Page 11 Section V.F. – First sentence, ie "The average . . . . . 9,000 miles".
Section V.J. – First sentence, ie "Check dynastarter every 9,000 miles."

Page 32 Section D.3. – First sentence, ie "Check carbon brushes . . . . . 10,000 miles".
Section D.5. – First sentence, ie "The dynamo is fitted . . . . . 15,000 miles".

2. Other Amendments

Page 11 Section V.H. – Second paragraph, line 4. After "0.4 mm"
AMEND to read "by using a screwdriver to move the contact breaker fixed arm relative to the baseplate".

Page 11 Section V.I. – Lines 9 and 10 AMEND "increases" to read "advances" and "decreases" to read "retards".

Page 13 Section I. – Removal and replacement of the engine of a Model 70 three-wheeler is described in more detail in Section . . . . . of the Workshop Manual and it is the instructions in that Section that should be followed.

Contents

HPG 307K
HPG 307K

General Description

The Department of Health and Social Security Model 70 Three Wheeler is powered by a two cylinder horizontally opposed Steyr-Puch engine. It is of overhead valve type, air-cooled and has a capacity of 493ccs. It is mounted at the rear of the vehicle.

Fuel is fed by a mechanical pump from the fuel tank located in the front compartment of the vehicle to a Weber 321CS or a Solex 40PID downdraught carburettor. The carburettor is fitted with a dry air filter and a manual choke.

Starting is by a Bosch voltage regulated dynastarter which also acts as a generator during normal running. The ignition system incorporates a Bosch distributor with flywheel advance/retard.

Power is transmitted from the engine to the rear road wheels via an A.C. Automatic Transmission. This incorporates a centrifugal clutch which is connected to a gearbox having three gear positions – forward, neutral and reverse. A Salsbury Model 795 Variable 'V' Pulley Drive transmits the drive from the gearbox to the drive shafts via spiral bevel crown and pinion gear with a differential unit with built-in 'pot' type universal joints. Rubber shock drive units take the drive from the drive shafts to the hubs.

The separate chassis is of welded construction using steel sections and plate.

The front suspension to the single front wheel is of leading arm parallelogram type incorporating a coil spring and telescopic damper. The rear suspension is of semi-trailing arm type, also fitted with coil springs and telescopic damper units.

Steering employs either a direct linkage or the worm and segment principle according to the control system used in a particular vehicle. There are a number of alternative control systems available to suit drivers' individual needs. The standard system with bicycle type handlebars (and also the system using a tiller) uses a direct linkage between the handlebar (or tiller) and the front wheel via ball-jointed links and an idler shaft.

The alternative system uses a steering wheel splined to a universally-jointed shaft which is coupled to the idler shaft via a worm and segment steering box.

All three road wheels are fitted with 7 inch diameter Girling hydraulic drum brakes and an independent parking brake is provided to the two rear wheels.

The body is of moulded glass reinforced plastic and may accommodate both the driver and a folding wheel chair. Lockable sliding doors are fitted to both sides of the body and each door has a lockable sliding window of toughened safety glass.

The seat is capable of sliding from the central driving position to either side of the vehicle to facilitate entry and exit.

An approved seat belt and anchorage points to BS AU48, 1965, are fitted. This is the standard to which all seat belts must conform. Each vehicle also carries a fire extinguisher of the aerosol type filled with B.C.F.

A saloon heating and windscreen demisting / defrosting system is installed. This employs a non-mixing heat exchanger in the exhaust system. The heated fresh air is directed to an outlet under the seat and/or to the windscreen. The control unit allows variation of air temperature and distribution to either or both outlets.

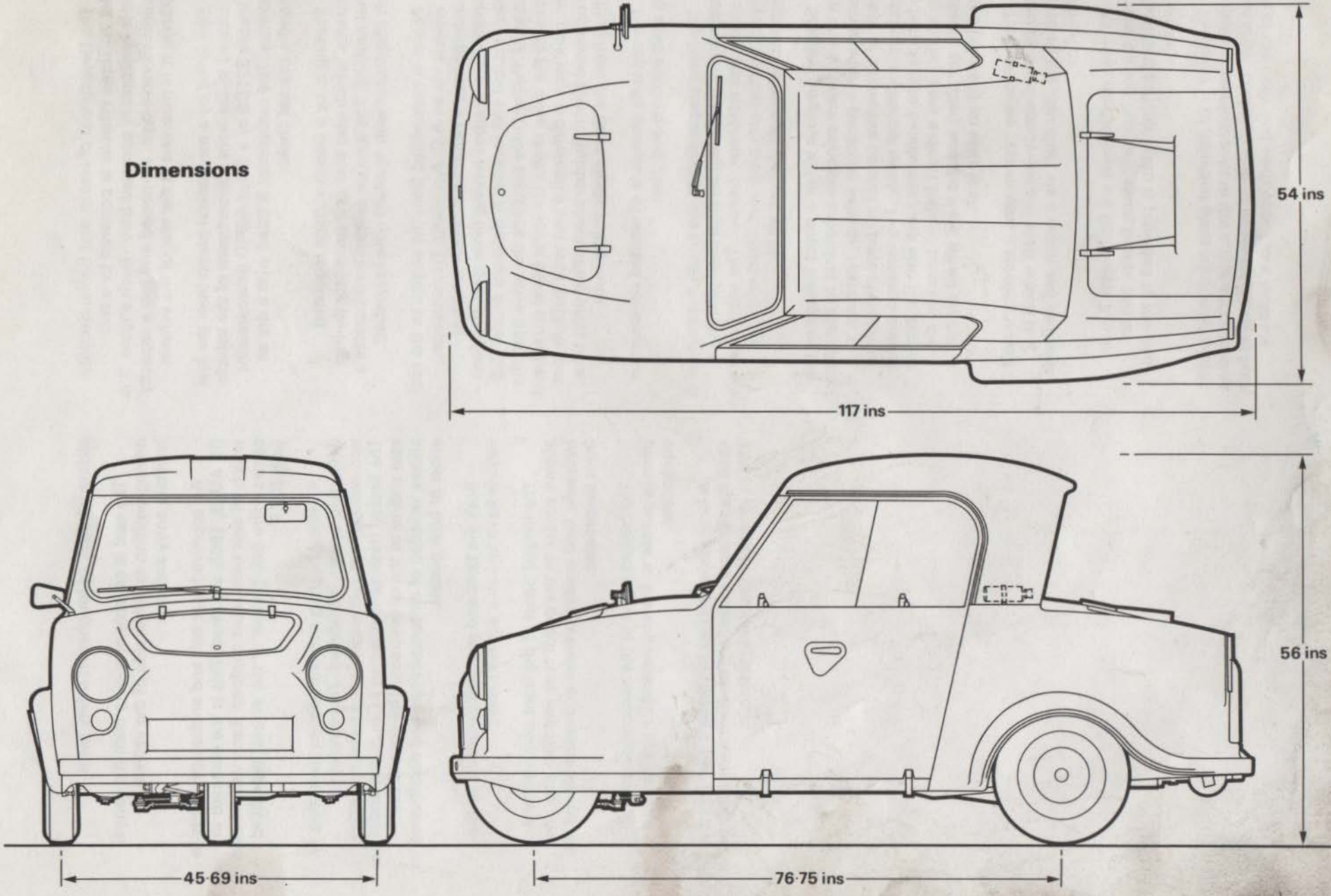
Both the front and rear compartments of the vehicle have lockable access panels.

The hinged panel of the front compartment allows access to the petrol tank and filler cap, the hydraulic fluid master cylinder and reservoir and the front suspension.

The hinged panel to the rear compartment permits access to the engine and its ancillary equipment.

A large panel behind the driver's seat forms a shelf for personal impedimenta. Removal of this panel allows access to the transmission.

Dimensions



General Specification

Dimensions

Length overall	117 in.
Width overall	54 in.
Unladen height overall	56 in.
Unladen ground clearance	8 in.
Wheelbase	76.75 in.
Track	45.69 in.
Turning circle	23 ft.

Weights

Maximum kerb weight (without Wheelchair)	896 lb.
Maximum load	420 lb.

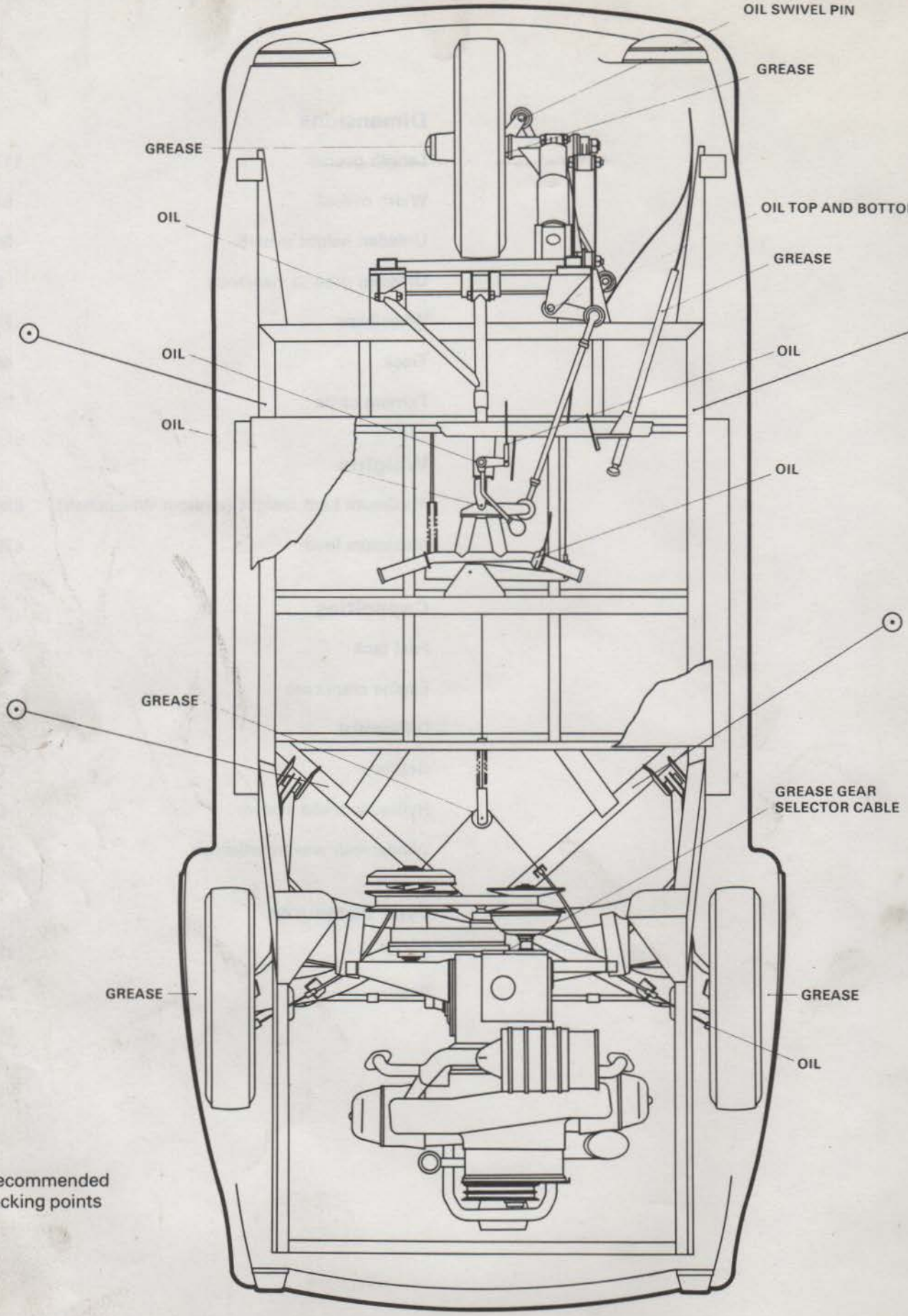
Capacities

Fuel tank	4.5 gals.
Engine crankcase	3.5 pts. 2 LITRES
Differential	2.5 pts.
Gearbox	0.875 pt. ½ LITRE
Hydraulic brake system	0.4 pt.
Windscreen washer reservoir	1.0 pt.

Tyre Pressures

Front	17 psi
Rear	22 psi

Lubrication Chart



Recommended Lubricants

	BP	ESSO	SHELL	CASTROL	MOBIL
ENGINE SAE 30	B P SUPER VISCO - STATIC 20W - 50 or B P MOTOR OIL 20W - 30	ESSO UNIFLO or ESSO EXTRA MOTOR OIL 10W/30 or ESSO MOTOR OIL 30	SHELL SUPER MOTOR OIL or SHELL X-100 30	CASTROL GTX or CASTROL CRI 30	MOBILOIL SUPER or MOBILOIL SPECIAL 20W/50 or MOBILOIL A
GEARBOX AND DIFFERENTIAL SAE 90	B P GEAR OIL SAE 90 E P	ESSO GEAR OIL G X 90/140 or ESSO GEAR OIL G X 90	SHELL SPIRAX 90 E P	CASTROL HYPOY	MOBILUBE G X 90
GREASE POINTS	B P ENERGREASE L 2	ESSO MULTIPURPOSE GREASE H	SHELL RETINAX A	CASTROL LM GREASE	MOBILGREASE MP MOBILGREASE SUPER

Steyr·Puch Engine 500 c.c.

SERVICE MANUAL

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Introduction

This manual is a guide for correct servicing procedures. Please take the time to read the manual and ensure all your workshop mechanics have access to it.

In addition to describing the required maintenance and repair jobs, all technical data, clearances and permissible wear limits are listed. A further chapter lists and describes all special tools required.

The Steyr-Puch engine is an Austrian quality product. No doubt you are aware that Austria uses the metric system and all data and dimensions quoted in this manual are metric units. To assist you we have translated torque values, limits and wear limits on Page 43 to British units.

We hope the manual will be an aid for your workshop and your customers.

STEYR-DAIMLER-PUCH

GRAZ WORKS

SERVICE DEPARTMENT

Index

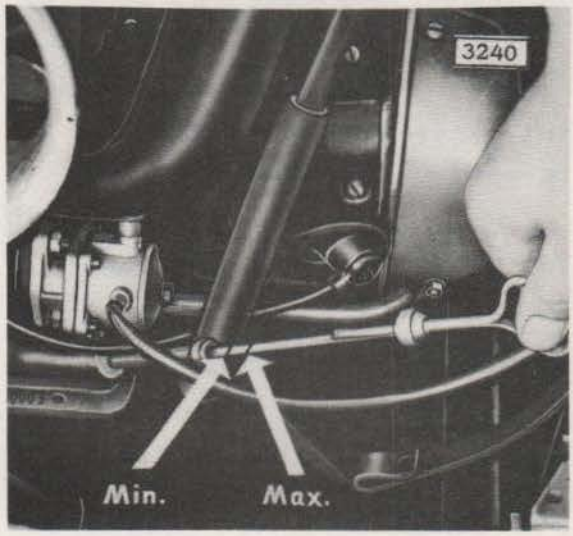
Section : Technical data

Type	2-cylinder, 4-stroke flat-twin engine, aircooled	
Capacity	493 cc	
Stroke	64 mm	
Bore	70 mm diameter	
Compression ratio	6.7:1	
Valves	Overhead type	
Valve clearance	inlet 0.15 mm adjust on outlet 0.15 mm cold engine	
Maximum continuous output	19.3 h.p. at 5,000 r.p.m. (DIN)	
Maximum torque	3.1 mkg at 3,500 r.p.m.	
Lubrication	Forced feed (gear pump) with oil cooler and oil filter	
Oil capacity	1.75 litres	
Fuel feed	Mechanical fuel pump	
Carburettor	Downdraught type with accelerator pump Type: Weber 32ICS or Solex 40PID	
Venturi	25	25
Main jet	135	112.5
Correction jet	230	100
Mixing tube	F17	K18296
Idling jet	55	55
Idling air jet	1.75	1.6
Accelerator jet	50	–
Return jet	90	–
Air filter	Dry filter with Micronic insert	
Cooling	Air cooling fan	
Dynastarter	Voltage regulated, 240 W, Bosch type LA/EJ 160/12/3000 +1, OR 1	
Distributor	Bosch, with flyweight advancer	
Timing	4° 30' before t.d.c. = 6–10 mm before t.d.c. measured on twin pulley T.D.C ± 0 TO 2MM"	
Contact gap	0.4 mm	
Sparking plugs	Bosch W225 T1 or equivalent	
Plug gap	0.6 to 0.7 mm	

I. Before operating

Engine oil level

The dip stick is positioned to the rear of the right-hand side of the engine. The engine must be switched off and standing horizontally to check oil level. Unscrew dip stick, pull out and wipe clean. Push back without screwing-in. Remove again and check oil deposit on dip stick. Oil must cover a zone between minimum and maximum mark. Oil level must not be below the minimum mark nor above the maximum. For topping up always use the same brand and type of oil.



Tensioning the fan belts

The fan belts transmit the starter forces (Dynastarter) to the crankshaft and eventually drive the dynamo and the fan. Correct belt tension must be ensured. Light thumb pressure must depress the belts no further than 10 to 20 mm.

II. Operating

Starting the engine

Close ignition circuit with ignition key or ignition switch. The charging and oil pressure light will light up. Pull choke, do not depress accelerator. Start engine by turning key or pressing starting switch as the case may be. Reduce choke subsequently when engine warms up. When engine is warm and runs properly, acceleration is permitted and the engine can be loaded.

Switching off the engine

Remove ignition key. Do not leave ignition on if engine is not running. Apart from the current consumption the ignition coil can burn out.

III. Running-in procedure

The life of your vehicle depends on how you drive the first 1,500 miles. We recommend not using full throttle or top speed during this period. The speed can be slowly increased from 1000 to 1500 miles up to the top limit. Note in particular the following points during running in:—

Let the engine warm up slowly after starting

Do not drive at the specified speed for long periods.

IV. Lubrication and maintenance chart

For description of the various work see paragraph V, maintenance jobs.

Every 300 miles

Check engine oil level.
Change oil of new engine at 300 miles
Change oil filter.

Every 1,500 miles

Check acid level of battery.
Change engine oil.
Clean air filter insert.

Every 3,000 miles

Check acid level of battery.
Change engine oil.
Clean air filter insert.
Check valve clearances.
Check fan belt tension.
Check sparking plugs.
Change oil filter

Every 6,000 miles

Check acid level of battery.
Change engine oil.
Check valve clearances.
Check fan belt tension.
Check sparking plugs.
Change oil filter.
Adjust contact breaker gap.
Adjust timing.
Check dynastarter.
Change air filter insert.
Clean carburettor.
Clean oil sieve (after 20,000 miles)

V. Maintenance jobs

A. Lubrication

Check oil level with dip stick every 300 miles. If level is down to minimum marking, top up but not above maximum marking. Use only brand lubricants of the following grading:

SAE 30 in summer
SAE 20 in winter
SAE 10 for easier starting at low temperatures (used in the open)
And Multigrade OIL

Change oil of new engine first after 300 miles. Further oil changes every 1,500 miles. Replace oil filter insert every 3,000 miles. Cleaning and re-use of oil filter insert is not possible. If used for short periods only, particularly in winter, change oil earlier. Various brand lubricants should not be mixed.

The total oil capacity is 2 litres; when draining 0.25 litres remain in the system.

To change oil, first warm up engine and switch off. Remove drain plug on finned crank housing and magnet screw on oil filter. Drain oil completely. Clean magnet screw. Lift off filter body after removal of domed nut. Remove and replace filter cartridge. Remove oil deposits from filter body. Replace filter body and drain screw. Fill with 1¾ litre motor oil through oil filler pipe. The oil filler pipe cover can be opened after pushing away the holding spring. Run the engine briefly and switch off. Check oil level with dip stick and top up to full mark.

B. Cleaning the air filter

Blow-out every 1,500 miles.
Replace every 6,000 miles.
The filter insert is of the dry type and must not be oiled.

C. Tensioning fan belts

Too much or too little tension can cause damage. To adjust, first remove the nut. Insert a rod into fan hole to remove or tighten nut. The belt tension is adjusted by altering the number of shim washers between the pulley halves.

These shim washers are placed between rear pulley half (fan) and centre piece and between centre piece and front pulley half. The belt tension is increased by taking away shims and increased by adding. Any removed shims are fitted below the nut to keep the distance.

Always replace and adjust both belts together.

D. Cleaning the carburettor

Use compressed air only to clean fuel sieve and jets. Wires or needle would damage the accurate bores.

E. Cleaning fuel pump sieve

The fuel pump sieve is fitted below the round cover on the pump face. Ensure proper sealing of gasket when fitting cover.

F. Checking sparking plugs

The average life of a sparking plug is approximately 9,000 miles. The plug gap should be checked at regular intervals. Unscrew sparking plug and adjust gap by bending the earth electrode to 0.6–0.7 mm. The plug insulator of properly operating engine should be dark grey to brown coloured.

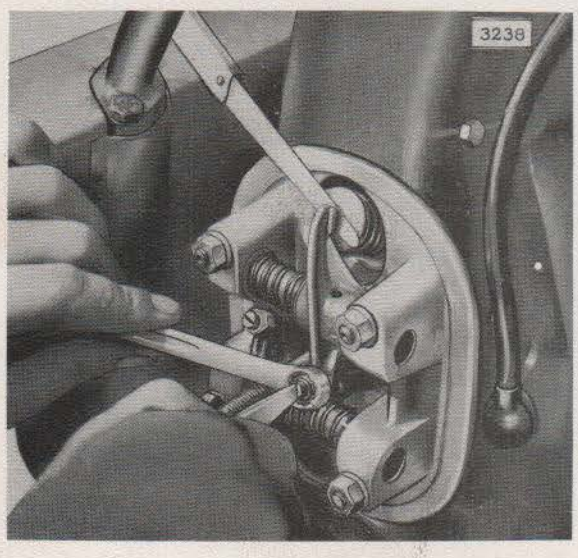
Insulator colour of light grey to white indicates mixture too weak and black or wet indicates mixture too rich or plug misfiring. Clean plug with wire brush and a piece of wood. Blow out before refitting.

G. Adjusting the valve clearance

Use a cranked ring spanner to remove domed nut from cylinder cover. Take off cover. A tight cover is removed by holding a wooden rod to the lift-up tags and a hammering with a mallet. Adjust valve clearance on cold engine to 0.15 mm on all valves.

Note position of cylinder for adjusting the valve clearance. Use the crank to turn crankshaft clockwise until both valves of one cylinder are closed and the markings on pulleys and fan are matching.

Use ring spanner to loosen counternuts on rocker arm adjusting screws and adjust clearance with feeler gauge. Finally tighten counternuts and check clearance again.



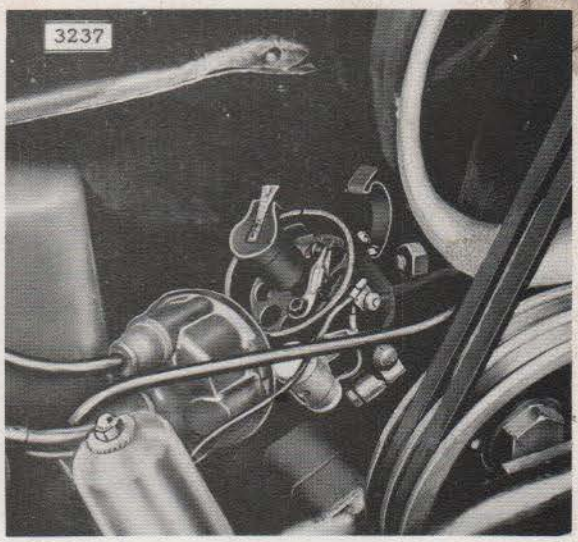
H. Adjusting of contact breaker gap

Check contact breaker gap and condition of points before checking the timing.

Push back holding spring, take off distributor cap and remove rotor. Turn crankshaft until distributor cam opens points completely. Loosen fixing screw on fixed contact and adjust gap to 0.4 mm, by turning the excentric screws. Tighten fixing screws.

I. Timing

Fit rotor and unscrew left sparking plug. Leave connected sparking plug on crank cable to earth. Switch on ignition. Use crank to turn crankshaft slowly clockwise until a spark jumps on sparking plug. This is the moment of contact opening. Providing the contact gap is correct, the rotor and distributor housing marking must match and pulley mark must be 6 to 10 mm before the fan mark. If not, loosen distributor clamp and turn distributor. Turning against operating direction increases and turning in operating direction decreases the ignition timing. Tighten distributor clamp, switch off ignition and replace distributor cap. The contact opening can be ascertained best with a test lamp. Connect lamp between terminal 1 (capacitor connection) and earth. If ignition is switched on, the lamp will light up on opening of contacts.



J. Checking

Check dynastarter every 9,000 miles. Lift up fan hood after opening the two spring locks. Remove brush cover from dynastarter and clean commutator with clean rag. Check carbon brushes for wear and replace if necessary. The dynastarter must be removed to replace brushes. Take off belts and open clamping band of fan. Regrease ball bearings if necessary.

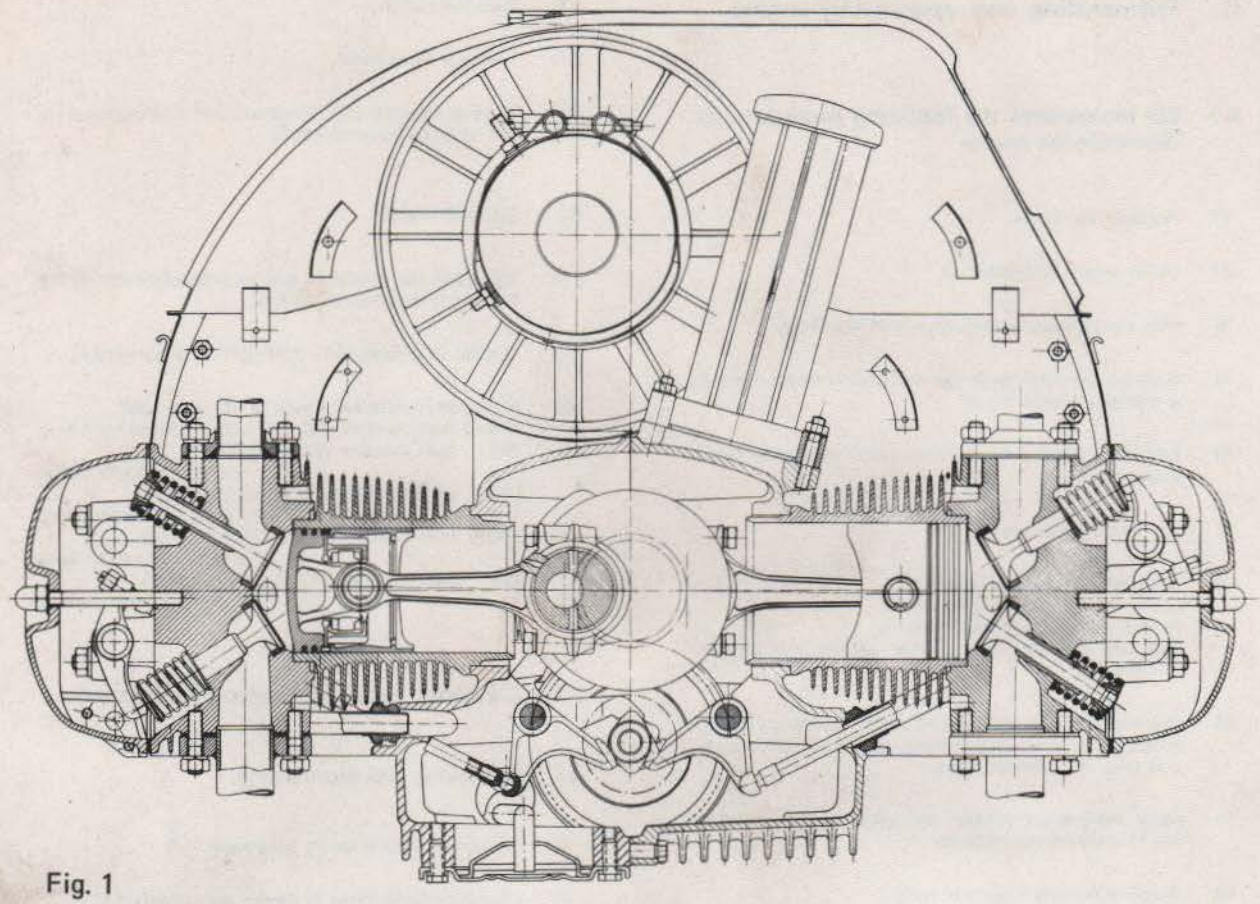


Fig. 1

USE OF THE QUOTED SPECIAL TOOLS IS DESCRIBED IN SECTION SPECIAL TOOLS

I. Removing and refitting of engine

A) Removing of engine

1) Prop up car on two stands

2) Open engine bonnet and disconnect battery

3) Remove fan hood and air filter

4) Disconnect accelerator and choke Bowden cables from carburettor

5) Remove fuel pipe from fuel pump

6) Unscrew earth lead from dynamo
Disconnect leads from dynamo terminals 30, D+ and DF;
disconnect oil pressure switch lead from connector and push leads through rear air deflector.

7) Disconnect H.T. and C/B leads from distributor

8) Push right heating hose off the exhaust

9) Disconnect and take out rear heating hose

10) Remove carburettor

11) Remove engine bracket with rubber mounting
a) Remove M12 screw from rubber mounting
b) Lift up engine slightly with jack
c) Remove the two M8 screws from engine bracket, press bracket with rubber mounting forward and take out downwards

12) Unscrew the 4 nuts from the engine-gearbox connecting screws and release jack to lower engine for removal.

B) Refitting engine

Place engine on jack and lift into car. Tighten nuts on engine-gearbox connecting screws.

Proceed in reverse order to removing (see removing of engine).

II. Dismantling and assembling engine

A) We recommend the following procedure to dismantle the engine

1) Remove the hood

2) Drain engine and filter oil

3) Remove exhaust system and inlet manifold

4) Remove dynamo with fan and twin pulley (Pulley is tightened to 14 mkg)

5) Lift off cylinder head cover with oil return tube and rubber ring

6) Remove distributor

7) Take off air cooling cowling.
Remove both upper side panels
Remove the four air deflectors
Remove the two lower cover panels and engine bracket

8) Remove cylinder head steel nuts, loosen cylinder heads, push over rocker arms to remove push rods and take off cylinder head

9) Mark matching cylinder and piston (left cylinder No.1) and remove cylinder

10) Remove pistons from con rods

11) Remove centrifugal clutch

12) Remove twin pulley from crankshaft (fixing screw is tightened to 14 mkp; lock with bracket part number 905.5.36.101.0)

13) Unscrew fixing nut and use extractor 905.5.34.101.0 to remove flywheel with copper seal and spring washer. The fixing nut is tightened to 34 mkg. (lock with bracket 905.3.36.101.0)

14) Take off oil filter

15) Disconnect fuel pipe from fuel pump. Remove pump from engine

16) Remove oil filter with casing

17) Remove oil cooler, use new rubber rings for assembling

18) Loosen flange of front cam shaft bearing (flywheel end)

19) Dismantle oil pump cover and take out both oil pump gears

20) Loosen fixing screws and take out oil pump housing

21) Remove suction strainer after loosening the fixing screws and take off suction tube

22) Remove locating screws from engine housing, unscrew connections and part the housing

23) Remove camshaft

24) Remove crankshaft

25) Take axles with cam followers and fuel pump drive out of both housing halves

B) Special notes

1) **Assemble the engine in reverse procedure noting the following sections III to XIII**

2) **Use set of gaskets 501.2.01.084.0 for assembly**

3) **Note the 5 different kinds of M8 nuts used**
M8 x 1 part number 900.2021 for carburettor fixing
M8 part number 700.1.08.035.1 for suction pipe fixing
M8 part number 900.2008 (brass) for exhaust flange fixing
M8 part number 900.2009 (hardened) for cylinder head fixing
M8 part number 24774 (standard 5S) for all other fixings

III. Cylinder head and valve mechanism

A) Removing and dismantling

1) Dismantle engine up to paragraph II/8

2) Clamp cylinder head in device part number 905.5.31.101.2
(see illustration in section special tools)

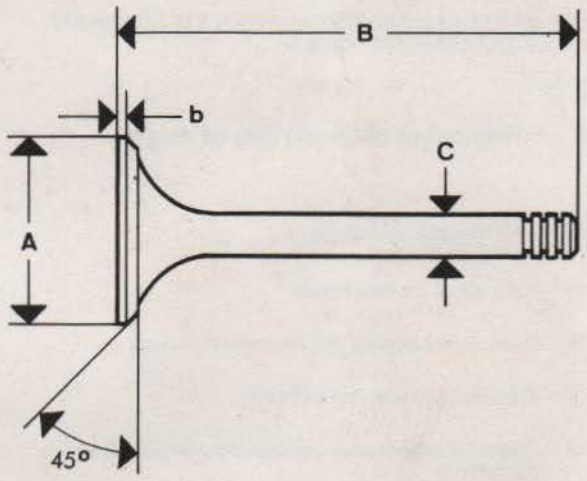


Fig. 2

Intake valve	A=34,85–35,1 c = 7,96–7,97 B=85,2 –85,6 b = 1,35–1,65
Exhaust valve	A=31,85–32,1 c= 9,36–9,37 B=83,5 –84,1 b= 1,35–1,65

3) Press out rocker arm shafts, remove rocker arms, washers and springs

4) Compress valve springs with lever and remove keys

5) Take valves out of guides. File carefully any worn valve key seatings to prevent damage to guides

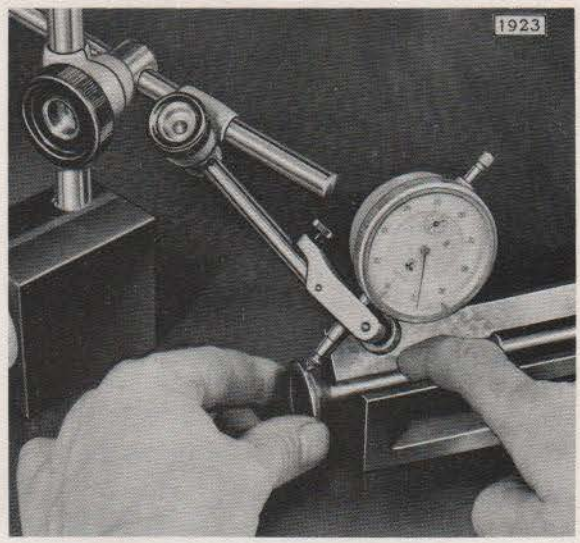


Fig. 3

B) Checking

1) **Check valve guides.** Clearance of new valves and guides is

inlet valve	0.035 to 0.056 mm
exhaust valve	0.035 to 0.056 mm

Permissible wear is 0.1 mm

2) Checking the valves

Check valve faces, if necessary regrind according to fig.2. Check for worn chromium plating. Replace valves if plating is worn off.
Check for bent valve stem. Permissible clearance, stem max run out seating, is 0.02 mm; see fig.3.

3) Check valve seating for wear or burns. Note the following for refacing:

45 degree angle surface. Ensure concentric seating without chatter marks;
Keep stock removal to minimum to allow future refacing. Afterwards, reduce the seating surface with 2 different milling cutters (15 degrees and 75 degrees) to the specified dimensions (fig.4). The seating on the valve head must not be smaller than the mean diameter of the 45 degree surface. (Valve cutter set use part number 905.5.90.101.5)

Valve seating surface (A) inlet valve 0.8 to 1 mm
exhaust valve 1 to 1.2 mm

Rectify small leaks between cylinder head and cylinder sealing surfaces using fine emery paste and light pressure. A used cylinder having the cooling fins removed is most suitable for this job.

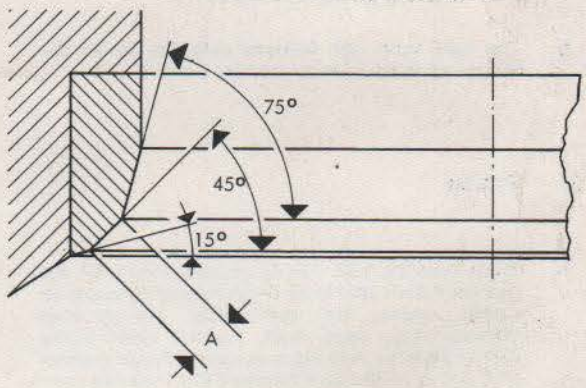


Fig. 4

4) Checking the valve spring

Relaxed length = 40 mm, when fitted: 32 mm (compression 8 mm, equals 23 kg)
Length when loaded with 47 kg ± 5%: 25 mm

C) Assembling

Assemble in reverse procedure but note the following points. Use assembling device 905.5.31.101.1.2

1) Prior to assembly, remove all traces of emery paste from valve guides

2) The valve springs are progressively wound. The narrower turns point to the cylinder head. Ensure the washers are fitted before adding the spring (fig.5)

3) Oil the valve stems

4) Worn rocker shafts can be reversed so the spring faces the worn side. Washers are only fitted to the spring end

5) The cylinder heads are fitted to the cylinders without gaskets

6) Rubber rings for cam follower tubes and for oil return tubes (latter fitted to cylinder head cover) must always be replaced

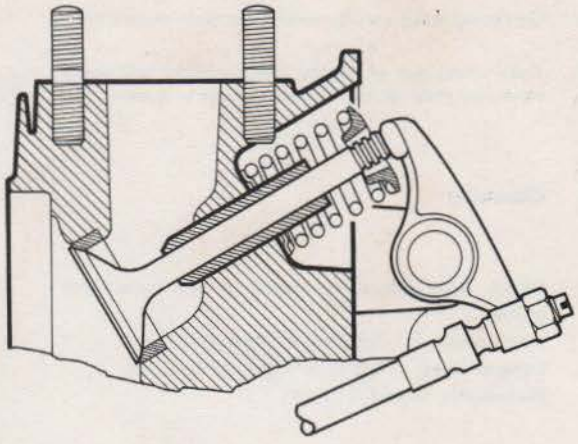


Fig. 5

IV. Removing and fitting cam followers

A) Removing

1) Remove cam follower only if damaged

2) Remove the complete cam follower out of housing after loosening the self-locking nut

3) The right hand cam follower axle also carries the fule pump drive lever secured by a circlip

B) Fitting

1) Right housing half: Fit all components from the rear (cam shaft gear side) in the following sequence. Circlip, washer, fuel pump lever, bearing boss, distance ring, angle lever, washer, short spring (25 mm) washer, bearing boss, cam follower, washer and circlip to the cam follower shaft and fit complete assembly to housing

2) Left housing half: Fit components from the rear in the following sequence: bearing boss, cam follower, washer, distance spring, washer, cam follower, spacer, bearing boss and fit assembly to housing

3) Secure both axles with new self-locking nuts

4) The cam followers must sit flat on the cams. To check, fit camshaft with bearings to each housing half and check that the arms are parallel with the cams. Adjust with fork 501.1.55.038.1 (see illustration in section "special tools")

V. Removing and fitting of cylinder

A) Removing

1) Dismantle engine up to paragraph II/19

2) Turn crankshaft to tdc and extract cylinder

3) Mark cylinder to prevent interchange (left cylinder No.1)

Fig. 6

B) Checking

1) Check cylinder for fractures and running marks

2) Measure cylinder

Clearance between new cylinder and piston end bore 70 mm is 0.039–0.055 mm, wear limit 0.15 mm. New permissible out-of-round is 0.015 mm, wear limit 0.15. Check clearance by measuring cylinder and piston (see figures 6 and 7)

C) Checking wear

1) Cylinder wear (check by measuring)

Data line	Parallel to gudgeon pin	
Approx. 12 mm below top edge	70.020	70.045 (max.)
Centre	70.010	70.025
Approx. 5–10 mm above bottom edge	70.005 (min.)	70.010

Maximum cylinder bore	70.045
Standard cylinder bore	70.005
Cylinder wear	= 00.040

2) Piston wear

Figure marked on piston head	69.96
Measurement according to section "Piston"	69.90
Piston wear	0.06

3) Total wear

Cylinder wear	0.040
Piston wear	0.060
Total wear	0.100

No repairs are necessary if total wear is below 0.15 mm and if oil consumption is low.

4) Check length of cylinder. At the compression ratio of 1:6.7 the overall cylinder length is 100 ± 0.1 mm.

D) Fitting

Commence fitting in reverse procedure to removing

1) Fitting limits

Cylinder and piston assemblies

Unit group	cylinder	piston	clearance
I from	70.005	69.955	0.040
to	70.014	69.965	0.059
II from	70.014	69.965	0.039
to	70.024	69.975	0.059

Fig. 7

2) Oil cylinder and piston bore well

3) Piston rings are easily inserted into bore because of the bore chamfer

4) Gaps of piston rings are assembled 120 degrees apart

5) Seating surfaces of cylinder and housing must be clean. Foreign particles cause leaks and damage cylinder and housing. Cylinder and heads are fitted without gasket. Ensure correct clearance when fitting new cylinder and pistons. Too much clearance causes piston slap.

6) Clean upper inner edge of cylinder with scraper (see fig.8)

Fig. 8

VI. Piston

A) Removing and dismantling

1) Dismantle engine up to paragraph II/10

2) Remove gudgeon pin circlip with suitable pliers

3) Remove gudgeon pin carefully without using force to prevent bending of conrod. Push sticking gudgeon pins back and clean circlip groove or pin bore. Do not interchange gudgeon pins. Push back into piston as soon as dismantled

4) Do not interchange pistons or piston rings. Each piston ring must be fitted to the same groove in the same direction (rings are marked "Top")

5) Use piston ring pliers to remove rings if necessary because of wear or coking. The piston rings are fitted in the following sequence: two compression rings, one scraper ring

6) Remove carbon deposits from piston head and piston ring grooves. Never use emery cloth

B) Checking

1) Measuring the piston

Measure diameter at right angle to gudgeon pin approximately 12 mm below upper edge (for dimensions and limits see "cylinder")

2) Check piston ring clearance

	Clearance for new rings	wear limit
I. ring	0.045–0.077	0.15
II. ring	0.035–0.062	0.15
Oil control ring	0.025–0.052	0.10

3) Check piston ring gap. Insert ring 4–5 mm into lower end of cylinder bore at a right angle. New clearance 0.30–0.45 mm, wear limit 1.0 mm

4) Radial clearance: the outer surface of the compressed rings must be 0.3 mm below the piston

5) Check gudgeon pin clearance. The pin has a sliding fit and can be pushed home by hand, clearance new 0.001–0.007 mm. Pistons and gudgeon pins are marked with white or black paint

White =	gudgeon pin bore	20.001 – 20.000
	pin diameter	19.997 – 20.000
Black =	gudgeon pin bore	19.998 – 20.000
	pin diameter	19.994 – 19.996

C) Assembling

Assemble in reverse procedure noting the following points.

Note

The gudgeon pin boss is offset. Therefore, when fitting the piston make sure this mark ⋀ on the piston crown shows to the flywheel.

1) When fitting piston rings ensure the "Top" marking points to the piston head

2) The rings must move easily in the grooves

3) The securing rings must lock in the grooves and must be pretensioned

VII. Distributor

A) Removing

1) Remove distributor cap and turn engine until markings on rotor and housing and on fan and twin pulley are matching (first cylinder firing)

2) Loosen clamping plate and remove distributor

B) Checking

1) Check centrifugal weights and springs for wear and oil lightly

2) Check Contact breaker gap and contacts. Use contact file to clean oiled or burnt contacts, replace if necessary. The dwell angle is 57–63° bearing equivalent to a gap of approximately 0.4 mm

3) If distributor gear must be removed, replace also the drive worm gear fitted to the crankshaft. Always use a new pin to locate distributor gear and fit new Bosch fibre washer and shims as required

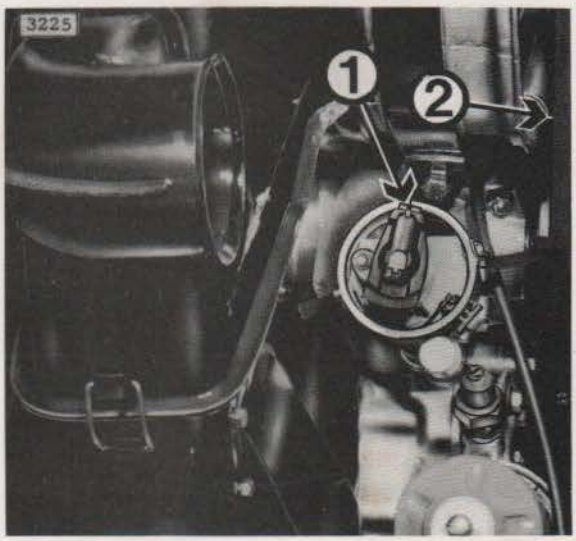


Fig. 9

C) Fitting

To fit distributor, turn crankshaft clockwise until the valves of the right cylinder (No.2) are rocking. At the same time the 'TDC' mark on the twin pulley (see fig.9/2) must be at tdc. Match rotor mark with distributor housing mark (see fig.9/1) and fit distributor with gear fitted into engine. Ensure that the engaging gears do not move the rotor. To premit timing and lubrication fit the distributor lubrication opening away from the operating direction.

D) Timing

Remove spark plug of left cylinder and lay connected plug to earth. Switch on ignition. Turn crankshaft clockwise until the plug sparks (contacts just opening). In this position the rotor mark and the housing mark must match and the pulley mark must be 6 to 10 mm before the fan mark. The timing can also be adjusted with a test lamp connected between terminals of distributor (capacitor connection) and earth. The lamp will light up if the contacts open (ignition must be switched on).

VIII. Camshaft

A) Removing

1) Dismantle engine up to paragraph II/23

2) Remove camshaft from right housing half

B) Checking

1) Check rivetting of camshaft gearwheel (do not attempt rivetting)

2) Check gearwheel for wear. If worn, replace complete with matching gear on crankshaft. Gear play (0.01–0.03 mm). Gears are finished after rivetting and any camshaft and gears must be returned to the manufacturing plant for repair

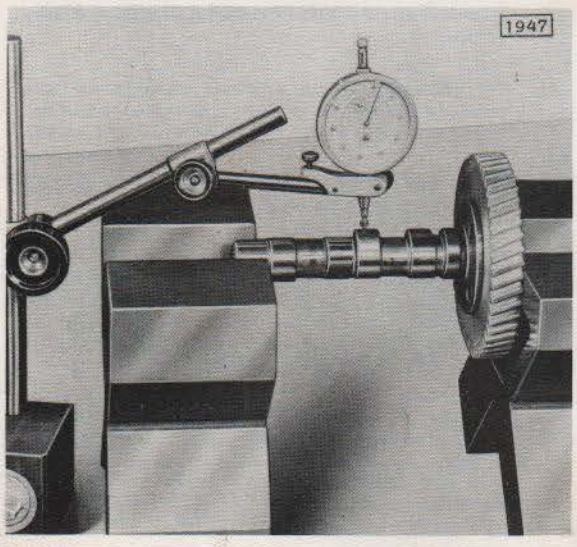


Fig. 10

3) Check camshaft wear:

check lifting face for wear
check cam surfaces
check heights of cams
Camshaft part number 506.1.05.004.2
Camheights 6.5 mm, wear limit–0.12 mm

The camshaft is measured on 2 V-blocs with a dial gauge, see fig.10

C) Fitting

1) Note correct valve control action when fitting the camshaft. The mark on the camshaft gearwheel must match the mark on the crankshaft gearwheel; The valve timing can be checked at 1 mm valve clearance.

The valve timing must be as follows:

Inlet open 3 degrees before tdc. Exhaust open 41 degrees before bdc
Inlet closed 41 degrees after bdc. Exhaust closed 3 degrees after tdc

2) The camshaft end float must be 0.2 mm and is adjusted by shims added to the camshaft bearing. To check, fit both camshaft bearings including paper gaskets to camshaft (on one end the oil pump housing is also the bearing). Furthermore, one shim must be added to the camshaft bearing to act as thrust washer. Insert camshaft into housing half, press both bearings to the housing and check float. To increase float, fit a further paper gasket and shim as necessary.

IX. Crankshaft

A) Removing and dismantling

1) Dismantle engine up to paragraph II/24

2) Remove bearing and clamp crankshaft in vice using aluminium or wood jaws

3) Remove pulley key

4) Remove from crankshaft first third bearing bush, then distributor drive, spacer, camshaftgear with extractor part number 501.1.5520.2

5) Extract main bearing ring (ternary alloy) from crankshaft and remove keys

6) Remove conrods with bearing shells (section "conrod")

7) Remove crankshaft plugs and clean oil bores (always use new plugs and fit well)
Oil bores must not be cleaned without removing the plugs

B) Checking

1) **Crankshaft check bearing points for balance (see fig.11)**

Main bearings nominal size	Big end bearing	auxiliary bearing
48.92–48.93	44.95–44.96	39.92–39.94
wear limit		
48.89	44.92	38.89
Out-of-round		
0.015	0.015	
wear limit	0.03	0.03

Maximum side-play of shaft and gudgeons 0.03 mm.

2) **Checking the bearing seating**

To measure, fit main and auxiliary bearings to engine housing and at the four main screws (4 mkg) and the locating screws

	Float	Wear limit
Main bearings	0.076 to 0.102	0.18
Auxiliary bearings	0.060 to 0.092	0.2
Big end bearing, radial	0.040 to 0.060	0.14
Big end bearing, Auxiliary	0.12 to 0.26	0.60
Crankshaft end float float	0.10 to 0.19	0.60

3) **Examine crankshaft for hair-line cracks**

4) **Tightening torque for flywheel fixing screw = 34 mkg**

5) **Tightening torque for twin pulley fixing screws = 14 mkg**

C) Reconditioning of crankshaft

Crankshafts are hardened by a nitriding process. Therefore crankshafts must be nitrided after regrinding. All nitrided crankshafts are marked "N" on the crankweb.

D) Assembling and fitting

Assemble the crankshaft in reversed procedure noting the following points (for fitting of conrod see section "connecting rod")

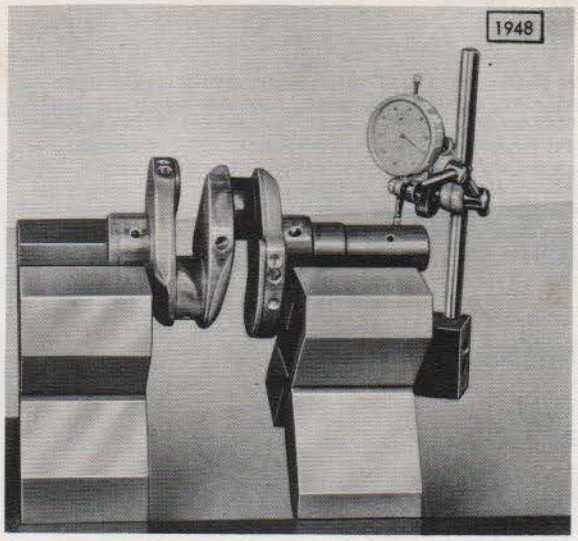


Fig. 11

1) Slide main bearing to crankshaft, locating hole nearer to crankweb. Add shorter key and fit camshaft gearwheel with tool part number 501.1.5533. Proceed by fitting spacer, insert key and assemble distributor worm using the same tool. Fit bearing bush to crankshaft pivot, chamfered bore side facing the crankweb

2) No bearings must be reconditioned

3) Locating holes of the crankshaft bearings must locate on the appropriate locating pins when fitting to housing

4) Fit camshaft including bearings, paper gaskets and shims (see section "camshaft") noting the gearwheel markings. Apply sealing compounds to paper gaskets

5) Apply sealing compound to housing half and studs (do not use paper gaskets)

6) Match the two housing halves and press in the locating screws. Hand tighten first the 2 nuts (M10) of one housing half followed by the 2 nuts on the other half. Tighten the nuts to 4 mkg using the same sequence. All other housing screws are equally tightened without torque spanner

7) Measure the crankshaft and float after fitting the housing halves and flywheel. Add further gaskets between flywheel and crankshaft to achieve specified float. Use special tool part number 501.1.5522 and part number 501.1.5523 to press crankshaft sealing rings into housing

X. Connecting rod

A) Removing

Dismantle engine up to paragraph II/24

1) Loosen conrod clampingscrews and remove conrods and bearing shells

   Do not interchange the conrod bearing shells. Marking is advised. The shells of each conrod must not be interchanged because the lubricating holes in shell and conrod must coincide

B) Checking

1) Weigh the conrods (only if replacements are used). The weight difference of the 2 conrods must not exceed 5 gramms

2) Check small end bush for wear and play on gudgeon pin. Permissible play 0.05 mm. At normal temperature a new small end bush must slide on gudgeon pin using light finger pressure only

C) Assembling

Proceed in reversed order noting the following points:

1) The conrods must be assembled so that the r.h. conrod has its oil-hole facing upwards, the l.h. one downwards (when seen facing the front)

   Ensure matching of lubricating holes between bearing shells and conrods.
   Blank shells must be drilled, hole diameter 3.5 mm.

2) Never use oversized gudgeon pins with worn small end bushes but fit new bushes and pins Press in new small end bush and drill lubrication hole 3 mm diameter. Gudgeon pins are classified in two groups. White marking, 19.997–20.00 mm diameter; black marking, 19.994–19.997 mm diameter.

   Therefore, small end bushes must be reamed to 20.018–20.021 mm diameter for white pins and to 20.014–20.017 mm diameter for black pins.

3) Note temporary markings when refitting old bearing shells (see "dismantling")

4) Tighten conrod clamping screws to 3 mkg. Always use new bolts. The screws must be peened at the end to prevent loosening. Use rounded not sharp punch

5) Upper and lower part of conrod must be in line when tightening the clamping bolts. Insert spacer (0.15–0.25 mm) to take up the end float between conrod and crankshaft for tightening (see fig.12)

This is important because the outer diameter of the bolts is smaller than the holes in the connecting rod and centering is not automatic. Tighten the bolts first to approximately 1.5 mkg and locate the connecting rod bearing halves by light lateral tapping until the upper and lower parts of the bearing halves are in line. Tighten the bolts to 3 mkg. The conrod must slide under its own weight.
Reconditioning of bearings is not permissible.

Fig. 12

XI. Lubrication system

A) Remarks

After dismantling of engine all deposits in oil channels of engine housing and crankshaft must be removed. It is not sufficient to flush the crankshaft channels with petrol or paraffin but they must be removed and all recesses must be cleaned thoroughly. New plugs must always be fitted, locked and checked for leaks. Add sealing compounds to plugs prior to pressing in.

Lubrication circuit from oil pump to lubricating points: The gear pump sucks the oil through a removable oil sieve out of the crank case. The pump incorporates a pressure control valve limiting the maximum oil pressure to 4.5–5.5 Kg/m2.

Excessive oil returns to the engine through the control valve. All oil flowing to the lubricating points pass the oil filter. The oil filter housing contains a by-pass valve ensuring lubrication even if the filter is clogged. Continuous use with clogged up filter damages the engine. The oil flows from the filter via an oil cooler to the lubricating points.

B) Oil pump and oil pressure regulator

When assembling the oil pump ensure the pump gears clear the pump cover but do not have excessive float (End float of gears must be 0.04 to 0.07 mm, oil gears well). Turn engine when fitting the oil pump to ensure engagement of pump drive in camshaft grooves. A paper gasket is fitted between pump and engine. (Note proper fitting of gasket.) No gasket is fitted between pump housing and cover; a thin sealing compound should be used. Check proper valve seating in oil pump cover when fitting the mushroom type valve of oil pressure regulator. The seating can be reconditioned with a special tool part number 501.1.55.045.0 (see "mushroom type valve").

Oil Pressure

Check the oil pressure at an oil temperature of approximately 80–90 degre s C on the warmed up engine. The idling pressure is 1.5 to 3 Kg/m2, maximum pressure at 5000 rev/min 4.5 to 5.5 Kg/m2.

Lines 3 and 4 Amend "Kg/m 2" to read "Kg/cm^2"

C) Fault tracing of insufficient oil pressure

It is particularly important not to interchange the springs for the pressure valve and the by-pass valve. The pressure valve spring has a wire diameter of 1.2 mm and 3.7 mm outer diameter in a relaxed length of 50 mm. The by-pass valve spring has a wire diameter of 0.9 mm, 8.5 mm outer diameter and a relaxed length of 45 mm.

1) **Oil pressure too low at lower speeds but correct at full throttle.**

CAUSE
Mushroom type valve seating leaking.
REMEDY
Remove mushroom type valve, clean oil pump cover, hammer in valve prior to fitting. If hammering does not help, recondition valve seating (see "mushroom type valve").

2) **Oil pressure in order when cold but too low when warming up.**

CAUSE
A leaking mushroom type valve can cause this but it is more likely due to a fault in the oil feed system. Likely causes are: too much float of pump gear wheels due to pump cover wear, driven pump gear wheel fitted incorrectly (rounded side of teeth facing pump cover), driven pump gearwheel damaged on both sides, oil sieve leaking or fault in the tube or flange.

3) **Low oil pressure when driving on bends**

CAUSE
Insufficient oil, or reduced pumping capacity, (see previous page), suction tube leaking in flange or broken.

4) **Reduced oil pressure at high revolutions on cross country drives and when engine is hot, pressure normalised on reduction of speed.**

CAUSE
Too much oil, the crankshaft agitates up the oil and the pump sucks oil mixed with air resulting in reduced oil pressure.
REMEDY
Drain until oil level reaches upper mark on dipstick (inserted nut screwed in fig.13). To check the oil pressure, a pressure gauge can be fitted in place of the drain screw.

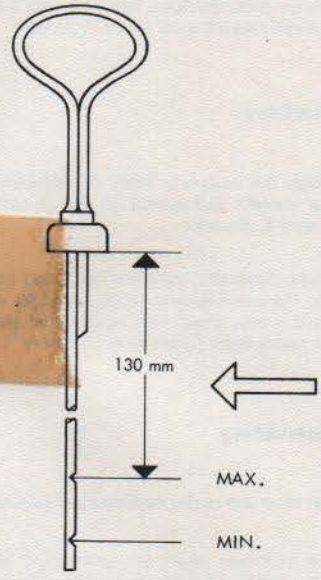


Fig. 13

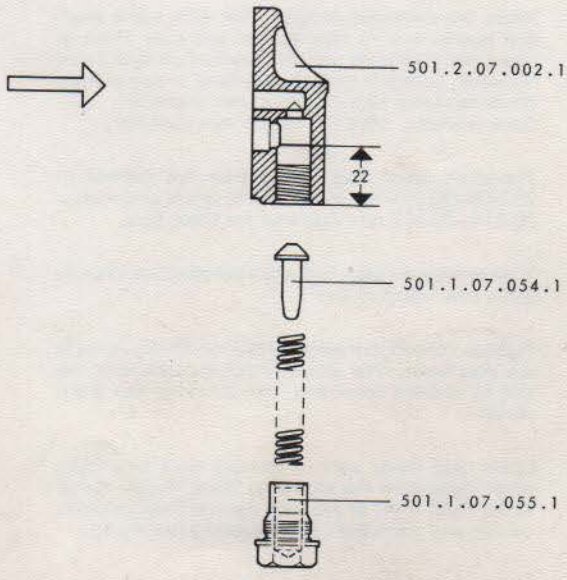


Fig. 14

D) Mushroom type valve (fig.14)

This valve is very sensitive to dirt or seating leaks because the total control lift is only approx. 0.5 mm. Any trapped particles can cause oil pressure reduction. Therefore no large seating is provided and the sealing surface on the aluminium housing for the pressure regulator taking the valve has a sharp edge in fact.

Too much hammering of the valve on the seating enlarges the seating surface and disturbs proper functioning of the regulator valve. Whenever the seating has increased excessively due to the previous-mentioned hammering or due to normal wear the seating must be countersunk to reproduce the sharp edge. Countersink with cutter for oil pressure valve part number 501.1.55.045.0. After countersinking hammer in lightly the valve using our hammering tool part number 501.1.55.052.1.

It is advisable to check the oil pressure after countersinking using a pressure gauge because this can reduce the spring tension and the oil pressure.

To increase oil pressure increase spring tension by adding washers to the valve screw. However washer must only be added if a pressure gauge is used because too much oil pressure could damage the oil cooler.

E) Oil filter and by-pass valve

The engine life depends on proper functioning of oil filter and care must be taken when fitting the filter and particularly the by-pass valve. This by-pass valve uses the same mushroom type valve as used on the oil pressure regulator but a different spring, part number 501.2.07.094.1 is fitted. The relaxed length of this spring is 45 + 1.0 mm and must not be shorter. The by-pass valve opens as soon as the pressure difference before and after the filter exceeds 0.8. The valve seating must be checked visually every time the filter is changed. If necessary, recondition with hammering tool part number 501.1.55.052.1. Leaks on this valve increase engine wear because oil by-passes by the filter.

The filter insert part number 501.1.07.058.1 must be changed at least with every second oil change. A copper ring seals the domed nut on the oil filter. Rings of any other material must not be used because of fractures when tightening. A new paper gasket must be fitted between filter and engine if the filter is removed.

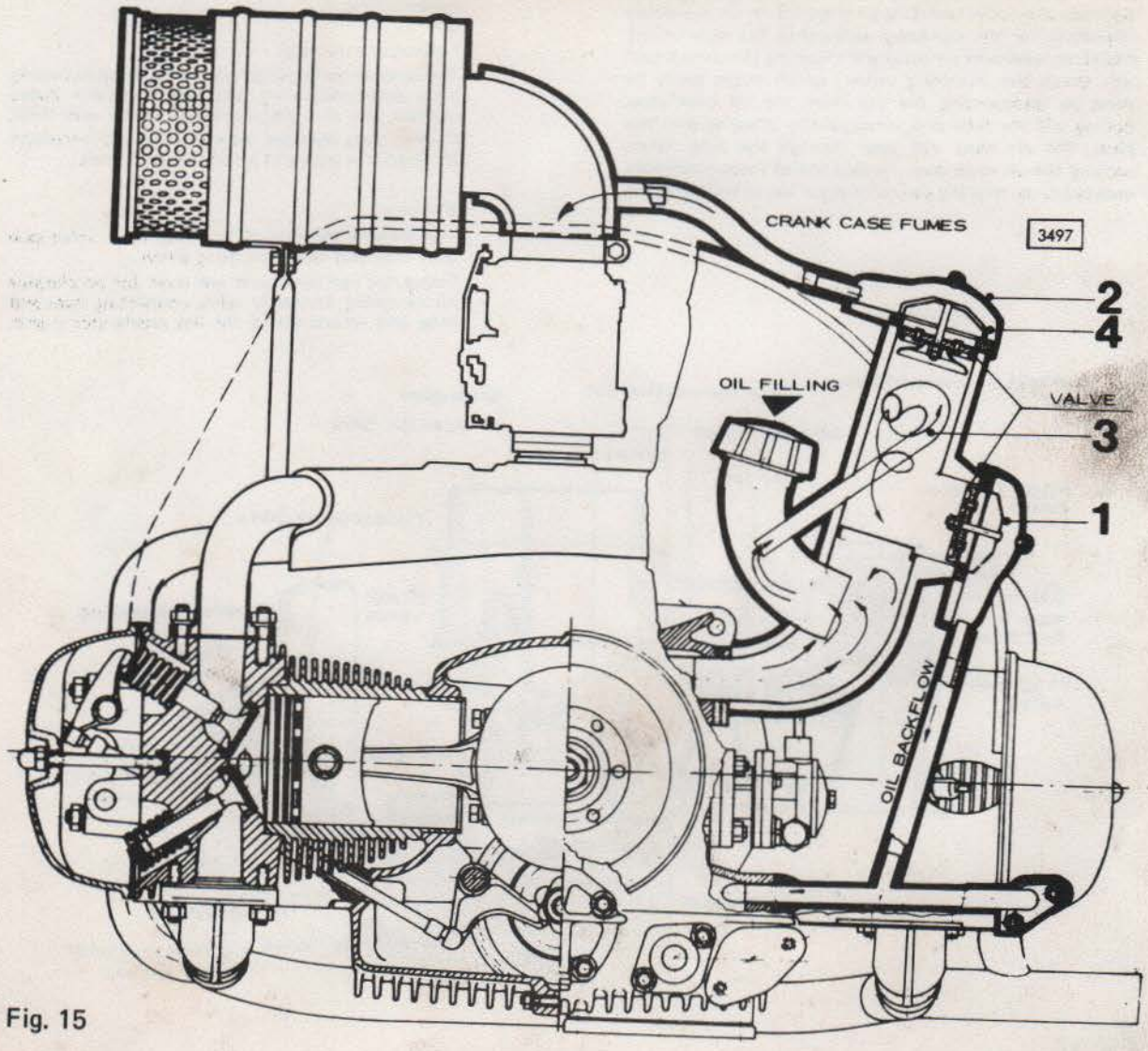


Fig. 15

F) Oil cooler

When fitting the oil cooler, always use new and only genuine rubber rings part number 501.1.0717. The oil cooler lugs must be flat on the housing to prevent any tensions. Tighten all fixing screws equally. When fitting a new oil cooler, first remove all plugs from the oil channels.

G) Closed crankcase ventilation system

1) Operation Fig.15

The oil contained in the fumes emerging from the crankcase is separated in the oil filler pipe and in the space preceding the two fluttering valves (Fig.15/1 and 2). The separating procedure is intensified through the cyclonic effect created by the special elbow (Fig.15/3). After leaving this space, the separated oil returns to the crankcase on passing over the bottom valve (Fig.15/1). The remaining fumes reach the combustion chamber over the top valve Fig.15/2. In order to avoid a carburettor backfiring the cap has been equipped with an additional protective grid Fig.15/4.

2) Checking the fluttering valves

The fluttering valves for the crankcase ventilation have been fitted in the two caps of the oil filler pipe. The tightness and correct working of these valves are extremely important for the crankcase ventilation. We recommend, therefore, whenever servicing and repairing the vehicle that you check the fluttering valves, which might easily be done by dismounting the cap from the oil filler pipe, pulling off the tube and subsequently blowing into the pipe. The air must not pass through the pipe. When sucking the air must pass. In case one of these conditions does not come true the source of error has to be identified.

XII. Fuel System

A) Note

The following carburettors have been selected by us after extensive tests under operating conditions and in test beds. Main jet, correction jet and venturi are originally balanced to give best output at lowest fuel consumption.
The original setting should not be modified.
Most troubles thought to be carburettor adjustments are in fact due to coking, leaking valves, dirty filters, leaks, incorrect timing or similar.
Any such fault must be rectified prior to adjusting the carburettor.

B) Carburettor Solex 40PID

The carburettor Solex 40PID is of the downdraught type with choke and mechanical accelerator pump (see fig.16).

1) Design

The carburettor consists of 3 main parts:

Carburettor cover:
The carburettor cover contains the fuel connector, float needle and choke complete with lever and return spring.

Carburettor housing:
The carburettor housing holds the pressed-in mixing tube with vapouriser and the complete pump injector and also the accelerator pump with lever.
Further parts are float, venturi, main jet, correction jet, economy jet, pilot jet and by-pass bore.

Throttle:
The throttle consists of butterfly valve, valve axle with lever and idling adjusting screw.
Fitted to the valve axle are lever for accelerator return spring, butterfly valve, connecting lever and lever and return spring for the accelerator pump.

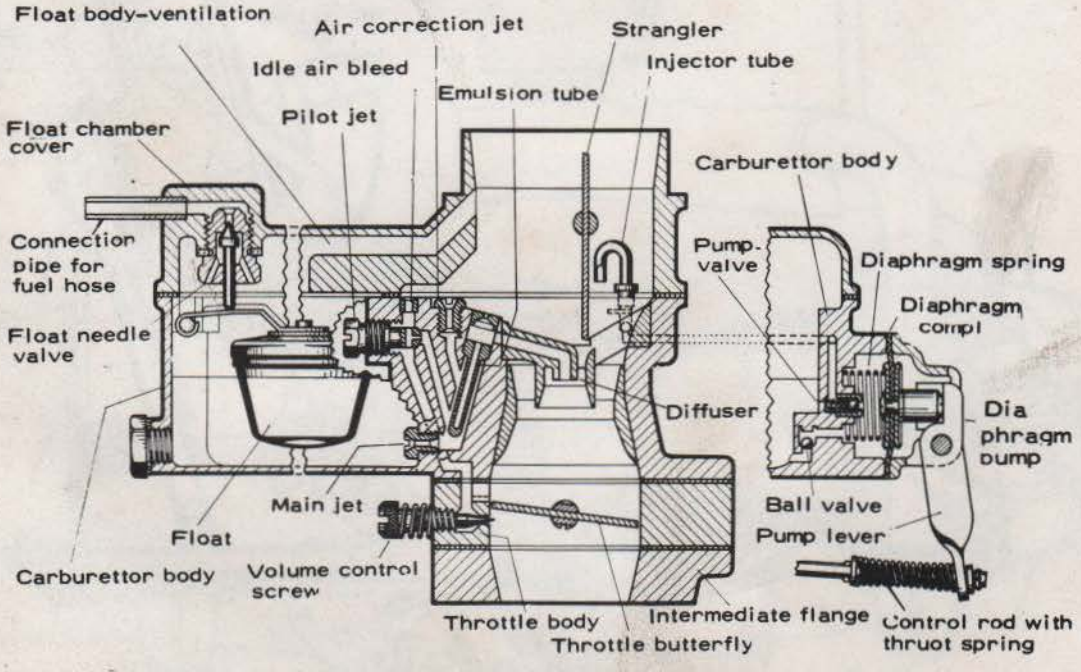


Fig. 16

The throttle also contains the idling mix screw and the intermediate flange is screwed on with four screws.

2) Function and adjustment

Two distinctive functions in a carburettor are noticeable. First the idling system operating from partial to full load.

A separate choke system is not necessary because engine choking is affected by the butterfly valve movement. Closing the butterfly valve produces sufficient vacuum on the venturi to suck fuel for the main jet system.

Starting:

The offset butterfly valve is normally open and is closed by operating the choke control. The valve is spring loaded and the vacuum generated by the running engine opens the valve accordingly to prevent a too rich mixture.

Idling:

At idling air and fuel is mixed through the idling jet and the idling air bore. The mixing ratio is adjustable by the mix adjusting screw fitted to the throttle. The idling adjusting screw also fitted to the throttle permits adjusting of engine idling speed.

Adjusting the idling:

Check condition and gap of spark plug before idling and adjustment commences.

Proceed as follows:

Warm up engine and switch off.
Close idling mix adjusting screw completely and then open one complete turn. Start engine.
Adjust idling screw until engine runs slightly above idling speed.

Turn mix adjusting screw either way to find highest engine speed. Turn back idling screw to correct engine speed (approximately 700 r.p.m.).

Turn again mixture adjusting screw either way to find highest engine speed. If the idling speed is now again too high, reduce with idling screw and repeat finding highest engine speed. If the engine cannot be adjusted ensure accelerator pump is in order. If the pump is in order check as follows: Increase idling speed with idling adjusting screw and turn the mix adjusting screw. If the speed increases by screwing in, the mixture is too rich at partial load and must be weakened as much as possible at idling. If screwing out increases the speed the mixture is too weak at partial load and can be enriched at idling. Note that light movement of the mix adjusting screw is already noticeable.

The screw must not be screwed home completely. If in exceptional cases idling cannot be adjusted in this manner change the idling jet to the next larger or smaller size.

A second check is to screw the mix adjusting screw fully home after carburettor tuning. The engine must stop.

If the engine is not affected by screwing in the mix adjusting screw or if the engine runs balanced only when screw is turned home completely the idling is too high or by-pass bores in the carburettor are incorrect.

Normal operation:

The fuel outlet for normal operation is different to other carburettors. The mixing tube carrier is replaced by an outlet arm cast into the carburettor housing, pointing downwards and ending in the smallest section of the carburettor. The outlet arm is connected to a vertical bore holding the mixing tube. A cross bore connects to the correction jet. This system prevents foam problems. Normally the fuel reaches the same level in float chamber and mixing tube. The vacuum generated in the suction channel sucks fuel through the outlet arm mixing with the incoming air.

Air enters through the correction jet as soon as the increasing vacuum reduces the fuel level in the mixing tube. This air mixes with the fuel flowing through the main jet and ensures the same mixture ratio at all engine speeds.

Acceleration

The chamber of the carburettor is filled with fuel sucked from the float chamber. A spring presses the membrane to the pump lever. Opening the butterfly valve actuates the pump level by a linkage and the lever presses the membrane inwards injecting fuel through the injection tube into the mixing chamber.

The amount of additional fuel for acceleration is controlled by the pump stroke. The pressed-in pump nozzle controls the duration only.

3) Adjusting the float

Note the following points for adjusting the float fuel level: Ensure the needle valve is properly screwed into the seating. Hold float chamber horizontally for the float weight to press downwards.

Measured from the TOP FACE OF THE FLOAT CHAMBER (without gasket) the fuel level must be 14 to 16 mm. If the petrol level is not correct, this can be corrected by placing gaskets between the float needle valve and the carburettor cover.

Note

The float level adjustment must be rechecked every time the float or the needle jet (needle valve) is replaced.

4) Tune up data for carburettor Solex 40PID

Diameter	32
Venturi	25
Main jet	112.5
Correction jet	100
Mixing tube	K 18296
Idling jet	g55
Idling air bore	1.6
Injection quantity	0.4–0.5 cm3/stroke
Float needle valve	1.5 with ball
Weight of float	7.3 grams.

Level adjustment float

At a pressure of 2mWS with removed carburettor cover measured from top of float chamber 14–16 mm

By-pass 1.2/1.6 + slot 0.65

ADJUSTING THE FLOAT NOTE

THE FUEL PIPE FROM THE PUMP TO THE CARBURETTOR MUST BE DISCONNECTED FROM THE CARB BEFORE REMOVING THE FLOAT CHAMBER COVER. IF THIS IS NOT DONE, FUEL WILL SPILL FROM THE PUMP/CARB FUEL PIPE INTO THE FLOAT CHAMBER ON REMOVAL OF THE FLOAT CHAMBER COVER AND GIVE A FALSE FUEL LEVEL IN THE FLOAT CHAMBER

C) Carburettor Weber 32ICS3

The carburettor Weber 32ICS3 is of the down-draught type with butterfly valve and mechanical accelerator pump. Twin float chambers with 2 floats guaranteed fuel supply when in a sloping position.

1) Design

The carburettor consists of 2 main parts.

Carburettor cover: (see fig.17)

The cover holds fuel connector, filter sieve with water trap (syphon), float unit with damped float needle valve and butterfly valve with flutter valve.

The carburettor cover is designed to take pure air for float ventilation and idling system through the air filter.

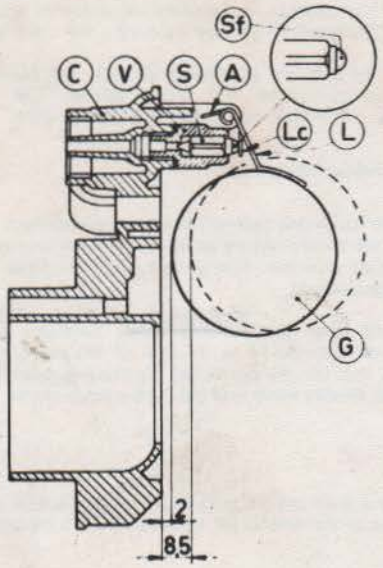


Fig. 17

Carburettor housing (see fig.18)

The carburettor housing contains the butterfly valve, valve axle with bearing and butterfly valve adjusting screw. Fitted to the valve axle are the levers for accelerator linkage, return spring, butterfly valve, return spring and accelerator pump. The housing also holds the accelerator pump with pressure bolt and spring, the pressure and the suction valve with return bore and the injector system consisting of main jet, mixing tube, correction jet, vapouriser, venturi idling jet, idling air jet, mix adjusting screw, idling inlet bore and by-pass bores.

2) Function and adjustment

From the functioning point the carburettor can be separated in two parts.

First the idling carburation operating from no-load to partial load, secondly the main carburation operating from partial to full load.

Starting

A separate choke system is not necessary because engine choking is affected by the butterfly movement. Closing the butterfly valve produces sufficient vacuum on the venturi to suck fuel from the main jet system.

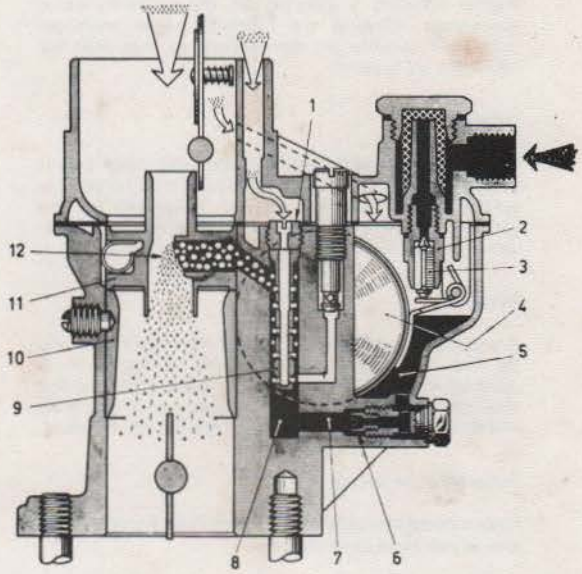


Fig. 18

Close choke by pulling knob out completely—position "A". Reduce choke in steps during the engine warming-up period (applies too if vehicle is rolling). **(fig.19)**

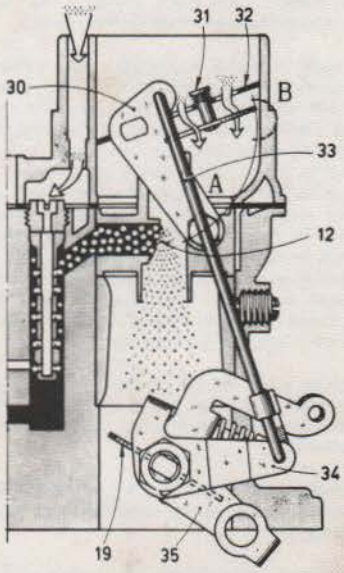


Fig. 19

Normal use of vehicle—no choke

Position "B" as soon as engine reaches operating temperature. Do not use metallic aids to clean the accurate fuel-mixture-and air bores on the carburettor.

Idling system (fig.20)

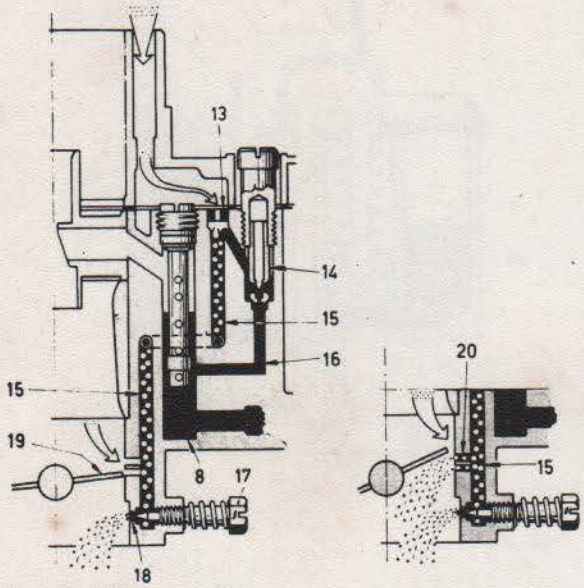


Fig. 20

The fuel flows through channel (16) and guided mixing tube chamber (8) to the idling jet (14) and idling bore (18) controlled by the screw (17) and reaches the outlet port by channel (15) through the by-pass bore (20).

The idling mixture is controlled by:

The idling jet for fuel quantity.

The idling jet for air quantity of mixture.

The idling mix adjusting screw for quantity of mixture.

The air entering through the butterfly valve opening.

Fuel required for idling originates from the main jet system after the main jet. The idling jet sucks the fuel to the apex above the fuel level where mixing with air from the air nozzle is taking place. This mixture flows through the idling bore and is controlled by the idling mixture adjusting screw.

The bore ends above the butterfly valve. At almost closed butterfly valve this mixture is sucked from the bore into the suction channel and mixes further with air entering the butterfly valve gap to the final idling mixture. All other bores are by-passed for different purposes. Some primary mixtures are also sucked through the by-pass near the butterfly gap, but the by-pass above the butterfly valve acts only if this valve is opened.

The by-passes help to improve the change from idling to main system. The idling mixture can be made weaker or richer by turning the idling mix adjusting screw. Turning-in weakens, turning-out enriches the mixture. The correct mixture ratio is therefore adjusted with this screw.

The actual idling speed is adjusted with the idling adjusting screw fitted to the butterfly axle bearing. Idling speed increases by turning-in the screw and decreased by turning-out.

Adjusting the idling system

Check condition and gaps of sparkplugs prior to adjusting idling speed.

For correct idling adjustment proceed as follows:

Warm up engine and switch off again.

Close idling mix adjusting screw and reopen one full turn.

Start engine.

Adjust idling screw until engine runs slightly above idling speed. Turn mix adjusting screw either way to find highest engine speed. Turn back idling screw to correct engine idling speed (approx. 700 r.p.m.). Again turn mixture adjusting screw either way to find highest engine speed. If the idling speed is now again too high, reduce with idling screw and repeat, finding highest engine speed. If the engine cannot be adjusted, ensure accelerator pump is in order. If so, check as follows: Increase idling speed with idling adjusting screw and turn the mix adjusting screw. If the speed increases by screwing in the mixture is too rich at partial load and must be weakened as much as possible at idling. If screwing out increases the speed, the mixture is too weak at partial load and should be richer for idling. Note that light movement of the mix adjusting screw is noticeable. The screw must not be screwed home completely. If in exceptional cases idling cannot be adjusted in this manner change the idling jet to the next larger or smaller size.

A second check is to screw the mix adjusting screw fully home after carburettor tuning. The engine must stop. If the engine is not affected by screwing in the mix screw or if the engine runs balanced only when screw is turned home completely, the idling is too high or by-pass bores in the carburettor are incorrect.

Normal conditions: (see fig.18)

Fuel flows through the needle valve (2) to the float chamber (5). The float (4) controls opening of needle (3) to retain fuel level. From the float chamber (5) the fuel flows through the main jet (6) and channel (7) to the mixing tube chamber (8). Air from mixing tube (9) and from correction jet (1) mixes with the fuel and the mixture passes through the spraytube (12) into the carburation zone consisting of vaporizer (11) and venturi (10).

In normal conditions carburation commences in the mixing chamber by the main jet system. The venturi is in the mixing chamber. Above the venturi is the vaporizer connected to the mixing tube storage chamber by a calibrated channel. In the storage chamber is the mixing tube clamped by the correction jet. The main jet is screwed into the main carrier on the lower part of the float chamber.

This gives a constant fuel/air mixture ratio at varying vacuum and air speeds respectively. The total of all by-pass square sections is larger than the correction jet square section. Therefore, the correction jet is activated as soon as the fuel level in the mixing tube storage chamber sinks to open all by-passes. The correction air jet and the main fuel jet are the final mixture for maximum engine speed.

Production vehicles are tuned for economical fuel consumption and the main jet is one size smaller than required for maximum engine output. Because the correction jet is only activated after the by-passes are opened, it is obvious that jet size effects the mixture in the upper range only.

The air/fuel mixture under normal conditions is controlled by:

the main jet for fuel quantity;
the correction jet regulating exchange air together with the mixing tube;
the vaporizer calibrating flow out of mixing tube storage changer;
the venturi regulating the main air.

Fuel flows from the float chamber through the calibrated bore to the main jet. This jet is filled up to the general fuel level. A vacuum builds up as soon as the butterfly opens, most in the venturi. This vacuum actuates the main jet system and sucks fuel from storage chamber of mixing tube through outlet port of vaproizer.

To prevent too rich mixture at increasing vacuum, the mixture tube has by-pass bores controlled by the reducing fuel level, permitting air to enter from the correction jet.

A smaller jet gives a rich mixture, a larger jet a weak mixture in the upper range. A larger main jet richens the mixture over the full normal range. A smaller main jet weakens the mixture accordingly. The main carburation must commence before the idling system stops. Commencement of main carburation can be adjusted by altering outlet port, vaporizer and venturi. Correction jet size can also sometimes effect this. Original adjustment of main jet, correction jet and venturi give good output at reasonable fuel consumption. Changes are only called for if a very different fuel is used. In general we advise you not to alter this adjustment.

The following rules apply for changing jets.
Main jet larger = higher output, increased fuel consumption.
Main jet smaller = reduced output, reduced fuel consumption.
Correction jet larger = reduced fuel consumption, reduced maximum output.
Correction jet smaller = increased maximum output, increased fuel consumption.

Acceleration (fig.21)

The lever (24) moves shaft (26) to lift piston (27) when closing the butterfly valve. Fuel is sucked from the housing into the pump cylinder through suction valve (29) and the channel (28). Opening the butterfly valve releases shaft (26) and the piston is pushed to the lower of the return springs.

Fuel flows through channel (23) and pressure valve (22) to the pump jet (21) and is injected into the carburettor tube. A correction bore can be added to the suction valve (29) to return part of the fuel from the pump to the housing.

The carburettor acceleration pump is of the piston type. An auxiliary chamber acts as pump cylinder for the moving piston. The piston hangs on a rod fitted with the accelerator pump spring. The piston moves upwards on closing of butterfly valve and sucks fuel through the suction valve into the pump cylinder. This is the suction cycle of the pump controlled by the length of the rod. A shorter rod reduces, a longer rod increases the stroke and, therefore, the injection quantity. The rod is released when the butterfly valve opens and the spring moves the piston downward. This is the pressure cycle of the pump.

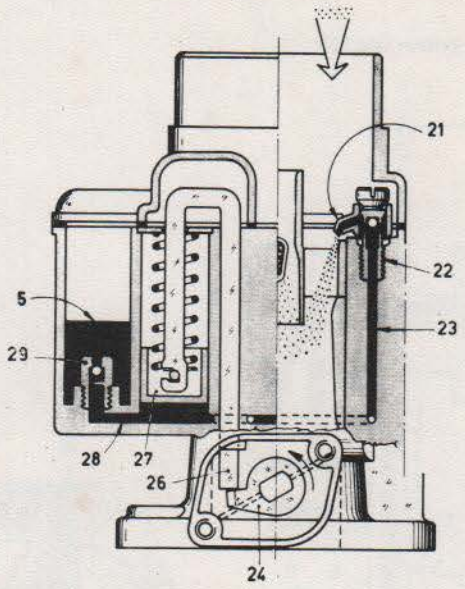


Fig. 21

Pressure and injection duration at equal outlet opening is controlled by the spring. During the pressure cycle, fuel is pushed through the pressure valve and the injector into the space above the vaporizer. This space has the least vacuum in the carburettor. Therefore no fuel can be sucked through the injector by vacuum at normal conditions but only at full load and high engine speed. Check and clean the pumping injector whenever the carburettor is serviced.

Dirt on reposition of injector gives weak mixture in the upper speed range and causes reduced output and overheating of engine. The pump suction valve has a return bore to permit adjustment of injection quantity and duration without altering stroke or spring pressure. Part of the sucked fuel returns through this bore to the float chamber.

Fuel injected during the pressure cycle improves change from idling system to main carburation for improved vehicle acceleration. Accelerator pump adjustment has been established during tests in the manufacturing plant and should not be altered. For special conditions, extreme operating heights or cold weather a suction valve with smaller (richer mixture) or larger (weaker mixture) return bore can be fitted.

3) Adjusting of float

Adjusting of float fuel level (fig.17)

The following remarks must be considered when adjusting the float fuel levels.

Ensure needle valve (V) is properly screwed into seating. Hold carburettor cover (C) vertically to enable weight of float (A) to press fully on free ball (Sf) positioned on top of needle (S). When the cover is vertical and the spring (Le) just contacts ball (Sf) of needle (S) the float (G) should be 2 mm from the cover surface (without gasket).

After level adjustment ensure travel of float (G) is 6.5 mm.
Rectify by altering position of boss (A).
If float (G) does not stand properly, alter position of float springs (L). Ensure that small spring (Lc) is vertical to the axis of needle (S) and that contact surface is not scratched. The needle must slide freely.
Fit carburettor cover and ensure float moves in housing without friction.

Note: Check float level adjustment after replacing float needle valve.
In the latter case replace also the gasket.

Choke (see fig.19)

If lever (30) is in position "A" the butterfly valve (32) stops air supply and the butterfly valve (19) is partly opened by the lever (34). Spray tube (12) now feeds a rich mixture for quick engine starting. The vacuum on the running engine opens the small valve (31). Air can enter through the holes in butterfly valve (32) and weakens the mixture from the spray hole (12) to suit normal running of engine.

During warming up of engine the butterfly valve (32) must be opened progressively. Switch off choke when normal temperature is reached. Position "B".

4) Tuning valves for carburettor 32ICS3 part number 700.1.08.250.0.

Diameter	32	Starter valve	160 grams at 7 mm
Venturi	25		
Main jet	125	Fuel needle valve	1.50 mm
Correction jet	230	Float weight	25 grams
Mixing tube	F17	(Distance from cover valve closed	
Idling jet	55	without gasket	2 mm
Idling air jet	1.75	Float air vents	2 x 8 mm
Vaporizer	4.5	Correction jet vent	4.3
Accelerator jet	50	By-pass	3 bores
Return jet	90		2 dia. 1.7 dia. 1.7 dia.
Accelerator pump stroke	10 mm		

D) Maintenance, carburettor with fuel pump

1) Clean carburettor every 3,000 miles

Cleanliness is of utmost importance, particularly for sealing surfaces.

Always use new gaskets. To clean jets use compressed air only. Check once every year all gaskets, rubber membranes and float needle valve. Replace as necessary. Do not alter adjustments for normal use. Do not over-tighten jets and screws.

2) Fuel pump Weber PM27 and Solex PE15080

For fuel pump troubles always check membranes and valve leaves. When fitting upper and lower part together ensure air vent in lower part is at the bottom when fitted. If oil leaves air vent replace lower housing and operating plunger. The pressure must be approximately 1 to 1.5 m water gauge, that is 0.1 to 0.15 kg/m2.

The same applies for the Solex fuel pump. However, when fitting a new membrane, the plunger length must be adjusted to press down the membrane completely but without over tensioning. The pumps are fitted to the engine with insulating plates. At lowest position of pump lever, the pumps including insulating plates and gaskets must be pretensioned by 0.5 mm.

XIII. Operating troubles and causes

A) Starting and carburation troubles

1) Engine won't start

Possible causes

Belt tension insufficient, causing belt to slip.
Battery discharged or bad cable connection.
Faulty starter delay.

Ignition: faulty ignition coil, loose cable, dirty distributor, faulty spark plugs, wrong timing (wrong position of fan to engine housing).
Wrong tappet clearance.
Carburettor: choke nut closing, flutter valve spring faulty.

2) Bad Idling

Idling or correction jet blocked.
Idling channel or by-pass bore blocked.
Wrong fuel level or leaking float needle valve.
Damaged mixture adjusting screw or worn butterfly valve axle.
Leaks: on carburettor flange;
on cylinder head.

3) Increased Idling

Above 800 r.p.m.
Incorrectly adjusted mixture screw.
Choke stop screw too far screwed in.
Choke butterfly valve not opening.

4) Carburettor flooding

Leaking float needle valve.
Faulty float needle valve seal.
Faulty float.

5) Rough change from idling to main carburation

Blocked by-pass bore.
Loose or blocked injection tube.
Incorrect injection tube.
Incorrect injection quantity.
Leaking seating or wrong size of return jet.

6) Fuel consumption too high

Leaking float needle valve or seating leaking.

Fuel level too high.
Feed pressure of fuel pump too high.
Idling or main jet loose or blocked mixing tube.
Choke butterfly valve not opening completely.
Injection jet too large or return jet too small.

B) Lubrication system

1) No oil pressure

If oil pressure light remains on when engine is running switch off immediately and find cause.
A faulty oil pressure switch can cause the oil pressure light to come on. The oil pressure switch is earthed and a short circuit to earth of switch cable has the same effect.

Check oil level in engine.
The oil level must be between minimum and maximum marks on dipswitch. Ensure oil level is not above maximum mark. The crankshaft would be submerged causing the oil to foam and air to enter the oil bores. Pressure would reduce and oil pressure lamp light up. After checking the oil level, a pressure gauge can be fitted in place of the drain screw on the oil filter housing. The maximum oil pressure is 4.5 to 5.5 kg/m2. Idling pressure 1.5 to 3 kg/m2.
Trouble shooting if no oil pressure.
Check for leaks of oil bores, crankshaft bearings and oil cooler. If in order, remove oil pump and check pump gears and gear drive.

2) Trouble shooting if oil pressure too low

Oil pressure too low at low engine speeds but in order at full throttle.
Cause: seating of mushroom type valve leaking.
Remedy: clean oil pump cover. Recondition seating. Hammer mushroom type valve with special tool part number 501.1.55.052.1.

Note: Too much hammering enlarges valve seating and prevents functioning of regulating valve.
The oil filter is fitted with a by-pass valve opening at a pressure of approximately 0.8 kg/m2 if filter is completely blocked.

I. Dynastarter
Bosch IA/FJ 160/12/3000+ 0.1 R 3

The Bosch Dynastarter used in Steyr-Puch cars is a unit combining a starter and a dynamo.

A) Test Valves (see Fig.22 and 23)

N max = 240 W
J max = 20 A
N max = 10000 r.p.m.
O watt = 2800 r.p.m.
Cut in speed = 2900–3000 r.p.m.
Minimum speed = 3000–3200 r.p.m.
Stall torque current 300 A
Battery voltage 9V
Torque 1.8 mkg

Check stall torque current of starter by blocking flywheel or on test bench. Temperature 20°C, battery 50% discharged. Measure stall torque and battery voltage two seconds after switching on.

Do not mix up connecting cables of dynamo and regulator. It is advisable to use an open cable shoe for terminal DF (the nut on terminal DF cannot be removed). Use closed cable shoes for terminals D+ and D–.

Use the following cable sizes:
Terminal DF: 1 mm^2 minimum
Terminal D+/61: 4 mm^2 and 1 mm^2 minimum.

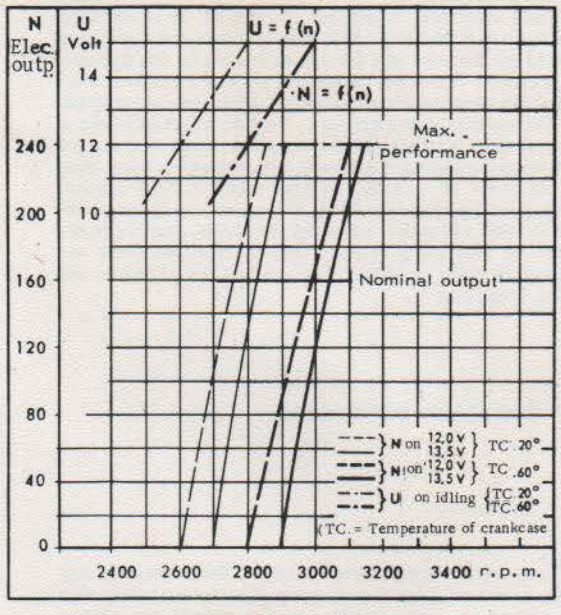


Fig. 22 Dynamo

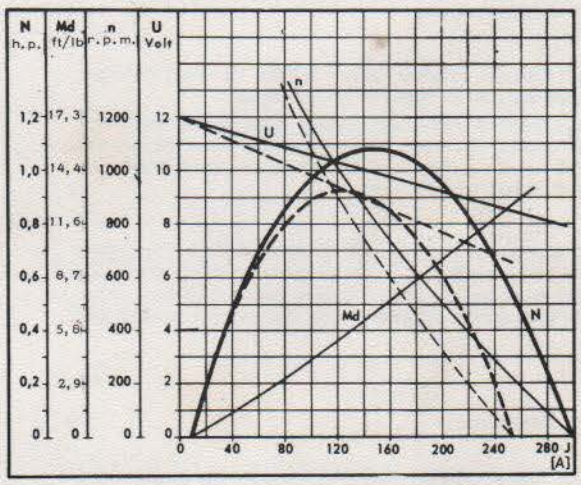


Fig. 23 Starter

B) Components

The main components of this unit are:
Housing with 4 pole shoes
Starter field coil
Dynamo exciter coil
Armature with winding and commutator
Carbon brushes and brush holders
Bearing flanges

C) Function

The Dynastarter is one of the most important parts of the electrical equipment.

1) When starting, the starter unit has to overcome various mechanical engine resistances (compression, piston and bearing functional. A series wound motor is required for this work. Armature windings and field coils are connected in series to take the full battery current to develop larger torque. After starting the engine, the starter windings are switched off.

2) The dynamo is driven by the engine and has to supply current to the various electrical consumers in the car as well as charging the battery sufficiently. This has to be done under constantly changing conditions because the engine speed varies constantly particularly when driving in towns or mountains. The dynamo speed will alter accordingly. Since output voltage and current relate to the speed the dynamo requires a regulator to work properly in all conditions. The regulator is fitted separately.

The dynamo works as follows: the armature has copper winding and rotates in a magnetic field. The rotating armature windings cut through the magnetic lines of force between the field poles inducing an electronic force in the windings. If the circuit is closed a current flows, is picked up on the commutator and is fed to battery and consumers.

The dynamo is a direct current shunt type unit. Armature and field coils are connected in parallel. A shunt type dynamo is self exciting. This means the current required to build up the magnetic field is generated by the dynamo and is taken from the armature. Any magnetised iron (pole shoe) retains some magnetism called residual magnetism. On starting a dynamo only a weak magnetic field is active at first. Cutting of the magnetic lines of force by the armature windings induces at first a small voltage causing the flow of a small exciter current. This current strengthens the magnetic field. The electronic force generated in the armature windings increases and increases further at increasing speed. This is repeated until the dynamo is fully excited. For control of dynamo see section "regulator".

D) Maintenance of dynamo

1) Belt tension

The belts transmit the starter forces to the crankshaft and subsequently to drive the dynamo. Correct belt tension is very important. Light thumb pressure should not depress the belts more than 1 to 2 cm.

2) **The danger of short circuits is present on all work on the electrical installation and therefore the battery should always be disconnected.**

3) Carbon brushes

Check carbon brushes every 6,000 to 10,000 miles. Brushes must move freely in brush holder.

Carbon brushes and brush holders must be free from dirt. oil or grease. Dirty or sticking brushes must be cleaned with a cloth damped with petrol, properly dried and checked for free movement.

Blow out brush holder well. Brushes worn to the point where brush spring or brush lead nearly touch the brush holder must be replaced. Fit only genuine Bosch carbon brushes to ensure sufficient life and current quality and size.

4) Commutator

Proper functioning of the dynamo depends on the commutator surface. The surface should be smooth and greyish black and must be free from dirt, oil or grease. The commutator must also run true or brushes will lift off and cause commutator sparking, preventing proper current supply.

Clean commutators with a clean cloth damped with petrol and dry well. Grooved or untrue commutators must be turned down (permissible out of balance 0.03 mm). Turn down as little as possible and skim insulation between commutator leaves. Finally smooth commutator with finest lapping paper (not sanding paper) and blow out properly.

5) Lubrication

The dynamo is fitted with ball bearings sufficiently greased to last for 15,000 miles. Dismantle dynamo at this interval, clean ball bearings with petrol and regrease with special Bosch grease.

E) Trouble shooting

Generating troubles can be caused by dynamo, regulator, battery and cables. Some causes and possible remedies are mentioned as follows:

F)	Fault	Remedy
1)	Battery is flat or insufficiently charged. Brushes not contacting commutator properly, sticking in holders, are worn oiled up or dirty.	Check brushes, clean or replace as necessary.
	Commutator dirty or oiled up.	Clean commutator.
	Commutator worn.	Turn down commutator and skim.
	Cable 30/51 between battery and regulator or earth cable between battery earth and dynamo loose or damaged.	Repair or replace, tighten terminals.
	Faulty battery.	Have battery repaired by specialised workshop.
	Open or short circuit in dynamo.	Check dynamo, or pass to specialised workshop for repair.
	Regulator adjustment too low: regulator faulty.	Readjust or replace faulty unit.
	Fan belts too loose.	Tension fan belts.
2)	**Charging light not lighting up when engine is off and ignition switched on:**	
	Indicator bulb faulty	Replace bulb.
	Battery discharged.	Charge battery.
	Battery faulty.	Repair or replace battery.
	Cable 61.30 or 31 loose or damaged.	Repair or replace cable, tighten terminals.
	Faulty regulator.	Replace regulator.
3)	**Charging light not off at higher speed:**	
	Cable 61 short circuit to earth.	Repair or replace cable.
	Regulator faulty.	Replace regulator.
	Fuse blown.	Replace fuse (25A). Regulator must be earthed.

II. Regulator

The cars are equipped with a Bosch regulator type RS/TBA 160/12/1 and a separately fitted Bosch starter relay type 0.333.009.003.

The Bosch regulator RS/TBA 160/12/1 fitted to Steyr-Puch engines is of the two contact type. This is a unit combining voltage regulator and cut-out. The regulator

has an output curve reducing the voltage at increasing load. This gives a high charging current to a discharged battery but a low current to a charged one and prevents over-charging.

A) Starter Relay

1) Design

The starter relay consists of:
Magnet core
Exciter coil
Armature with contacts.

2) Function

Turning the ignition key energises the starter relay magnet coil and pulls in the contact armature. A current flows now through the closed contacts from the battery to the starter field, to armature windings, to earth back to battery and turns the starter. Releasing the ignition key interrupts the starter relay exciter and the spring loaded contact armature opens the contact disconnecting the starter windings from the battery.

B) Regulator

1) Design

The most important components of the regulator are frame, magnet core, regulator armature, cut-out armature, cut-out contacts.
The magnet cores carry the voltage coil (many turns of thin wire) and the current coil (few turns of heavy wire). Regulator and cut-out armatures are held by a spring acting against the electromagnetic forces of the coil assemblies.

C) Purpose of Regulator

The dynamo must be disconnected from the battery automatically if the engine is switched off or runs slowly, because the dynamo output voltage is below battery voltage and the battery would discharge through the dynamo. At increased engine speed the contact armature connects the dynamo automatically parallel to the battery and the dynamo supplies consumers and charges the battery.

D) Function

The cut-out contacts close when the dynamo has sufficient speed and reaches the cut-in voltage. The dynamo is connecting parallel to the battery. The dynamo output voltage is somewhat higher when the battery voltage and current flows from dynamo to the battery. The battery is charging. Current flowing through the current coil ensures further proper closing of contacts until the speed drops too much.

The cut-out contacts are opening when the dynamo voltage falls below the battery voltage due to reduced speed. The reverse current flowing from the battery to the dynamo through the current coil reduces the magnetic field force and the regulator armature is pushed off.

The cut-out contacts control also the charging light. This light is connected in series to the ignition switch and to terminal 61 of regulator. The charging light lights up if ignition is switched on but the dynamo is stationary or slow running. The dynamo output voltage is below battery voltage and the cut-out contacts are open. The voltage difference between dynamo and battery permits the flow of current from positive pole of dynamo to charging light. Lighting up of this bulb indicates ignition is switched on but dynamo is not charging. The light goes out as soon as the dynamo output voltage reaches the value of the battery voltage at a certain speed enabling the cut-out contacts to close. The light is then short circuited. Charging light switching off indicates dynamo working and connected to the consumers. However, it does not necessarily mean the battery is being charged.

E) Voltage regulator—regulator contacts

1) Function

The regulator contacts are activated as soon as the dynamo reaches the regulating voltage and further speed increase would increase also the output voltage. The inner and the outer contacts are fixed. The centre contact moves with the spring loaded regulator armature. First regulation commences between the outer pair of contacts. A resistance is connected before the dynamo exciter winding approximately 50 to 200 times per second thus keeping the output voltage at the same level.

If the speed increases, this method is insufficient to hold the voltage and the inner pair of contacts takes over. These contacts short circuit the exciter winding in rapid succession and again hold the output voltage level. Both regulations are controlled by the voltage coil. The full dynamo output current flows through the current coil and lightly reduces the regulating voltage at increasing load. This protects the dynamo from overloading and the regulator is said to have a fallen output curve.

F) Maintenance

The regulator does not require any maintenance. Regulators with worn contacts or other faults must be replaced.

G) Adjusting of no-load voltage and reverse current respectively

Do not open the sealed regulator during the guarantee period because Messrs. Bosch would not honour any such claims.

1) Checking the no-load voltage

A direct current voltmeter of the moving coil type having a range of 20V is required.
Check as follows:

Connect positive (+) terminal to voltmeter to Regulator terminal (B+/30) and negative (–) terminal to earth.

Connect terminal 30/51 to positive terminal of battery. Start engine, increase speed by moving butterfly valve axle on carburettor and again disconnect cable 30/51 from positive terminal.

Increase engine speed slowly until voltmeter reaches maximum movement and read no-load voltage.

Regulator adjusting values

Regulating voltage,	no load	14.3–15.3V
		Cut in voltage
		12.4–13.1V
	full load	13.1–14.3V
		Reverse current
		2–7.5A
	output	160W
	full load current	15A

Increase engine speed to approximately 4,000 r.p.m. The indicated voltage should not alter more than 0.2 to 0.6 volts.

The regulator cover must be fitted for measuring and the engine must be warm.

Run on a cold engine for approximately 20 minutes prior to measuring.

2) Adjusting the Regulator

To adjust remove regulator cover. Engine must be warm (see measuring the load voltage). Adjust regulator by bending angle bracket of regulator armature using the regulator adjusting tool. Bend angle bracket towards regulator to increase voltage and away to decrease voltage.

Proceed until required value is obtained. Note that the no-load voltage will reduce approximately 0.1 to 0.2 volts after fitting the cover (see fig.24). To prevent short circuiting switch off engine, leave positive battery terminal disconnected, replace regulator cover and recheck no-load voltage again.

H) Cut-in voltage

Check cut-in voltage with battery in circuit. Connect voltmeter to terminal 61 or D+ respectively. Connect load resistance (nominal load) to terminal 51 or 51B+ respectively. Increase speed slowly and the voltage increases accordingly. The cut-out has switched when the voltage drops. The maximum voltage before dropping is the cut-in voltage. Do not keep engine running at cut-in speed because the cut-out flutters. Light flutter is not significant because cut-out switches positively under normal operating conditions. Use regulator adjusting tool to adjust the cut-in voltage (see fig.25)

1) Checking the reverse current

A direct current ammeter with centre zero position and a range of 15A is required.

Check as follows:

Disconnect cable from regulator terminal 30/51 and connect ammeter to terminal and cable.

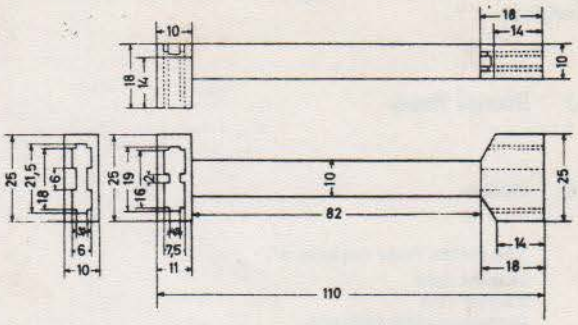


Fig. 24

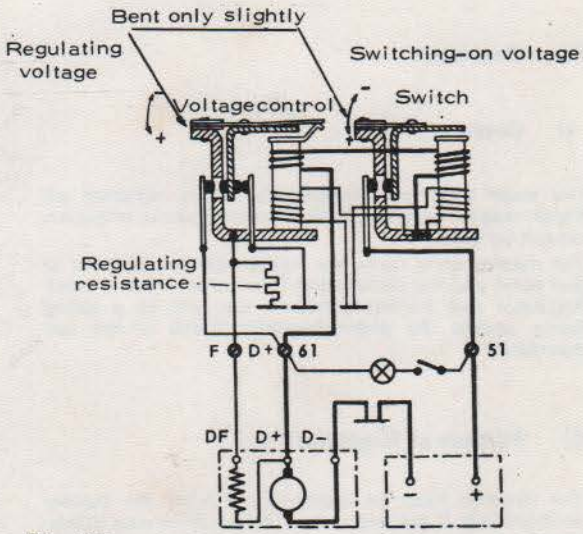


Fig. 25

Start engine and increase speed until maximum charging current is indicated. Reduce engine speed slowly, ammeter returns to zero, then indicates discharge and returns to zero again. If idling speed is too high and the needle does not return to zero, switch off ignition and read maximum discharge. The discharge shown on the ammeter is the reverse current. It should be between 4 and 9A. If for instance 5A discharge was indicated and the needle has jumped back to zero, the cut-out has disconnected the dynamo from the battery at 5A. The reverse or cut-out current was therefore 5A.

J) Final charging current

The final charging current with fully charged battery, at a battery temperature of +20°C and daylight driving should be 0.8 to 1A.

If the battery is partly discharged the charging current will be accordingly higher.

III. Ignition system

A) Ignition coil

The ignition coil contains an iron core. Wound on the core is the secondary winding (high tension) and above that the primary winding (low tension). At ignition, the contact breaker interrupts the primary current. The magnetic field induced by this current breaks down and induces a current impulse in the secondary winding. This impulse is passed alternatively to the electrodes of the spark plugs by the distributor.

B) Capacitor

Foils of aluminium and insulating paper are alternatively built up and finally rolled and inserted into a housing.

The capacitor is connected parallel to the contact breaker points and prevents arcing as well as aiding the breaking up of the magnetic field in the ignition coil. This in turn increases the secondary voltage.

C) Checking ignition coil and capacitor

Ignition coils and capacitors are checked with commercially available testers. Ensure coils and capacitors reach operating temperature before testing commences.

D) Timing

Highest engine output is obtained at the highest mixture pressure immediately after the piston passes top dead centre. Time is required to ignite the fuel/air mixture and to achieve highest mixture pressure. Therefore ignition is timed to commence before t.d.c. is reached by piston.

The timing measured on the twin pulley is 6 to 10 mm before t.d.c. for the 500 cc engine and 6 to 7 mm before t.d.c. for the 643 cc engine. This timing must advance at increasing speeds.

E) Flyweight ignition advance

The flyweight advancer unit in the distributor has to advance the timing automatically at increasing speed according to a specified advance curve and to retard the timing if speed decreases.

In this way an optimum engine output is achieved at all speeds. The distributor advance is maximum 32°, equalling approximately 45 mm measured on the pulley circumference (see drawing, fig.26). The advance can be checked with a stroboscope.

F) Closing angle

Correct closing angle of the contact breaker points is most important for proper functioning of the ignition system. The closing angle is the number of degrees during which the contacts are closed. The impulse times reduce with increasing speed and the ignition coil primary current cannot reach maximum value. Too small closing angles can cause missing of ignition at higher speeds. Too large closing angles increase primary current, the coil overheats and the contact points can be damaged.

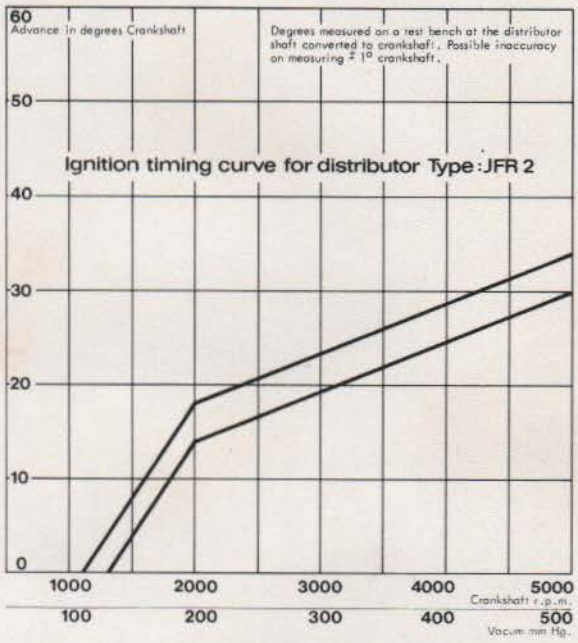


Fig. 26

The dwell angle is 57 to 63 degrees.

The closing angle is checked with a closing angle tester and is adjusted by altering the contact gap.

The closing angle is checked at idling speed and again at approximately 4,000 r.p.m. The angle must not reduce more than 3 degrees. If the reduction is larger, the distributor is mechanically faulty.

The correct closing angle on new distributor and points is achieved by 0.4 mm contact gap.

I. List of special tools

Locking bracket for flyweight	905.5.36.101.0
Extractor for flyweight	905.5.34.101.0
Milling cutter for mushroom type valve	501.1.55.045.0
Tool for hammering mushroom type valve	501.1.55.052.1
1 Set valve cutter for cylinder head	905.5.90.101.5
Press ring for fitting flyweight end seal	501.1.5522
Press ring for fitting pulley end seal	501.1.5523
Bending fork for tappet	501.1.55.038.1
Extractor for camshaft drive gearwheel	501.1.5520.2
Fitting sleeve for camshaft drive gear wheel	501.1.5533
Valve lifter for fitting and removing valve keys	905.5.31.101.2

II. Use and illustration of special tools

Locking bracket for flyweight (Part Number 905.5.36.101.0) see fig.27

To lock flywheel for loosening and tightening fixing bolt. The bracket is inserted into the top two holes for engine-gearbox connecting screws and is also screwed to the flywheel.

Fig. 27

Extractor for flyweight (Part Number 905.5.34.101.0) see fig.28.

The extractor is screwed to the flywheel after removing the fixing screw and the flywheel is pressed off by turning the extractor spindle.

Fig. 28

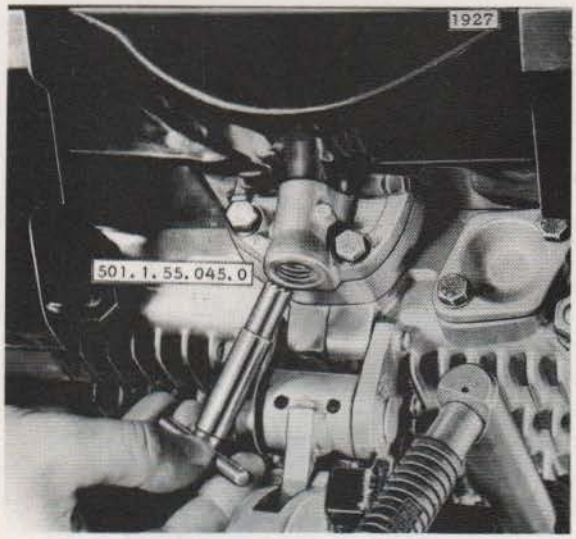


Fig. 29

Milling cutter for mushroom-type valve (Part Number 501.1.55.045.0) see fig.29.

The milling cutter is used to provide a sharp edge seating of oil pressure control valve if seating is too large or damaged (see following paragraph).

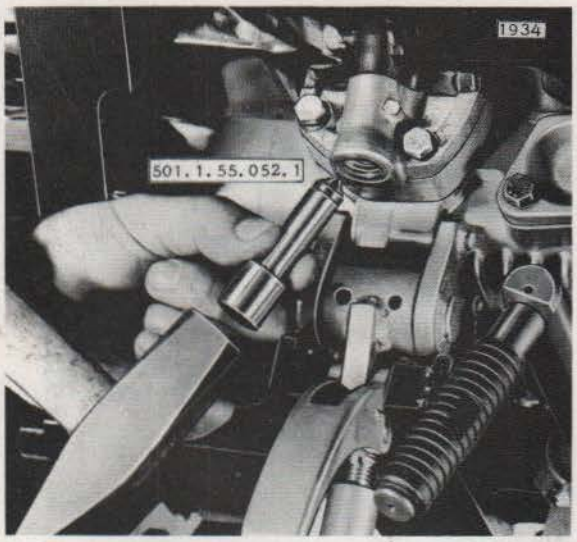


Fig. 30

Hammer tool for mushroom-type valve (Part Number 501.1.55.052.1) see fig.30.

The seating of the mushroom-type valve must be lightly hammered after reconditioning. Mushroom-type valve is inserted into hammer tool.

Valve cutter for cylinder head
(Part Number 905.5.90.101.5) see fig.31.

The cylinder head is placed in a vice for recutting of the valve seats. When cutting be sure that the seat is concentric and without chatter marks. Only cut as much as is absolutely necessary so that the valve seats may be recut repeatedly.

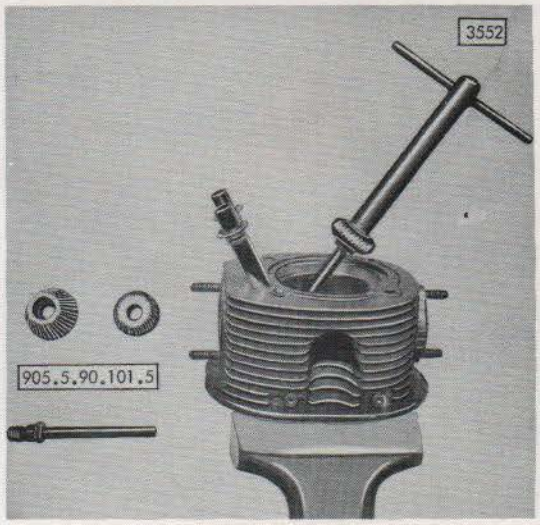


Fig. 31

Pressing for seal, flyweight end
(Part Number 501.1.5522) see fig.32.

Use this ring to press home the seal, outside coated with sealing compound. Only use if this ring ensures proper sealing.

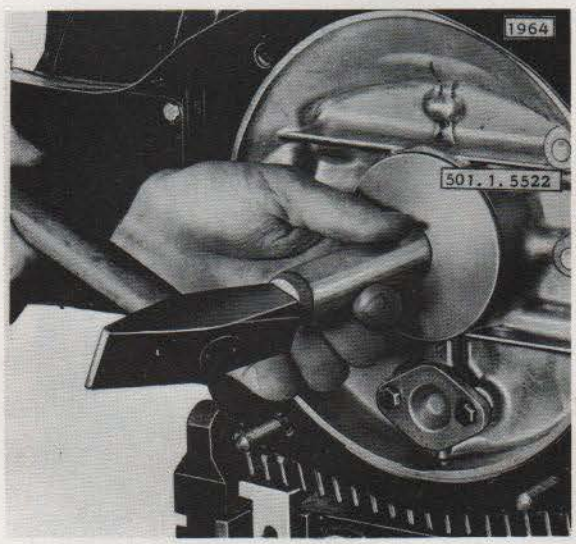


Fig. 32

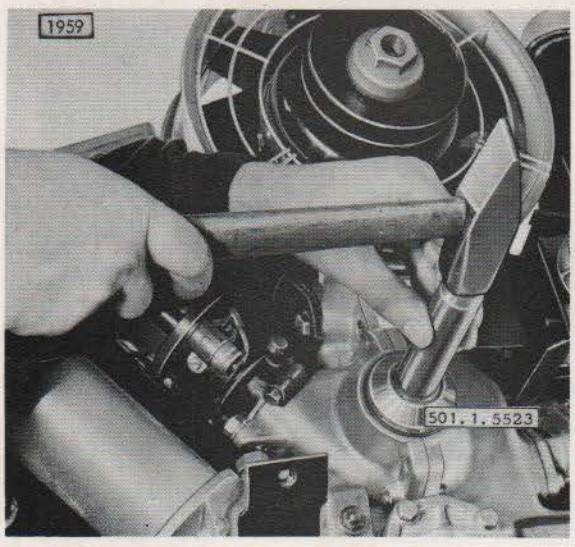


Fig. 33

Pressing for seal, pulley end
(Part Number 501.1.5523) see fig.33.

Use this ring to press home seal, outside coated with sealing compound. Only use if this ring ensures proper sealing.

Fig. 34

Bending Fork for tappet
(Part Number 501.1.55.038.1) see fig.34.

Rocker arms are checked for full contact on cams after assembling to crankhousing half. Rocker arms must be bent to take up any air gap with the bending fork.

Fig. 35

Extractor for camshaft drive gear (Part Number 501.1.552.0.2) see fig.35.

The extractor is used to remove camshaft drive gear from crankshaft. First add insert into crankshaft end. Fit extractor to rear end side of gear and remove all pressed-on parts Note: First remove pulley key.

Fig. 36

Press sleeve for camshaft drive gear (Part Number 501.1.5533) see fig.36.

Fit key into camshaft keyway. Place gearwheel with larger chamber facing crankweb into position of key and press home using the sleeve.

Fig. 37

Valve lifter for cylinder head assembly (Part Number 905.5.31.101.2) see fig.37.

Clamp cylinder head holder in vice. Add cylinder head and fix with wing nuts. Unscrew lever insert on centre screw of valve cover fixing. Press together valve spring with lever. The loose valve keys can now be removed or fitted as appropriate.

Section: Torque values, limits, wear limits

1 Screw tightening and torques

Part Number	Description	Size	Quality	Connecting	Locked by	ft/lb	mkp
501.1.02.043.2	Fixing screw for flyweight	M24 x 1.5	50CrV4	Flyweight/ crankshaft	Locking plate	254	34
700.1.02.002.0	Fixing screw for pulley	M22 x 1.5	37MnSi5	Pulley/crankshaft	–	101	14
501.3.03.004.1	Conrod screw	M8 x 1	10k	Conrod halves	wedged	22	3
24776	Housing main nuts	M10 DIN 934	5S	Housing halves	Wave washers	29	4
900.2009	Cylinder head nuts	M8	8G	Cylinderhead/ cylinder/housing	pretension	18	2,5
900.2935	Domed nut for oil filter	M8	5S	Oil filter box/ oil filter housing/ engine housing	gasket 8x14CU	14.5	2
700.1.06.003.1	Fixing screw for fan	M14 x 1.5	5S	Pulley/fan/ dynastarter		28.93	4
900.1111	Fixing screw for section tube	M8x30DIN933	8G	Suction tube/ cylinder head	spring washers	14.5	2
900.2016	Nuts for oil cooler	M8	5S	Oil cooler/ housing half	spring washers	14.5	2
900.2935	Domed nut for cylinder head cover	M8	5S	Cylinderhead cover/ cylinderhead		11	1,5

II Limits and wear limits

General: Wear limit means that parts reaching this limit or are near to it should not be refitted. The oil consumption of an engine must be considered when checking wear limits of piston and cylinder.

Cylinder, piston and engine housing	New		Wear limit	
Cylinder oval shape	0,00020–0,0059 in	0,005–0,015 mm	0,0020 in	0,05 mm
Piston/cylinder play	0,00154–0,00232 in	0,039–0,05 mm	0,0059 in	0,15 mm
Weight difference between engine pistons	maximum 5 grams			
Gudgeon pin play in piston	0,00004–0,00028 in	0,001–0,007 mm	0,00004 in	0,01 mm
Crankshaft bearing seating in engine housing	2,16535–2,16609 in	55,000–55,019 mm		
Piston rings				
Upper piston ring	0,0016–0,0028 in	0,04–0,07 mm	0,0059 in	0,15 mm
Centre piston ring	0,0012–0,0024 in	0,03–0,06 mm	0,0059 in	0,15 mm
Oil control ring	0,008–0,0020 in	0,02–0,05 mm	0,0004 in	0,1 mm
Split play on all 3 pistons	0,0012–0,0177 in	0,03–0,45 mm	0,0394 in	1,0 mm
Radical clearance (when pressing home the ring surfaces must be 0.012" 0,3 mm below piston surface)	0,012 in	0,3		
Conrod				
Gudgeon play in small end	max. 0,0020 in	0,05 mm		
Permissible deviation from right angle	max. 0,0016 in	0,04 mm		
Permissible weight difference of engine conrods	maximum 5 grams			
Crankshaft				
*Crankshaft bearing boss 49 mm diameter main bearings	0,00299–0,004015 in	0,076–0,102 mm	0,0071 in	0,18 mm
*Auxiliary bearing (aluminium)	0,00236–0,00362 in	0,060–0,092 mm	0,0079 in	0,20 mm
Big end, radial	0,00157–0,00236 in	0,040–0,060 mm	0,0055 in	0,14 mm
Big end, axial	0,0047–0,0102 in	0,12–0,26 mm	0,0236 in	0.60 mm
Crankshaft float	0,0039–0,0075 in	0,10–0,19 mm	0,0236 in	0,60 mm
Balance of crankshaft journal (main bearings)			0,0012 in	0,03 mm
Main bearing journal, oval shape	maximum 0,00059 in	0,015 mm	0,0012 in	0,03 mm
Big end journal, oval shape	maximum 0,00059 in	0,015 mm	0,0012 in	0,03 mm

**The specified limits are measured with fitted bearings (engine housing/conrod) and tightened to the required torque.*

Torque values, limits, wear limits

Flywheel	New		Wear limit	
Flywheel balance, axial	maximum 0,0118 in	0,30 mm		
Flywheel balance, radial	maximum 0,0157 in	0,40 mm		
Flywheel out of balance	maximum 5 cmg			
Camshaft				
Camshaft balance	maximum 0,0004 in	0,01 mm		
Camshaft float	maximum 0,008 in	0,2 mm		
Height of cam 65 mm – 0,25710 in			0,0047 in	0,12 mm
Gear play (camshaft/camshaft drive gear)	0,0004–0,0012 in	0,01–0,03 mm		
Camshaft bearing play	0,0016–0,00323 in	0,04–0,82 mm	0,0043 in	0,11 mm
Valves				
Valve spring length	1,6660 in	40 mm		
Valve spring loaded with 104 lb (47 kg) equals.	0,98 length	25 mm		
Clearance valve guide-inlet valve	0,00138–0,00220 in	0,035–0,056 mm	0,004 in	0,1 mm
Clearance valve guide-exhaust valve	0,00138–0,00220 in	0,035–0,056 mm	0,004 in	0,1 mm
Balance valve shaft-valve seating	maximum 0,0008 in	0,02 mm		
Width of valve seating, exhaust	0,0315–0,0394 in	0,8–1 mm		
Width of valve seating inlet	0,0394–0,0472 in	1–1,2 mm		
Valve seating chamber	45 degrees			
Shaft diameter, inlet valve	0,31339–0,31378 in	7,96–7,97 mm		
Shaft diameter, exhaust valve	0,36850–0,36890 in	9,36–9,37 mm		
Torque – rocker arm – fuel pump lever				
Tappet clearance	0,00150–0,00264 in	0,038–0,067 mm	0,004 in	0,10 mm
Rocker arm clearance	0,00150–0,00264 in	0,038–0,067 mm	0,004 in	0,10 mm
Valve clearance, inlet-exhaust	0,0059–0,0079 in	0,15–0,20 mm		
Fuel pump lever clearance	0,00150–0,00264 in	0,038–0,0067 mm	0,004 in	0,10 mm
Compression	92430–11376 psi 92,430	6,5–8 atü	71,10 psi	5 atü
Oil Pump				
Pump gear float	0,0016–0,0028 in	0,04–0,07 mm	0,004 in	0,10 mm
Gear play	maximum 0,00047 in	0,012 mm		
Clearance pump housing-gears	0,0031–0,07113 in	0,08–0,181 mm	0,0079 in	0,20 mm
Oil pressure at mushroom-type valve, no load speed	21,330–42.66 psi	1,5–3,0 atü	21,330 psi	1,5 atü

Torque values, limits, wear limits

Oil pressure at mushroom type valve at 4,500 r.p.m.	63.990–78.210 psi	4.5–5.5 atü	(kg/m2)
Oil pressure drop from 3,500 to 5,000 r.p.m.	Maximum 14.22 psi	1 atü	(Kg/m2)
Spring for pressure valve, not tensioned	1.930" + 0.0394m	19 + 1.0mm	
0.5516"–14mm pretension spring equals a pressure of	7.4970 lb	3.4 kg.	
Oil pressure switch opening at	11.376–17.064 psi	0.8–1.2 atü	(Kg/m2)
Spring for by-pass valve not tensioned	1.7730 + 0.0394m	45mm + 1,0 mm	
0.394"–10 mm pretension of spring equals a pressure of	1.6758 lb		

Removal of Engine from Vehicle

The engine and transmission unit should be removed together, as it is found that this is a quicker operation than attempting to remove the engine alone. It is recommended that a jack be used to take the weight of the unit in conjunction with a hoist to steady it, although if a hoist is not available, removal can be achieved quite successfully with a jack alone.

The engine is withdrawn from below whatever the method.

1. Jack up vehicle by placing jack under the round chassis 'drop' cross tube and lower onto 2 stands placed under front ends of chassis diagonal tubes just behind rear swinging arm pivot brackets.

   Note: A minimum of 24 inches clearance is required at the rear of the vehicle.

2. Remove bolts securing driving seat back and remove seat back. Secure loose seat belt out of way.
3. Remove screws from around perimeter of personal impedimenta tray and remove tray.
4. Open rear access panel to engine (Remove panel and panel stay if using a hoist).
5. Remove engine air cleaner and bracket from the carburettor and intake manifold and cover carburettor air intake.
6. Remove fan hood from engine.
7. Disconnect:
   (a) Earth leads from battery to dynastarter.
   (b) Two wires from dynastarter; push through hole in rear air deflection and stow in left hand wing.

   Note: one nut secures a spade terminal and stays on the stud.
   one nut secures a full terminal and screws off the stud.
   (c) Throttle cable at carburettor.
   (d) Choke cable at carburettor.
8. Refit fan hood to protect oil cooler.
9. Disconnect:
   (a) Petrol pipe from pump and secure outlet above level of tank.
   (b) Heater pipes from both ends of silencer and stow in wings.
   (c) H.T. leads from coil to distributor.
   (d) L.T. lead from distributor to coil.
   (e) Wire from oil pressure switch.
10. Remove drive shaft shoes from hubs of rear road wheels (see item **7** page **49**).
11. Remove No. 1 and 2 Variable Drive Pulleys (see page **55**).
12. Remove speedometer cable from chaincase by unscrewing knurled nut. Remove clip which secures speedometer and throttle cables on top of gearbox. Stow cables in right hand wing.
13. Disconnect gear change cable from bottom of external gear selector arm on gearbox by removing split pin and clevis pin.
14. Cradle engine in a sling if using a hoist.
15. Place trolley jack under engine sump.
16. Remove 4 bolts which secure gearbox to the 2 front rubber engine mounts.
17. Remove 1 bolt which secures rear mounting tube on engine to rubber on rear mounting bracket.
18. Take weight of engine on trolley jack.
19. Remove 2 bolts securing rear mounting bracket to chassis.
20. Raise engine and transmission and move unit slightly forward.
21. Remove rear engine mounting rubber and bracket.
22. Angle engine downwards at rear and withdraw towards the chassis under the rear.

Replacement of Engine in Vehicle

Replacement is by carrying out the instructions for Removal of Engine in the reverse order.

Note: Check the level of engine oil in a newly installed engine prior to starting the engine.

Page 49 - Replacement of Transmission Unit in Vehicle

Amend "Note" to read "Note (i)" and add "Note (ii) Liberally coat the mating splines in the drive shaft to road wheel hub connecting housing with Fiat B2G grease on installation" or SHELL RETINAX 'A'

Removal of Transmission Unit from Vehicle

Most work to the centrifugal clutch and gearbox will involve the removal of the complete transmission unit as follows:—

1. Remove No. 1 and 2 Variable Drive Pulleys (see page **55**).
2. Remove speedometer cable from chaincase by unscrewing knurled nut. Remove clip which secures speedometer and throttle cables on top of gearbox. Stow speedometer cable in right hand wing.
3. Disconnect gear change cable from bottom of external gear selector arm on gearbox by removing split pin and clevis pin.
4. Remove heater hose between 2 engine air outlets and which is laid across the top of the gearbox.
5. Disconnect: throttle cable at carburettor
   choke cable at carburettor.
   Secure cables out of way.
6. Secure out of way electrical cables which are laid across the top of the gearbox.
7. Disconnect drive shafts at road wheel hubs by unscrewing 4 bolts attaching rubber shoe units to housings.
8. Slide housings towards the differential and off splines on their respective drive shafts.
9. Ease drive shafts away from hubs towards differential, carefully removing compression springs carried in recesses in shaft ends.
10. Support engine under sump.
11. Remove 4 bolts attaching clutch housing to engine.
12. Remove 4 bolts which secure gearbox to the 2 front rubber engine mounts.
13. Slightly loosen the 1 bolt which secures rear mounting tube on engine to rubber on rear mounting bracket.
14. Lift out transmission unit complete through access panel behind seat.
    Note: The designations "left" and "right" assume looking from the rear towards the front of the vehicle.

There is no drain plug on the gearbox. Although there is a drain plug for the differential housing, the weight of the quantities involved is so small that the transmission unit should be removed complete with its content of oil.

Replacement of Transmission Unit in Vehicle

Replacement is by carrying out the instructions for Removal of Transmission in the reverse order.

Note: Check levels of oil in gearbox and differential housing in a newly installed transmission unit prior to driving the vehicle.

Centrifugal Clutch

Power from the engine is transmitted via a simple centrifugal clutch. This consists of three trailing shoes attached by pivots to the forward face of the engine flywheel, and which revolve inside a drum on the input shaft of the gearbox.

The shoes are held in the 'off' position at low engine speeds by springs. As engine speed builds up, however, centrifugal force overcomes the spring tension, the shoes come into contact with the drum and thus take up the drive. The clutch commences to grip at 1200 rpm and is fully engaged at 1500 rpm.

Dismantling Clutch

It is necessary to remove the transmission unit complete to gain access to the clutch.
With transmission unit removed, the clutch will be in two parts. The drum will be located in the clutch housing: the shoes will be on the flywheel still attached to the engine.

To remove shoes:

1. Knock back tabs on 6 washers under bolts which secure the three clutch shoe locking plates.
2. Unbolt shoe pivot bolts from flywheel.
3. Withdraw sub-assembly consisting of clutch shoe locking-plates, clutch top plate and the 3 shoes on their pivots.
4. Unhook shoe return springs from pins on shoes.
5. Withdraw shoes complete with bearing sleeves.
6. Withdraw pivot bolts and bearing sleeves from shoes.
7. Remove 3 clutch spring locating pets from clutch top plate.

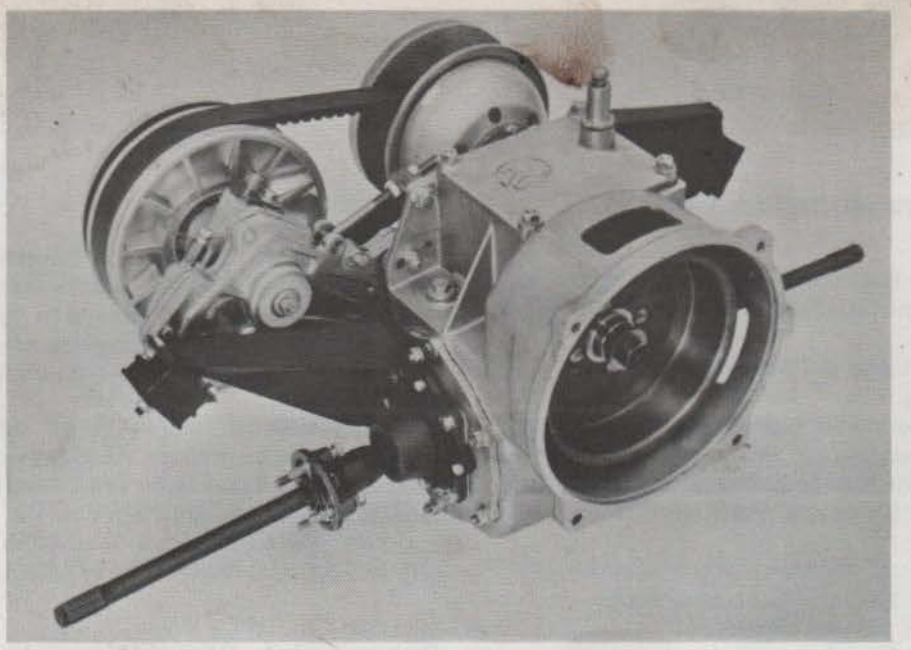
To remove clutch drum:

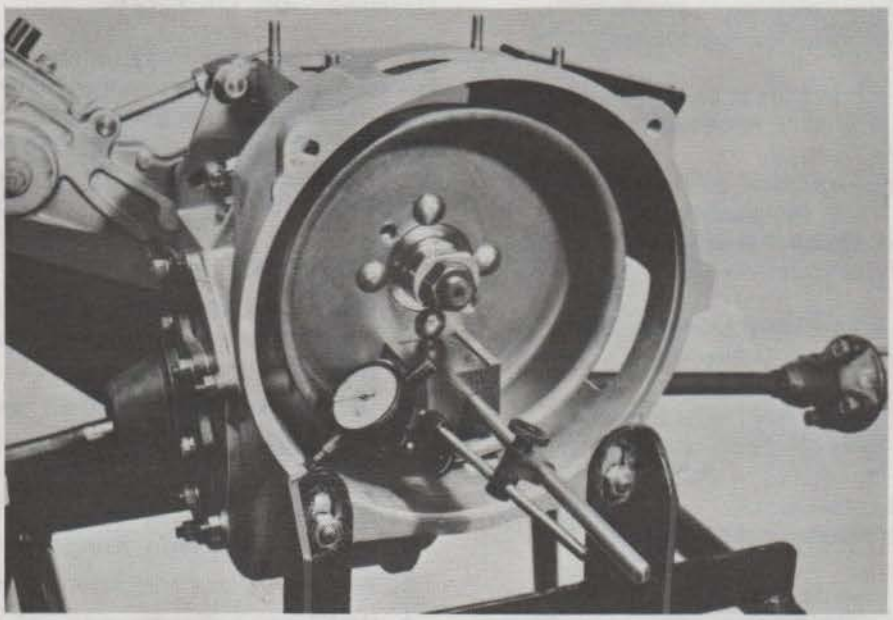
1. Knock back tab washer in the centre of drum and remove retaining nut and washer.
2. Withdraw drum and woodruff key from tapered drive shaft, using an extractor located in the two tapped holes in the drum boss if necessary.

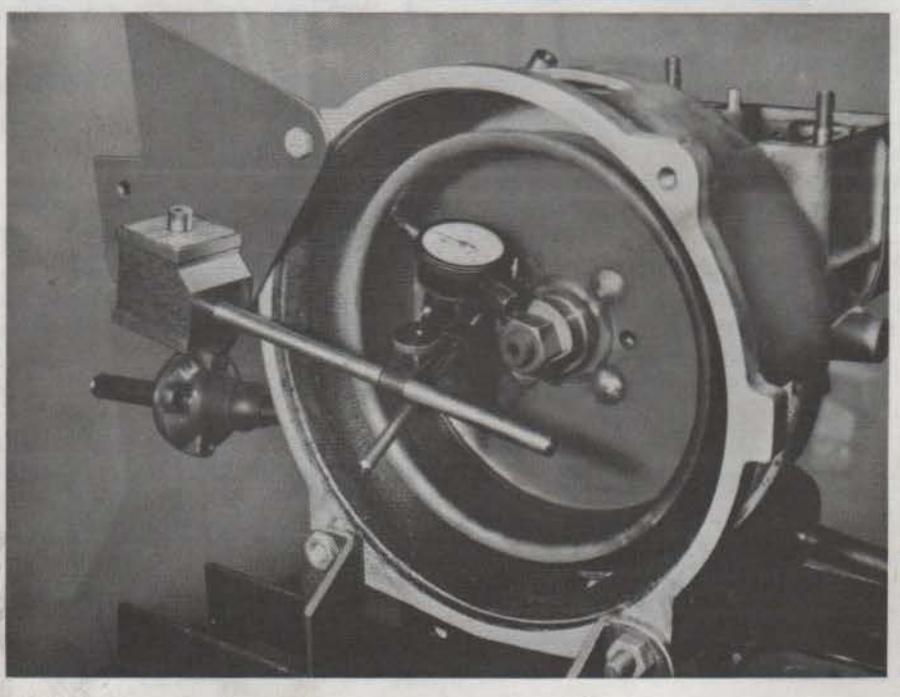
Reassembly of Clutch

Reassemble by reversing the above procedures. It should be noted that the lock washer on the clutch drum shaft should be knocked down in two directions – one side to lock to a flat in the drive shaft, one side to lock the retaining nut.

Any tab washer taken off during a partial or complete strip down should be renewed. Old tab washers should not be used again.

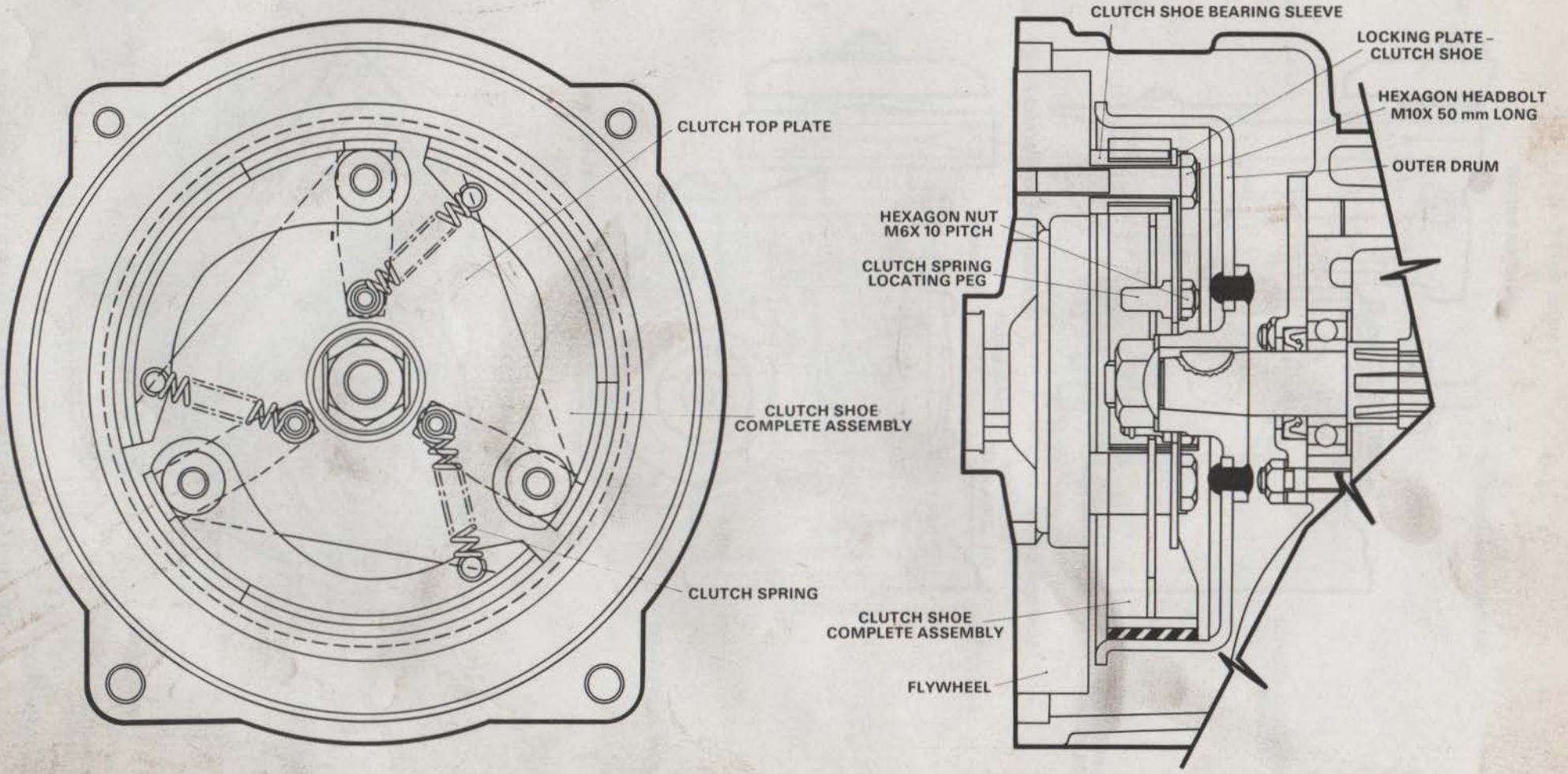


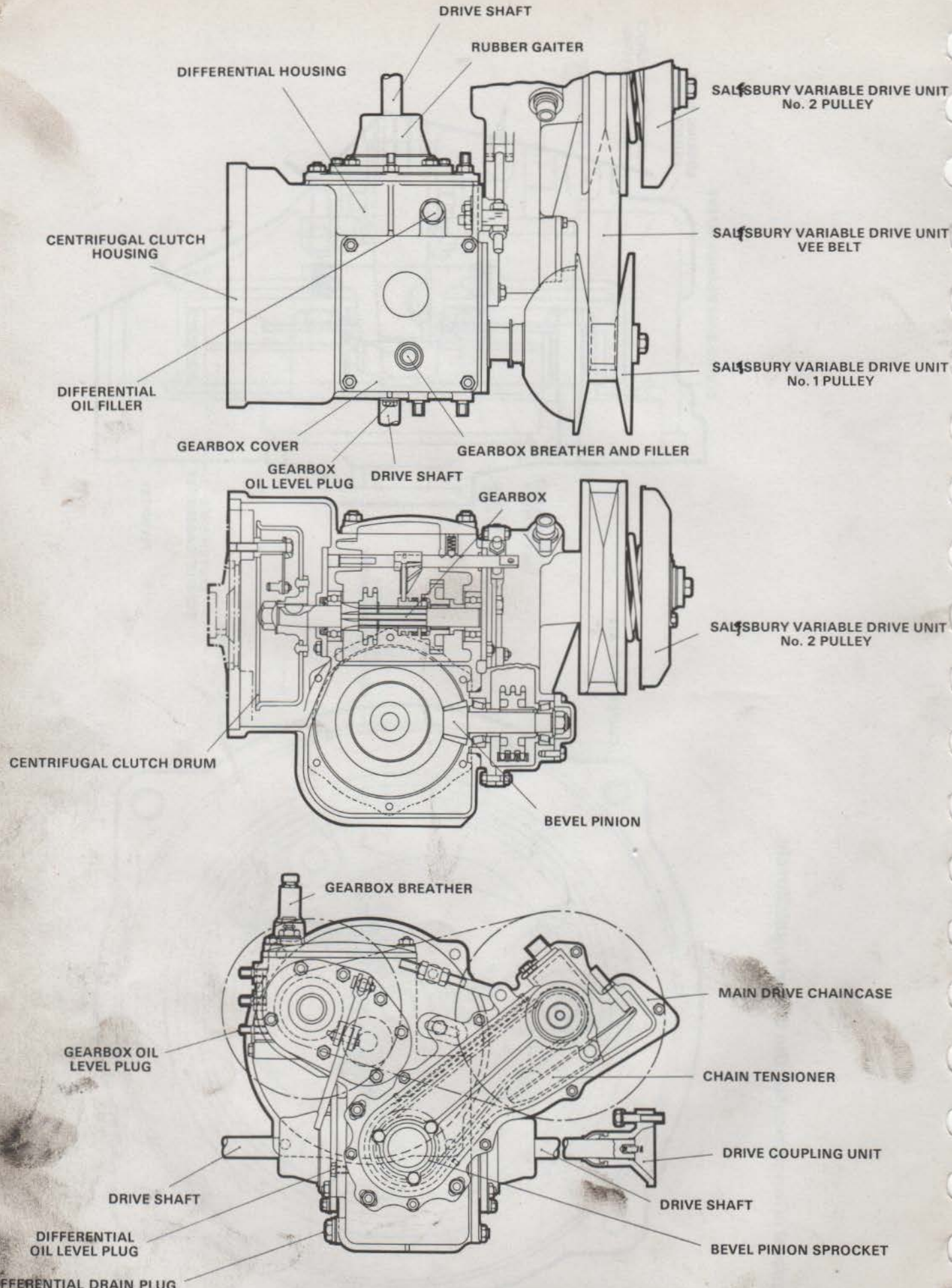




Automatic transmission unit with clutch shoes removed. Testing the clutch drum for swash and buckle.

General arrangement of the Centrifugal Clutch





GENERAL ARRANGEMENT OF AUTOMATIC TRANSMISSION GEARBOX AND DIFFERENTIAL

The clutch should be checked for lining wear, that the shoes are free on their pivots, that there is no excessive wear in the shoe bushes, and that the shoe return springs are intact.

The bushes are a press fit in the clutch shoes and may be replaced separately when necessary. However, the clutch shoes are not relineable and should be renewed when necessary.

A certain amount of scoring to the friction face of the drum will probably be observed. This will not affect the operation of the clutch unless excessive.

Any swash or buckling of the clutch drum may be detected using a dial gauge indicator secured to the clutch housing (see picture on page **50**).

Salsbury Variable Drive Unit Model 795

The Salsbury Model 795 Variable 'V' Automatic Drive Unit consists of three discrete components – the driving pulley assembly (No. 1 Pulley), the driven pulley assembly (No. 2 Pulley) and the drive belt. Both pulleys have a fixed sheave and a movable sheave.

After the clutch is engaged and as the engine speed increases, centrifugal force acting on 3 weighted toggles in No. 1 Pulley tends to force the movable sheave *towards* the fixed sheave. This action in turn tends to force the drive belt up in the pulley, away from the hub. The effective diameter of No. 1 pulley therefore *increases* and the drive belt tends to tighten. The belt forces the movable sheave in No. 2 pulley away from the fixed sheave against the action of a compression spring. The belt descends towards the hub, and therefore *decreases* the effective diameter of No. 2 Pulley.

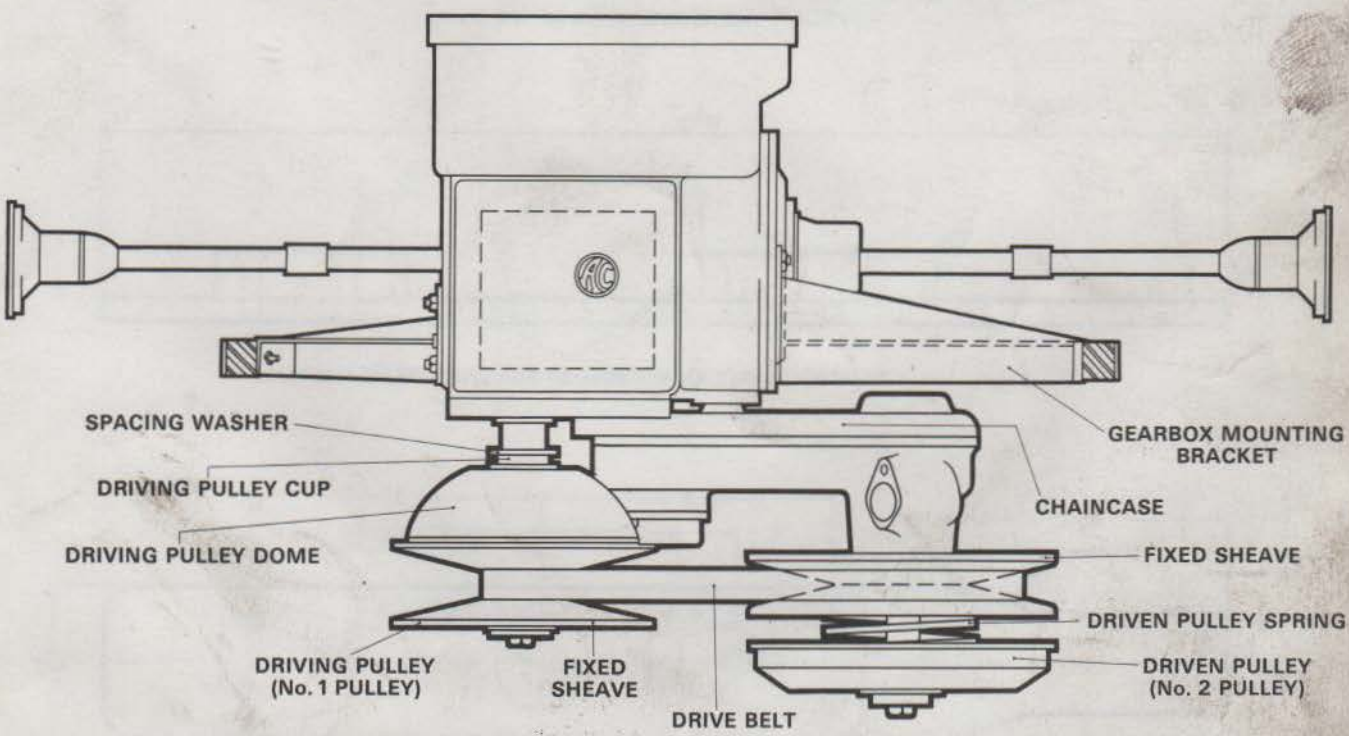
Hence, an increase in engine speed produces a higher gear ratio between the engine and drive wheels. Conversely, a decrease in engine speed produces a lower gear ratio between the engine and drive wheels.

Movement of the toggles in No. 1 Pulley is constrained by a "ramp" – the dome-shaped cover at the rear of the pulley. This ramp is, in effect, a cam whose profile has been designed to provide two working regions. One working region is effective at low vehicle speeds, giving a low gearing ratio. The other is effective at normal vehicle speeds, giving higher gearing ratios.

Automatic Transmission Unit showing Salsbury Variable Drive Unit.

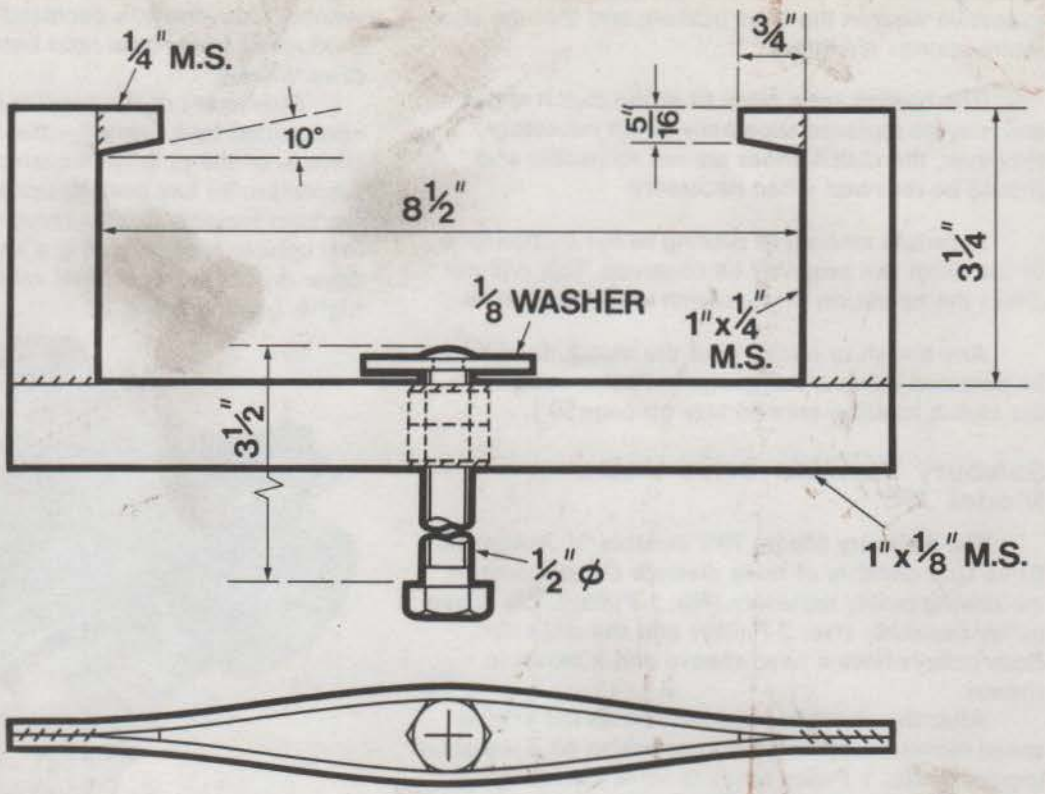
In addition to a compression spring, No. 2 Pulley also incorporates 3 small toggles moving under centrifugal force. These, to some extent, offset the action of the spring, and result in smoother working, especially during acceleration, than would be possible using a spring by itself.

The design of the two pulleys is such that the balance of forces acting in them ensures that the vehicle employs an acceptable gearing ratio at all



GENERAL ASSEMBLY OF AUTOMATIC TRANSMISSION WITH COMPONENTS OF SALSBURY DRIVE UNIT IDENTIFIED

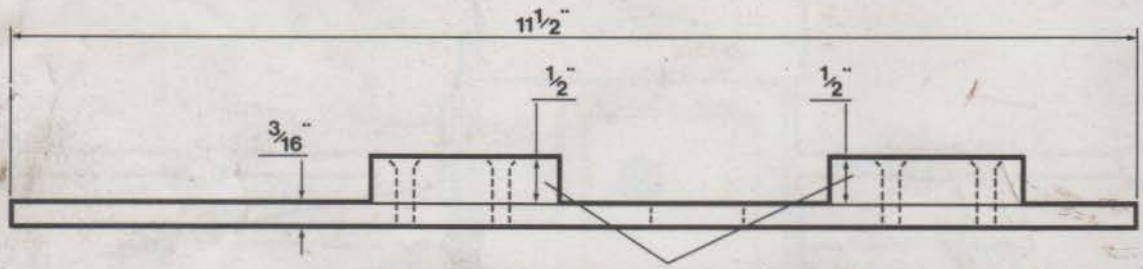
DRIVEN PULLEY (No.2) COMPRESSOR TOOL



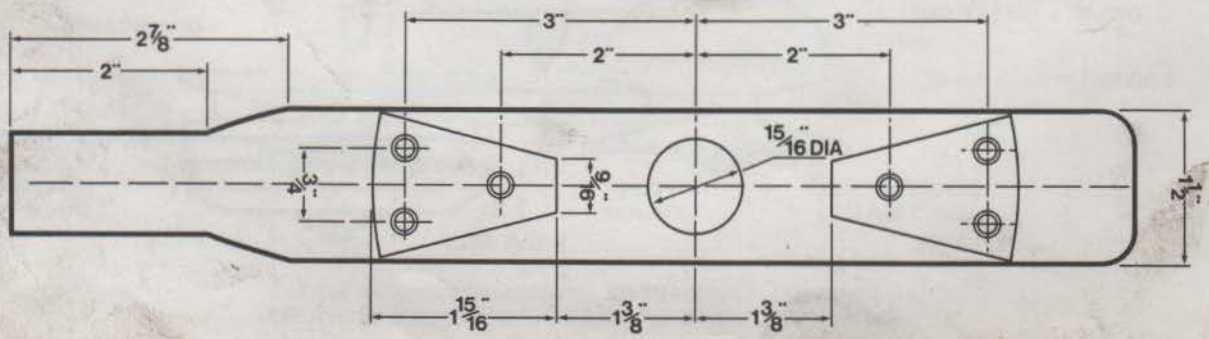
WELD

PULLEY SPANNER

THE HANDLE COMPRISES A 15" LENGTH OF 7/8" OD 16 SWG TUBING SUITABLY SHAPED TO ACCEPT THE REDUCED END OF THE TOOL



HARDWOOD BLOCKS SECURED BY 2BA C/S SCREWS AND NUTS



speeds. After engagement of the clutch, the engine speed rapidly builds up to about 3500 RPM, and holds this value from a very low road speed up to approximately 45 MPH, at which point the No. 1 Pulley toggles are in the highest position on the ramp, corresponding to a fixed gear overdrive. Above about 45 MPH, road speed increases proportionately with engine speed, giving a maximum speed of approximately 60 MPH at 4500 RPM.

It is not recommended that repairs be attempted to any of the drive unit components. Failure of a component will therefore involve fitting a replacement. Replacement of the belt or either pulley will necessitate the removal of both pulleys.

Removal of Pulleys

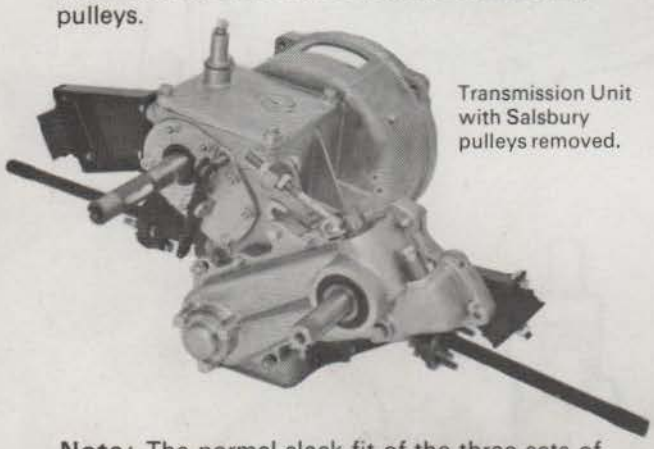
1. Remove bolts retaining driver's seat-back and tilt seat-back forward.
2. Remove screws around perimeter of the personal impedimenta tray and remove tray.
3. Remove central retaining nuts and washers from No. 1 and No. 2 Pulley.
4. Withdraw pulleys from their shafts.

If for any reason a pulley is removed, it should be inspected for the following:

No. 1 Pulley – Presence of all components
– Wear in centre bush
– Damage to toggle arms and pivots
– Excessive looseness of toggle arms
– Seized toggle arm pivots and rollers

No. 2 Pulley – Presence of all components
– Cracks in cover
– Damage to links, pins and pivots
– Excessive wear of links, pins and pivots
– Damage to coil spring

Inspection must be made without dismantling pulleys.

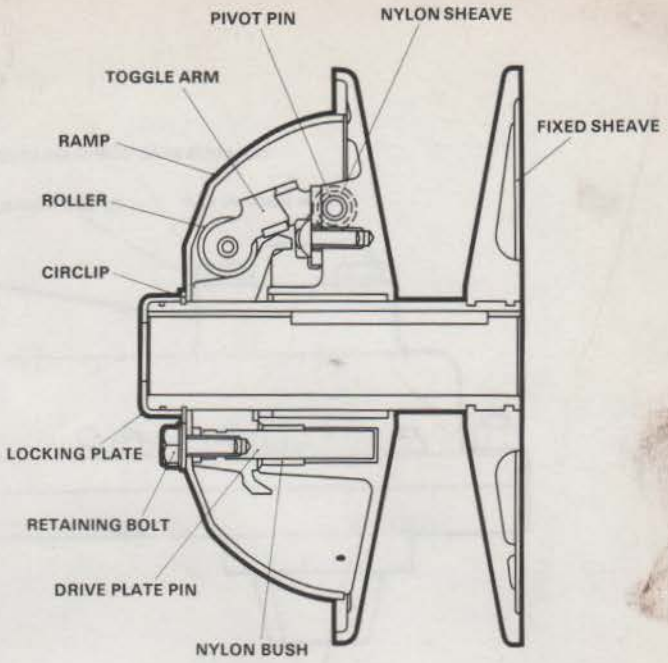


Transmission Unit with Salsbury pulleys removed.

Note: The normal slack fit of the three sets of links in No. 2 Pulley should not be confused with excessive wear.

Belt – Wear (Minimum width 26 mm)
– Missing or broken strengthening bars
– Canvas shredding from the contact surface or strengthening bars.

Note: The belt should not be changed solely because the rubber between the bars has cracked as this occurs very early in belt life.



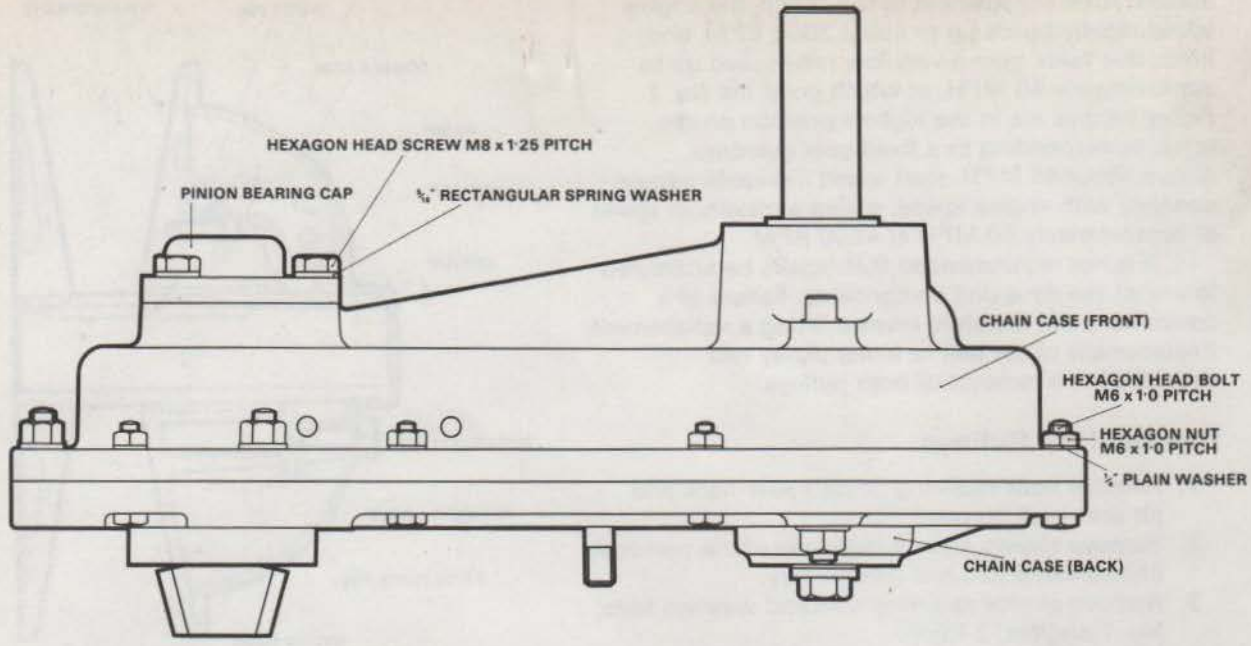
Replacement of Belt

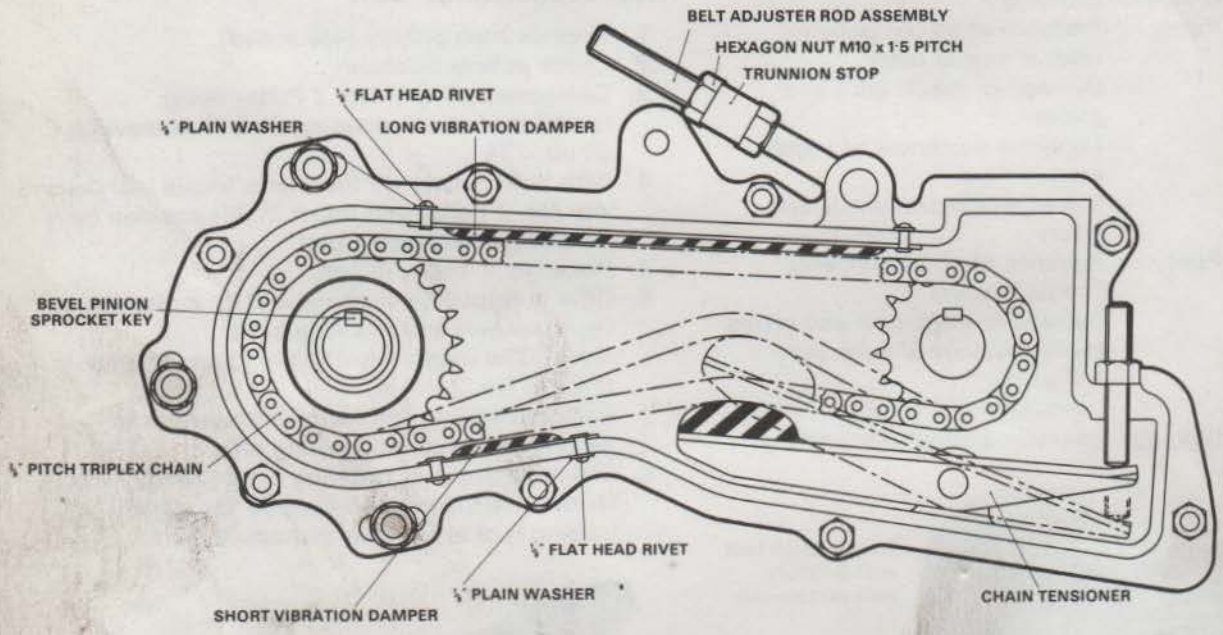
1. Remove both pulleys (see above).
2. Check pulleys as above.
3. Compress spring of No. 2 Pulley using recommended compressing tool. (See drawing on page **54**).
4. With both pulleys off the shafts, locate belt deep into No. 2 Pulley and trap it in this position by removing compressing tool.
5. Place No. 1 Pulley in belt.
6. Offer both pulleys to shafts and fit, replacing keys, washers and retaining bolts.
   Note: The longer key and the longer bolt are fitted to No. 2 Pulley.
7. Rock the vehicle and hence both pulleys to restore unit to correct gearing ratio.
8. Check tightness of retaining bolts (30–32 lb/ft.).
   Note: See drawing on page **54** for special holding tool to facilitate procedure No. 8.

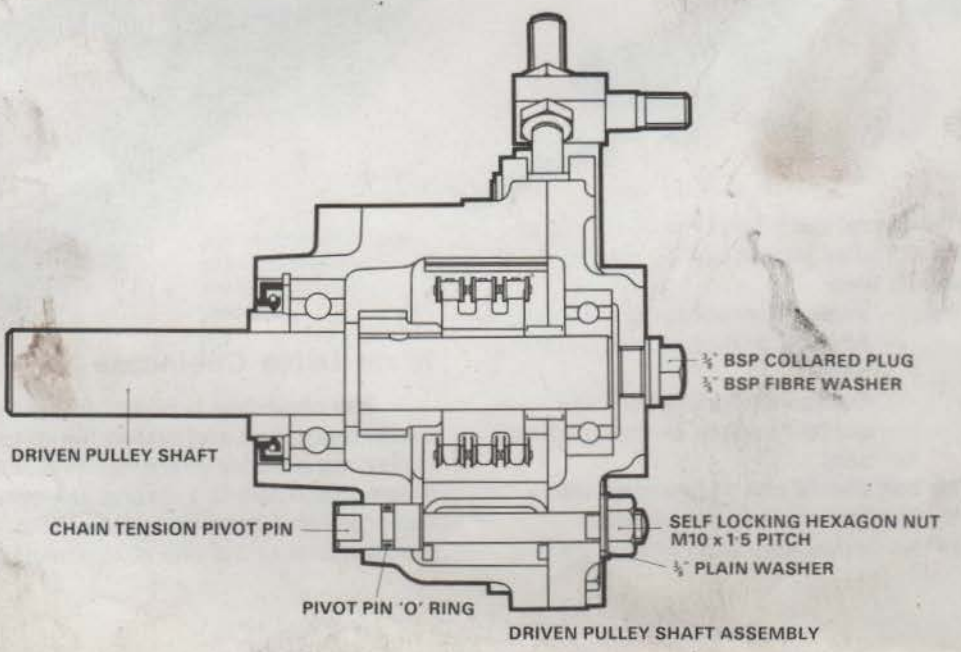
Use of recommended compressing tool in the replacement of belt.

Main Drive Chaincase

The chaincase is bolted to the front of the transmission unit and carries the drive from the No. 2 Pulley, via a triplex chain, to the bevel pinion of the differential. There is a setting link between the chaincase and gearbox, and also the 3 fixing holes in the perimeter of the chaincase are slotted to allow


HEXAGON HEAD SCREW M8 x 1·25 PITCH
PINION BEARING CAP
⅝" RECTANGULAR SPRING WASHER
CHAIN CASE (FRONT)
HEXAGON HEAD BOLT M6 x 1·0 PITCH
HEXAGON NUT M6 x 1·0 PITCH
¼" PLAIN WASHER
CHAIN CASE (BACK)

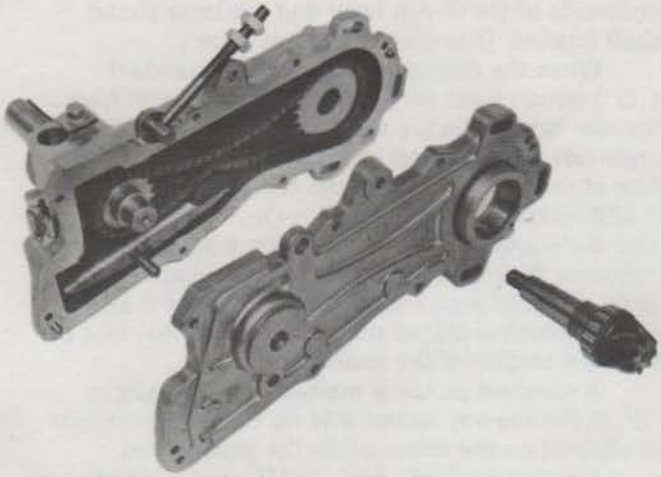

BELT ADJUSTER ROD ASSEMBLY
HEXAGON NUT M10 x 1·5 PITCH
TRUNNION STOP
¼" FLAT HEAD RIVET
¼" PLAIN WASHER
LONG VIBRATION DAMPER
BEVEL PINION SPROCKET KEY
½" PITCH TRIPLEX CHAIN
¼" FLAT HEAD RIVET
¼" PLAIN WASHER
SHORT VIBRATION DAMPER
CHAIN TENSIONER


¾" BSP COLLARED PLUG
¾" BSP FIBRE WASHER
DRIVEN PULLEY SHAFT
CHAIN TENSION PIVOT PIN
SELF LOCKING HEXAGON NUT M10 x 1·5 PITCH
¾" PLAIN WASHER
PIVOT PIN 'O' RING
DRIVEN PULLEY SHAFT ASSEMBLY

for setting so that the distance between centres of the shafts carrying No. 1 and 2 Pulleys is 10·250 inches.

The speedometer drive is taken from the driven pulley shaft by means of a worm gear on this shaft, and its mating gear is connected to the end of the speedometer cable.

The chaincase is lubricated by oil contained in the differential housing.



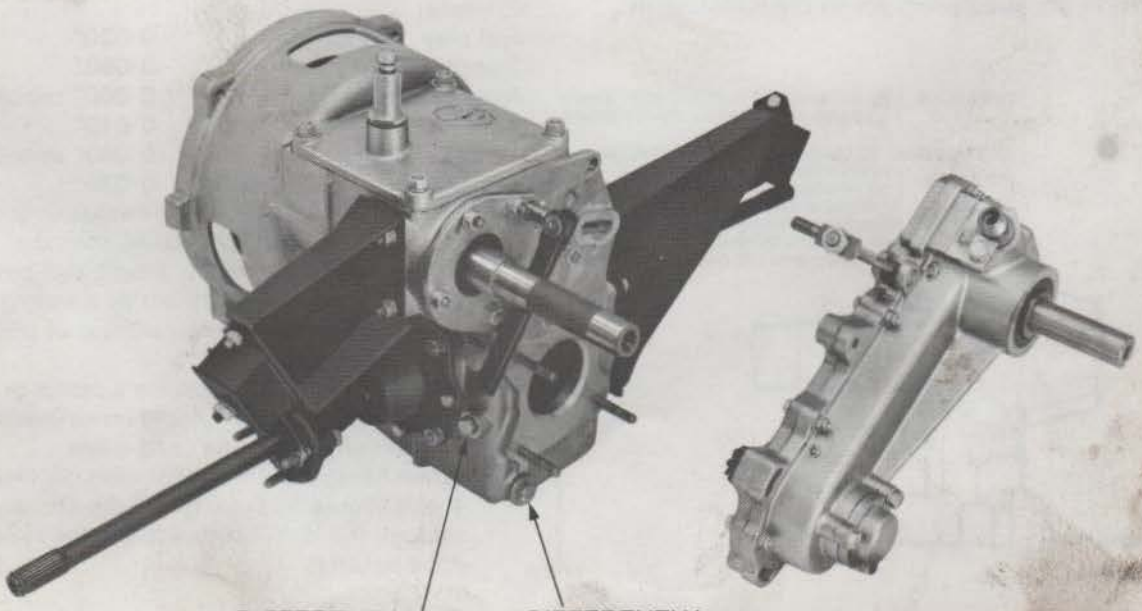
Removal of Chaincase

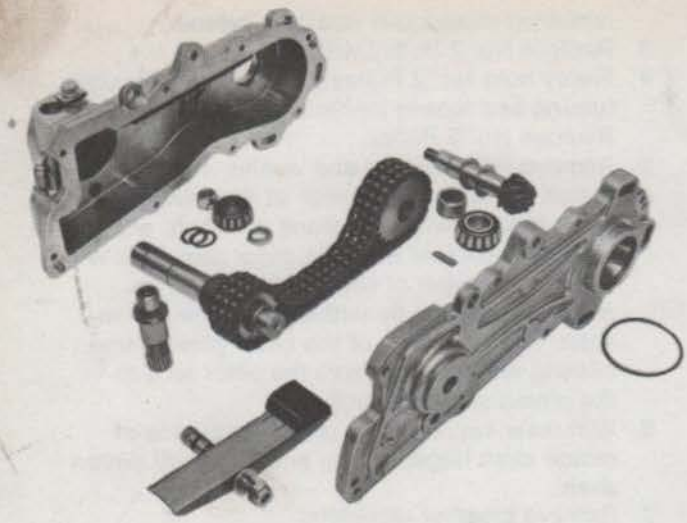
1. Drain differential. Drain plug is located on front of differential housing underneath the lower right hand corner of the chaincase. (See drawing on page **52**).
2. Remove Pulleys No. 1 and 2 (see page **55**).
3. Remove nut on stud securing adjuster rod to gearbox.
4. Remove 3 nuts on studs through chaincase slotted fixing holes.
5. Withdraw chaincase complete with drive belt setting rod.

Dismantling Chaincase

Important: Before dismantling any section of the chaincase, read Note 1 on page **58** in the section dealing with REASSEMBLY OF CHAINCASE.

1. Remove pinion shaft from bearing cap.
2. Withdraw speedometer drive housing after removing rectangular retaining washer.
3. Replace No. 2 Pulley with its key.
4. Firmly hold No. 2 Pulley to prevent mechanism turning and loosen pinion shaft retaining nut. Remove No. 2 Pulley.
5. Remove retaining nut and washer and withdraw pinion shaft. The inner race of the bevel pinion small bearing will slide along the shaft, and may then be separated from the outer race. This will expose a number of shims which must be removed before fully withdrawing the pinion shaft. The inner race of the bevel pinion large bearing will separate from the outer race as the pinion shaft is removed.
6. Withdraw key, distance piece, inner race of pinion shaft large bearing and shims off pinion shaft.
7. Remove breather complete.
8. Remove chain tension adjusting screw and its locknut.
9. Remove 8 bolts around perimeter of chaincase.
10. Remove nut on chain tensioner pivot.
11. Withdraw chain tensioner pivot through bearing in chaincase front plate.
12. Split casing. The driven pulley shaft large bearing will remain on its shaft in the front section of the chaincase. The inner race of the driven pulley shaft small bearing will slide along its shaft.
13. Remove belt adjuster rod assembly.
14. Remove chain tensioner.
15. Remove spacer next to sprocket from driven pulley shaft.
16. Withdraw driven pulley shaft, complete with chain and sprockets out of inner race of driven pulley shaft large bearing.
17. Remove sprocket off its key on driven pulley shaft.
18. Remove worm gear and ball key from driven pulley.
19. Remove driven pulley spacer from oil seal.
20. Remove oil seal and circlip and press driven pulley shaft large bearing out of front section of chaincase.
21. Withdraw driven pulley shaft small bearing out of back section of chaincase.





22. Press outer races of pinion shaft bearings of both sections of chaincase.
    Note: To facilitate removal of bearing races from chaincase sections, it is recommended that the complete casting be heated uniformly. In no circumstances should local heat be applied as this may distort the casting.
23. Grind off rivets to vibration damper rubbers and withdraw rubbers.

Reassembly of Chaincase

Reassemble by reversing the above procedure. However, the following points should be noted:

1. The preloading of the taper roller bearings of the pinion shaft is critically set from zero to 0·001" and should not be disturbed unless absolutely necessary. However, if the shaft has to be stripped, one of the following procedures should be adopted to obtain the correct preload on refitting:

(i) If no new or replacement parts have been fitted:—

After removal of the pinion shaft front bearing cap, the pinion shaft retaining nut should be marked relative to the pinion shaft itself. The number of turns required to remove the nut from the shaft should be noted. When reassembling, the shims must be replaced in the same positions on the pinion shaft and the nut should be tightened until it is in exactly the same position relative to the shaft.

(ii) If new or replacement parts have been fitted:—

(a) *Pinion shaft, Large Pinion Shaft Bearing and/or Back Section of Chaincase.*

The correct positioning of the pinion wheel relative to the crown wheel is most important. This is adjusted by the shims placed directly between the underside of the pinion head and the large pinion shaft bearing. (See drawing on this page).

When the appropriate shims for a standard ("O") pinion head are in place, the dimension from the rear face of the top shim (and hence the underside of the pinion head) to the machined rear face of the back section of the chaincase should be 0·538 inches

This dimension may be found using a dial gauge indicator. Alternatively, it may be measured directly using a special tool, recessed to a depth of 0·538 inches, which is placed on the machined rear face of the back section of the chaincase.

A standard pinion is marked with the symbol "O" in the keyway recess, and no further adjustment is required on the shims under the pinion head.

A pinion marked "+5", "+10", or "+15" etc. denotes that the pinion is ·05 mm, ·10 mm etc. *oversize*. The thickness of shims as found above must be reduced by the appropriate amount. (See drawing on this page).

A pinion marked "—5", "—10", or "—15" etc. denotes that the pinion is ·05 mm, ·10 mm etc. *undersize*. The thickness of the shims as found above must be *increased* by the appropriate amount. (See drawing on this page).

Preloading of the bearings on the pinion shaft is then achieved using the method described in Section 1 (ii) (b) below.

(b) *All other components on the Pinion Shaft, and/or front section of Chaincase.*

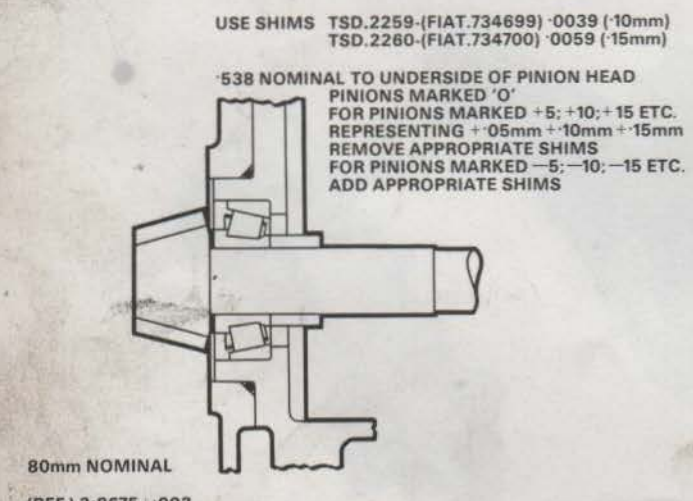
Refit original shims under pinion head. On assembly a dummy bevel pinion spacer of known length, longer than the original spacer, should be fitted. Using a dial gauge, check the pinion end float. The length of the dummy spacer minus the end float minus ·0001" is the length of the actual spacer required.

Example.

End play		0·020"
Dummy spacer		0·060"
Actual spacer required		0·060" minus 0·020"
	equals	0·040"
		0·040" minus 0·001"
	equals	0·039"

i.e. fit spacer and/or shims to the value of 0·039".

2. If the pinion shaft is replaced, then the differential crown wheel should also be replaced as each set is manufactured as a mating pair.
3. Paragraph required on tensioning of triplex chain in chaincase.
4. Any oil seal taken off during a partial or complete strip down should be renewed. Old oil seals should not be used again.
5. When filling the differential with oil, the last ½ pint should be poured into the chaincase through the hole which accepts the speedometer drive housing.



Page 58 - Reassembly of Chaincase

Para 1(i) last sentence, after "tightened" delete remainder of sentence and insert "to a torque loading of 35 lbs ft nominal, 40 lbs ft maximum. Fit new split cotter pin"

Para 1 (ii)(b) At the end of the paragraph add "Fit washer and castellated nut, torque tighten to 35 lbs ft nominal 40 lbs ft maximum. Fit split cotter pin".

Bottom left hand corner of sketch, delete "(REF) 3. 8675 ± .002" and insert "REF 3. 6875 ± .002"

Gearbox

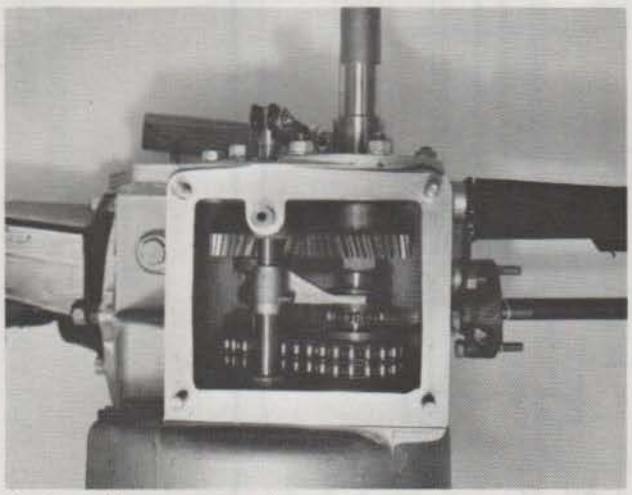
The gearbox is housed in a one-piece aluminium casting, the centrifugal clutch housing and final drive housing being cast integral with it. The clutch housing bolts directly onto the engine and the chaincase bolts onto the final drive housing.

The four ball bearings which are pressed into the gearbox housing carry two shafts. The drive shaft transmits torque from the clutch and the driven shaft transmits torque to the No. 1 Salsbury Pulley.

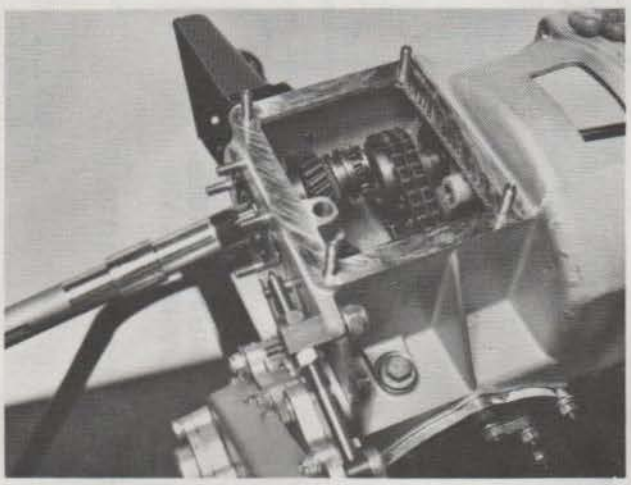
A cover plate is bolted to each end of the gearbox. These cover plates are fitted with oil seals around the drive, driven and gear selector shafts.

The gearbox housing acts as an oil container which is separate from that for the final drive gears. The gearbox housing contains an oil level plug, and the top cover is fitted with a combined oil breather/ filler plug. A drain plug is not fitted.

Gear selection is made by means of a sliding selector shaft which operates a selector fork. The shaft is notched to accept a spring loaded ball which retains it in each gear position. It is actuated by an external selector arm pivoted to a clevis on the forward gearbox housing cover plate.



Gearbox with cover removed.



Gearbox with layshaft partly withdrawn.

The gearbox has only three selector positions – forward, neutral and reverse.

Forward gear:

Torque is transmitted from the drive shaft to the driven shaft by a pair of constant mesh helical gears. The gear on the drive shaft is free running on needle roller bearings. The mating gear is keyed to the driven shaft. Selection of forward gear dogs the free running gear onto the drive shaft.

Reverse gear:

Torque is transmitted from the drive to the driven shaft by a constant running duplex chain and sprockets. The sprocket on the driven shaft is free running on needle roller bearings. The other sprocket is keyed to the drive shaft. Selection of reverse gear dogs the free running sprocket onto the driven shaft.

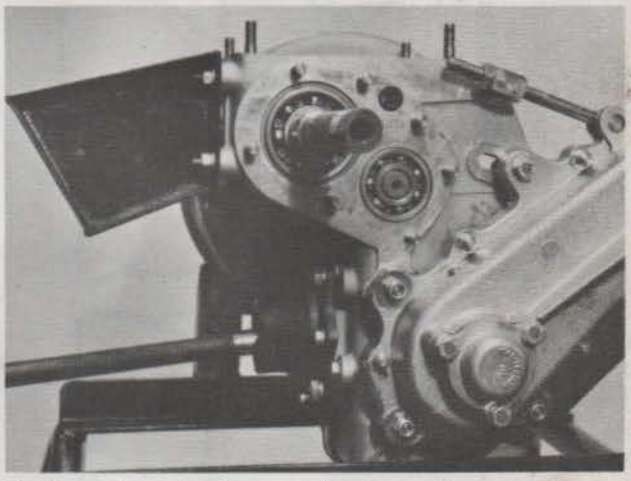
Neutral gear:

Both dog clutches are disengaged. Both gears are stationary with the driven shaft stationary. The sprockets and chain are rotating with the drive shaft.

Most work on the gearbox will involve removing the complete transmission unit (see page **49**).

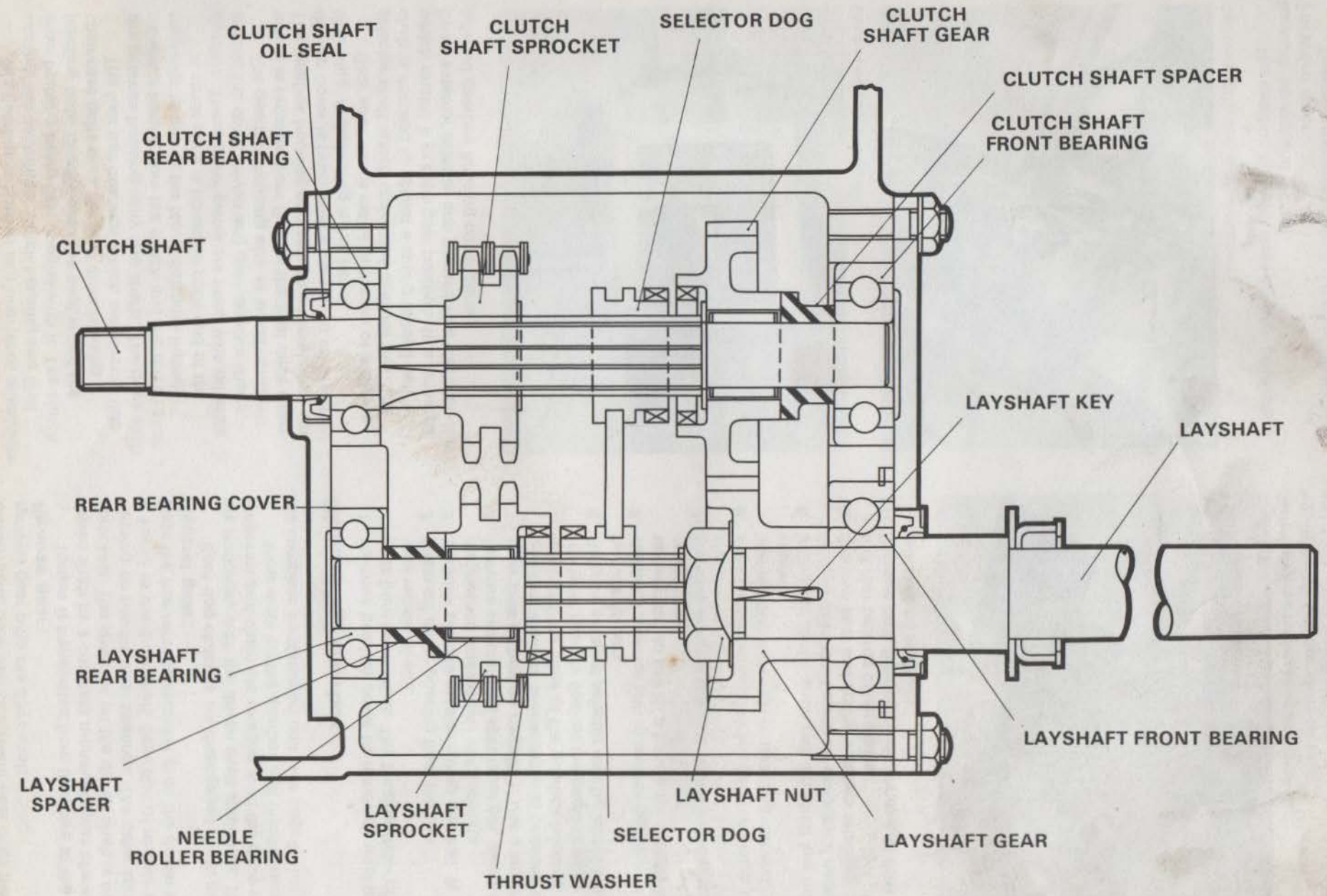
Dismantling Gearbox

1. Remove gearbox cover by removing retaining nuts from the 4 studs. The breather/filler plug may remain in situ.
2. Drain off oil by pouring from the top.
3. Remove selector locator spring and ball. A magnetised screwdriver will facilitate.
4. Remove selector fork split taper pin, using a lever (see picture on page **61**). Use a small block of wood or similar material between the lever and the edge of the gearbox housing. Do not lever directly against the gearbox edge.
5. Remove external selector arm by withdrawing two clevis pins.
6. Reattach selector arm in reverse position (clevis uppermost) to use as a handle for withdrawing cover plate.
7. Remove selector fork and withdraw selector shaft.
8. Knock back tab washer in centre of clutch drum and remove clutch drum retaining nut and washer.
9. Withdraw clutch drum and woodruff key from tapered drive shaft using an extractor if necessary.
10. Remove nuts and spring washers retaining front and rear bearing cover plates.
11. Remove both bearing cover plates and their recessed oil seals.

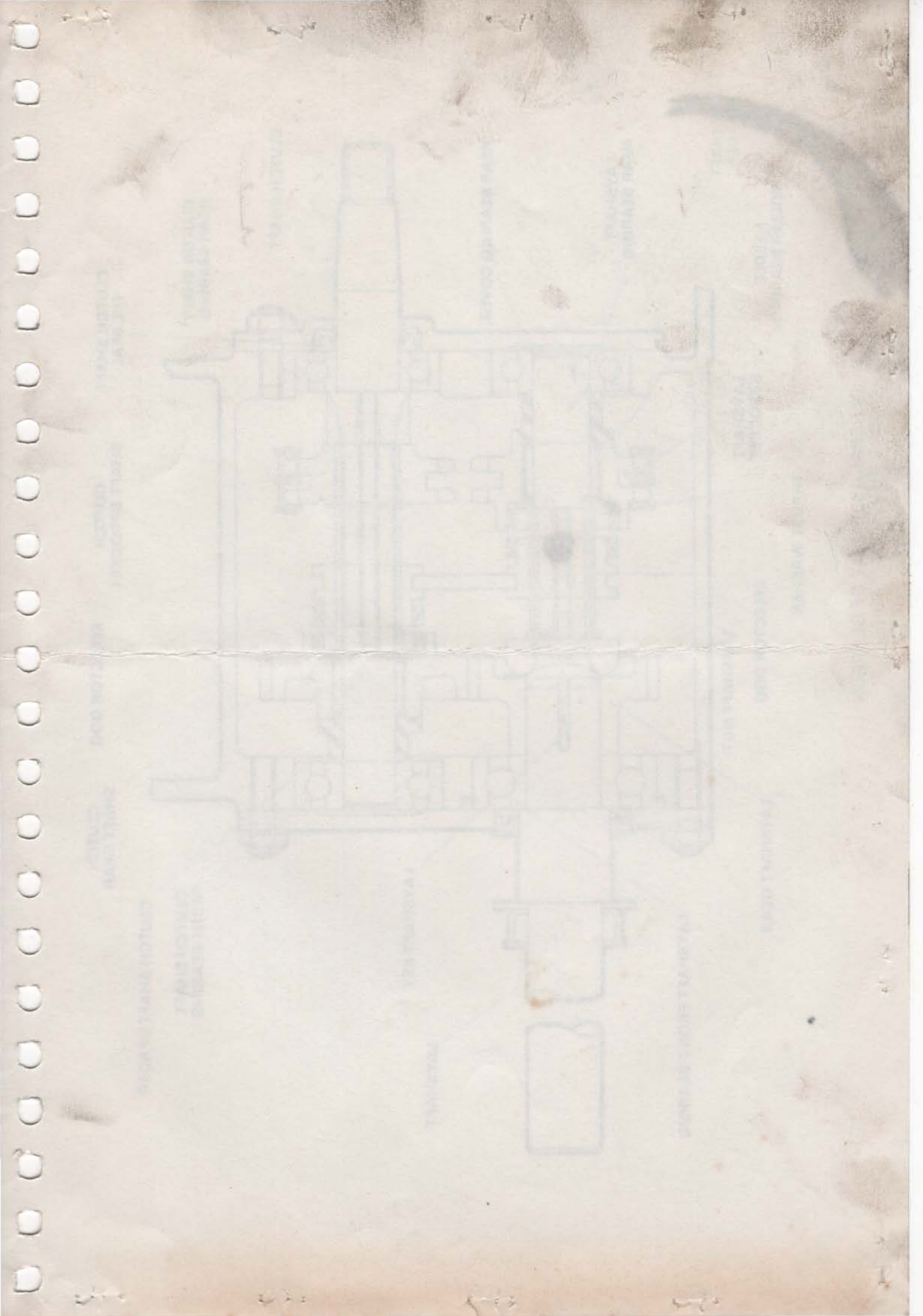


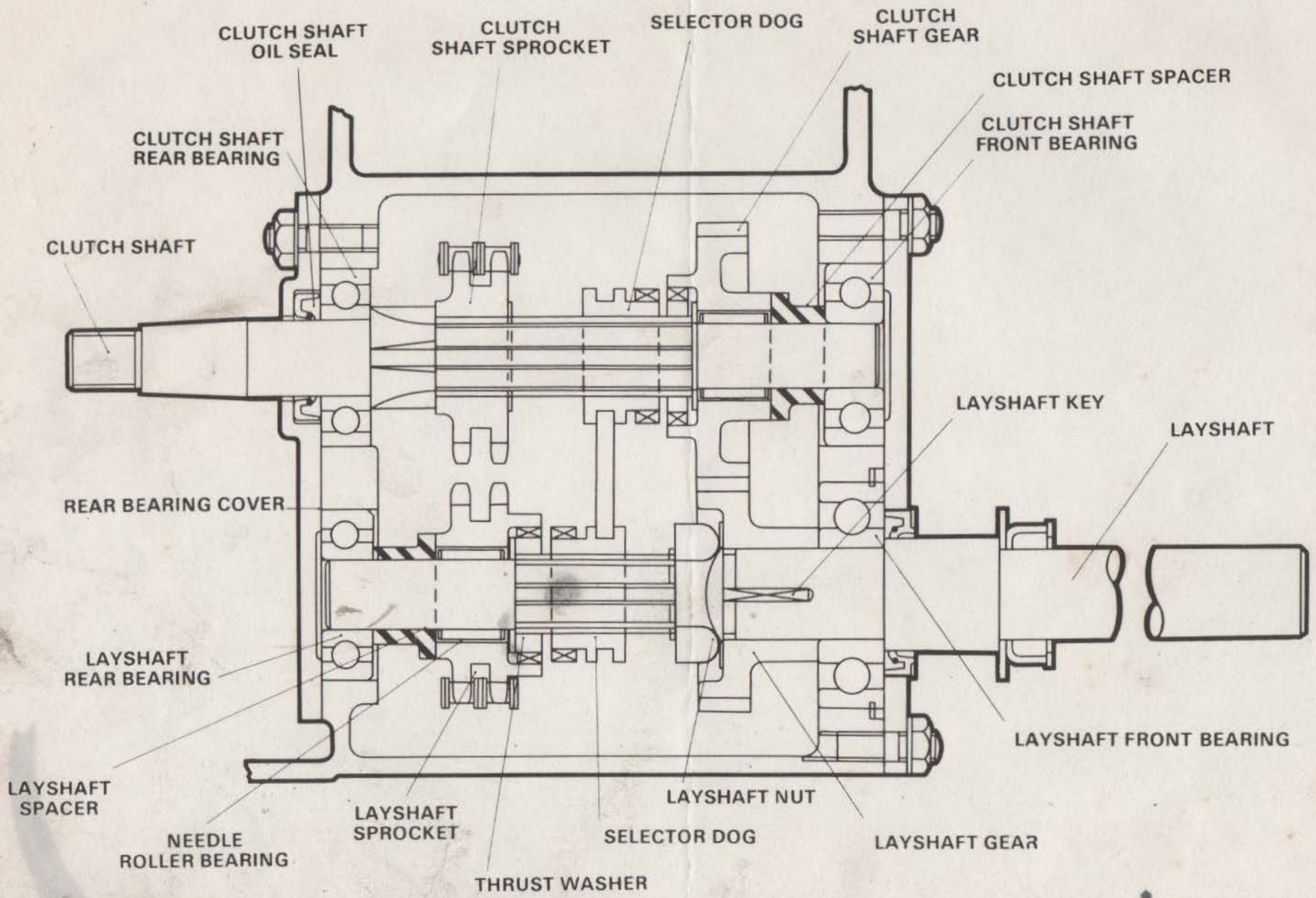
Gearbox with rear bearing cover plate removed.

12. Remove selector shaft oil seal.
13. Lock gears by engaging both dog clutches.
14. Knock back lock washer on driven shaft gear retaining nut and slacken off nut.



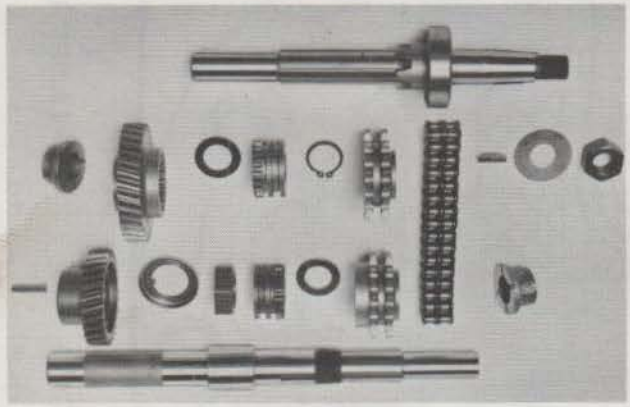
GENERAL ASSEMBLY OF GEARBOX





GENERAL ASSEMBLY OF GEARBOX

15. Ease driven shaft gear off its key using two levers
16. Withdraw driven shaft forwards (away from clutch housing), removing gear and other components from shaft as possible. The inner race of both driven shaft bearings will slide along shaft: the outer races will remain in the gearbox housing. Insert a rod through the rear driven shaft bearing to retain duplex chain sprocket as shaft is withdrawn.
17. Remove sprocket retaining circlip from drive shaft.
18. Ease sprocket along shaft.
19. Withdraw drive shaft complete with rear bearing through clutch housing. Inner race of front bearing will slide along shaft and outer race will remain in the gearbox housing. Remove all components on drive shaft plus driven shaft sprocket and duplex chain as possible.
20. Press inner race of rear bearing off drive shaft.
21. Extract outer races of remaining 3 bearings out of gearbox casing.

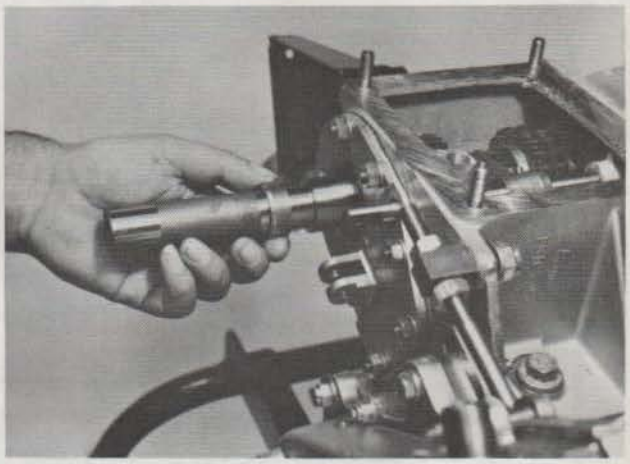


'Exploded' view of gearbox components.

Reassembling Gearbox

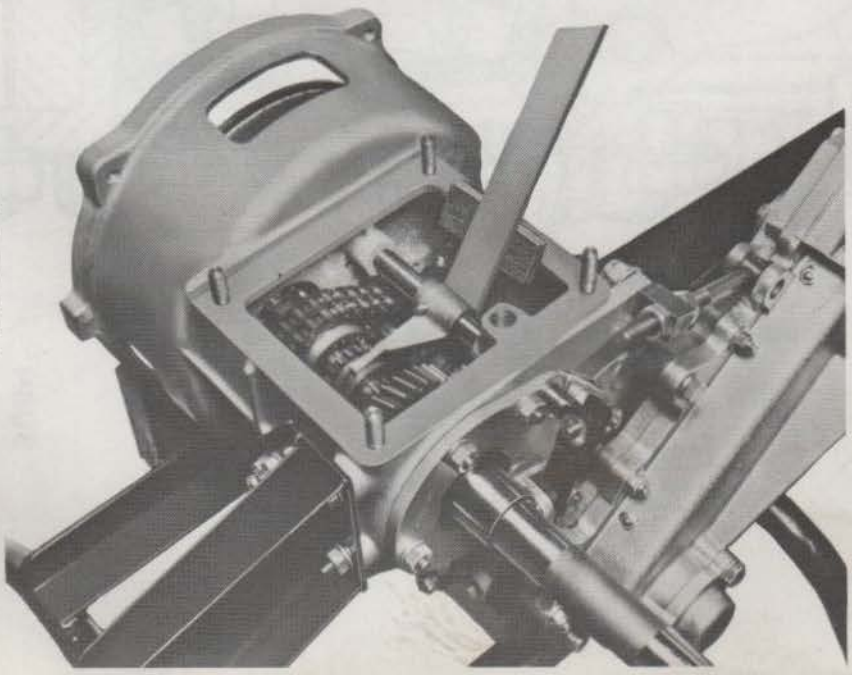
Reassembly is by reversing the dismantling procedure. However, the following points should be noted.

1. The clevis pin with a flat to the head is used for the pivot clevis in the gearbox front cover plate.
2. The gear selector fork is fitted with its webbed boss to the front (away from the engine).
3. None of the bearings should be left proud of the outside faces of the gearbox casting.
4. If facilities exist for warming the complete casting prior to fitting the bearings, these should be used. However, local heating must not be employed as this may distort the casting.
5. When adjusting sprocket and gear positions on their respective shafts, ensure that the shafts run freely but without excessive end play.
6. It is essential, when fitting the front bearing cover plate to ensure that the oil seal is not abraded on the sharp shoulder of the shaft. It is recommended that a collar of external diameter to match the shoulder, but with a radius to one edge, be made up. This should be temporarily slipped onto the driven shaft to abut the shoulder and with radiused edge outward. The cover plate, complete with oil seal should then be offered to the gearbox, bolted down, and the collar removed. (See picture on this page).



Radiused collar being positioned to protect oil seal when refitting front bearing cover plate to gearbox. See point 6 'Reassembling Gearbox'

7. Any oil seal taken off during a partial or complete stripdown should be renewed. Old oil seals should not be used again.

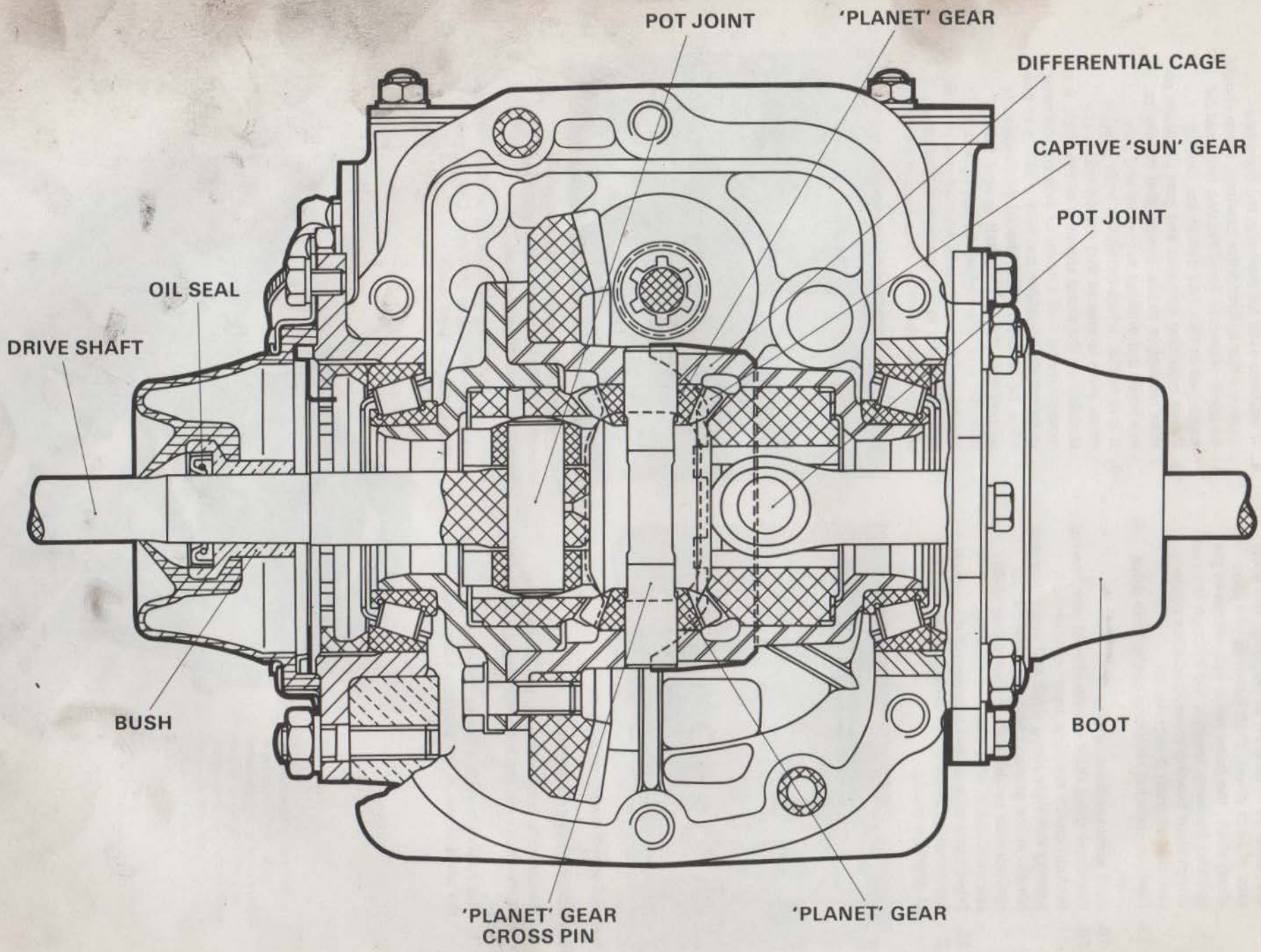


Removing selector fork split taper pin using a lever. Note the interposition or a small block of wood between lever and gearbox casing to prevent damage to casing.

Page 61 Reassembling Gearbox

Insert additional paragraph

"8. It is essential that the lay shaft nut is fitted with the chamfer against the locking washer. This ensures that the corners of the nut do not dig into the washer and tend to turn it, when tightening, so placing a strain on the internal locating tab."



GENERAL ARRANGEMENT OF DIFFERENTIAL

Differential

The differential is located within the transmission unit casting and is of spiral bevel crown wheel and pinion type. The two drive shafts are universally coupled to the two captive sun gears by means of 'pot' type slip joints (see drawing on page **62**). The differential cage, which contains the usual arrangement of 2 captive sun gears meshing with 2 free planet gears, runs in two taper roller bearings fitted to removable housings bolted on either side of the transmission housing. Each drive shaft is fitted with an oil seal in a flexible rubber gaiter.

Oil level and drain plugs are provided in the casing. (See drawing on page **52**).

Removal of Differential

1. Remove transmission unit from chassis (see page **49**).
2. Drain oil from differential case.
3. Remove circlip and sleeve from right hand drive shaft.
4. Remove nuts which secure both the left hand gearbox mounting bracket onto the differential casing and the larger (left hand) differential case cover.
5. Withdraw differential unit complete with drive shafts, sliding right hand drive shaft through its oil seal.
6. Withdraw right hand captive "sun" gear and shim.
7. Withdraw right hand captive "sun" gear and shim.
8. Prise back tabs on "planet" gear cross pin retaining ring and remove ring.
9. Withdraw cross pin, removing its two planet gears as possible.
10. Withdraw left hand drive shaft and remove 'pot' joint retainers.
11. Withdraw left hand captive pinion and shim.
12. Remove oil seal gaiter.
13. Remove oil seal.
14. Remove seal retaining bush.
15. Remove bearing locking ring.
16. Withdraw roller bearing.

Note: A special tool – Fiat No. SAT-A-55022 – is necessary for any adjustment of the bearing pre-loading rings fitted to the rubber gaiters.

Differential unit complete with left and right hand drive shafts.

Dismantling Differential

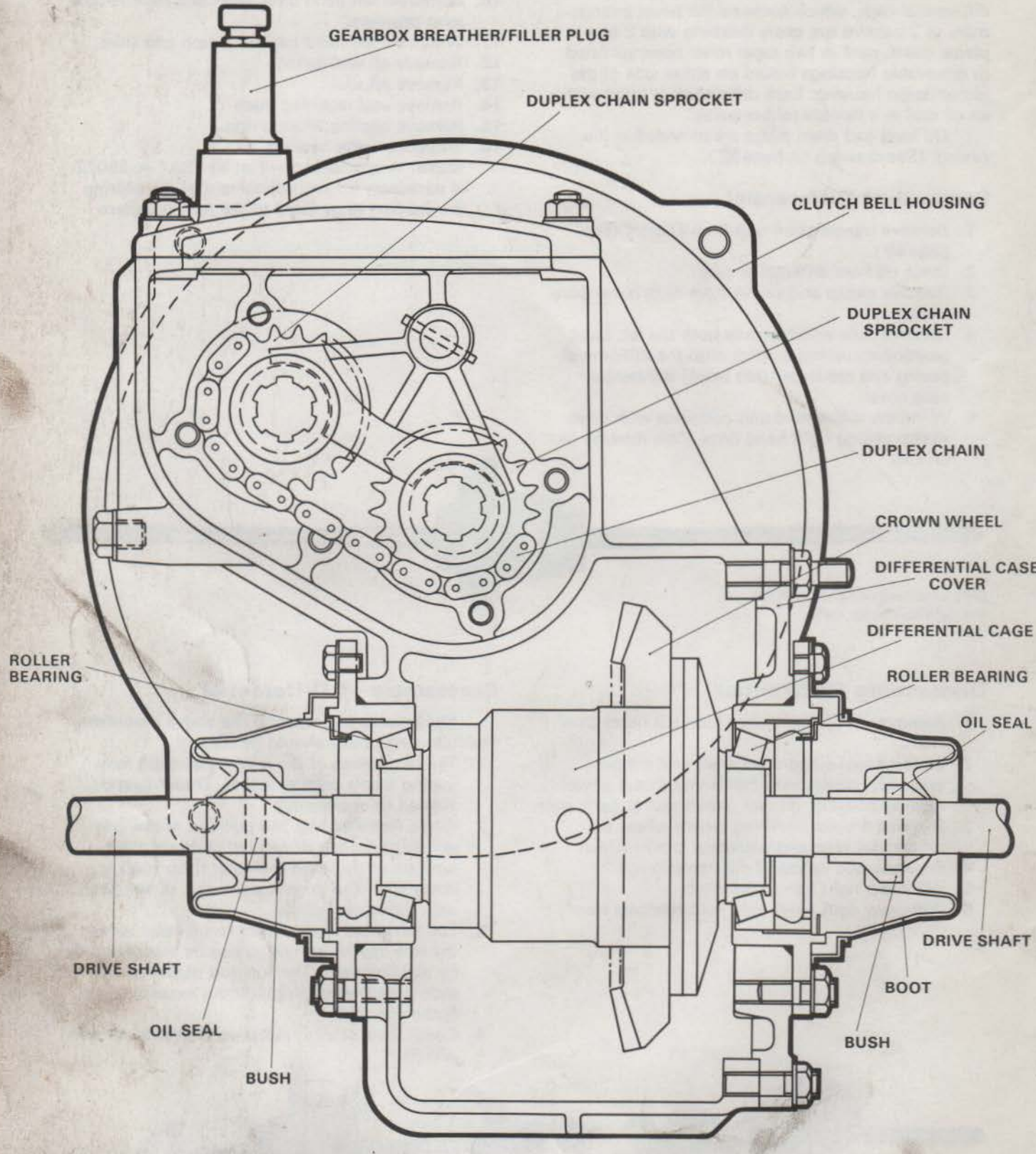
1. Remove circlip and sleeve from left hand drive shaft.
2. Slide oil seal along drive shaft and remove assembly, consisting of differential case cover, bearing housing, oil seal, seal housing, boot, etc.
3. Remove 6 bolts attaching crown wheel to differential cage and withdraw crown wheel.
4. Separate two halves of differential cage.
5. Withdraw right hand drive shaft.
6. Withdraw right hand 'pot' joint retainers from their pins.

Reassembly of Differential

Reassemble by reversing the above procedure. The following points should be noted:

1. The two halves of the differential cage have mating marks on their edges. These must be aligned on reassembly.
2. When reassembling, the position of the 'pot' joint pins on one drive shaft relative to the position of those on the other drive shaft is immaterial. The positions change, in any case, with differential action.
3. The thickness of the shims to be fitted behind the two captive sun gears can be assessed only by trial and error. The sun and planet gears should be free running without excessive play in the gear train.
4. Check level of oil in differential prior to running vehicle.

"Exploded" view of differential unit.



GEAR BOX AND DIFFERENTIAL

Fuel System

The petrol is contained in a 4½ gal. tank located on the left hand side of the front compartment. The filler does not project through the body and it is therefore necessary to lift the front compartment cover to refuel. The fuel outlet is located to the bottom left rear corner of the tank, the end of a length of 5 mm clear flexible plastic pipe being pushed onto the outlet nipple and a spring clip secures the pipe on the nipple. The flexible pipe passes through grommeted holes in two box section longitudinal chassis members just to the rear of the forward transverse chassis member. The run continues rearward along the inner face of the right hand longitudinal box section chassis member, passing through grommeted holes in three transverse members under the chassis platform and thence to the petrol pump at the engine where it is pushed onto the inlet nipple and retained by a spring clip.

The position of the petrol pump inlet will vary according to which of the two petrol pumps is fitted – either a Weber PM 27 or a Solex PE 15080. For details of fuel pumps and carburettors (Weber 32KS3 or Solex 40P1D) will be found on page **24** et seq. in the Engine section of this manual.

Removal of Fuel Tank

1. Remove flexible pipe from tank and drain tank.
2. Pull off electrical connection at tank fuel gauge unit.
3. Remove two bolts retaining bottom of tank to chassis.
4. Remove bolt retaining top of tank to front bulkhead.
5. Lower tank and withdraw from below.

Replacing Flexible Fuel Line

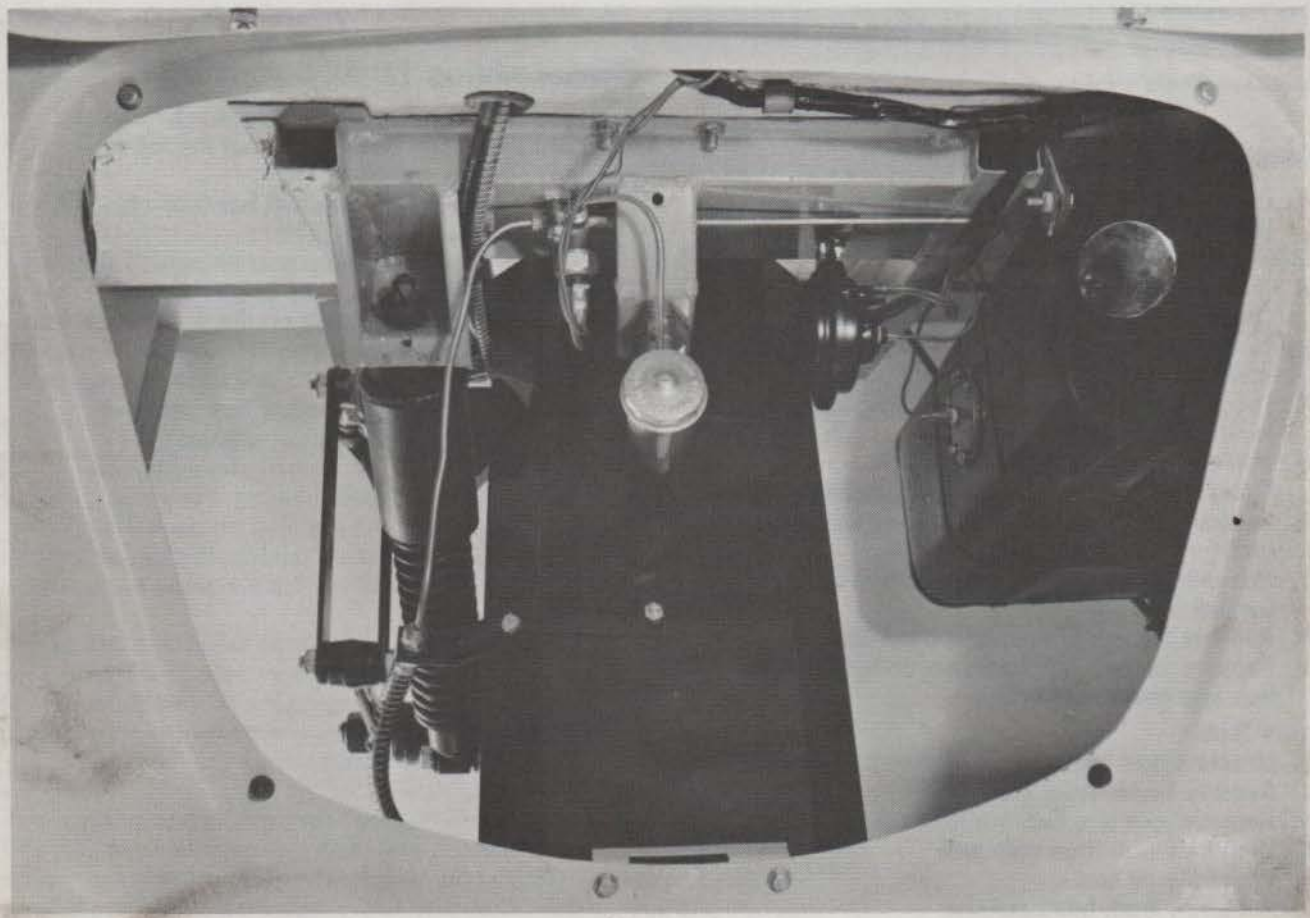
Replacing the 5 mm plastic fuel pipe is a simple matter of passing it through the various holes in the chassis members and clipping it to the chassis at close intervals. Any worn grommets should be replaced and the line should never be passed under chassis members where it might be damaged in jacking up the vehicle.

Note: At least 6" of slack must be left in the line to allow for subsequent shrinkage in service.

Fuel Gauge Tank Unit

The fuel gauge float unit within the fuel tank is dealt with in the section of this manual dealing with electrical systems. (See page **92**).

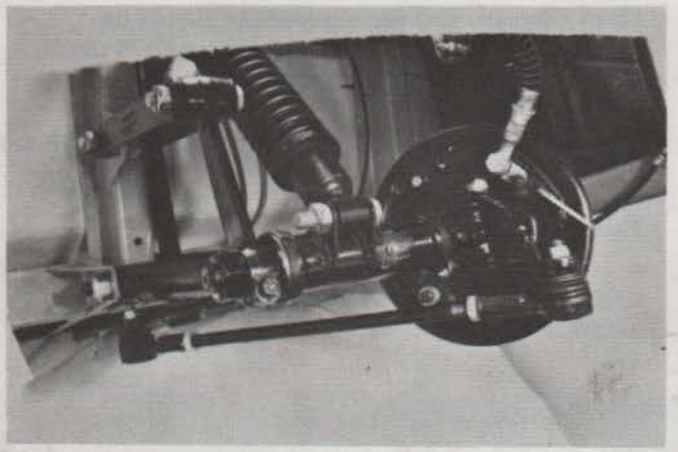
The fuel tank is located on the left hand side of the front compartment.



Suspension, Wheels, Tyres

Front Suspension

The front suspension is of leading arm parallelogram type. The arm is pivoted to the front cross member of the chassis. The leading end of the arm is provided with bearings for the front axle shaft and with a pivot bracket for the front spring/hydraulic telescopic damper unit. The upper anchorage for this unit is a bracket welded to the front bulkhead. The upper linkage of the parallelogram consists of two parallel links one end of each of which is attached to a bracket on the front bulkhead, the other ends being attached to a vertical lever which is splined onto the axle shaft. These ends are attached by means of bolts in rubber cone bushes.



Parallelogram front suspension.

Dismantling Front Suspension

1. Jack up front of vehicle at the recommended jacking points.
2. Remove front road wheel.
3. Disconnect hydraulic brake pipe from banjo, following the procedure detailed on page **77**. **Note:** Do not move the banjo which is preset at a specific angle.
4. Disconnect ball joint assembly on steering rod from steering lever.
5. Disconnect telescopic damper unit from top fixing (lock nut and nut or self-locking nut).
6. Remove lower pivot bolt to telescopic damper unit.
7. Remove pivot bolts at bulkhead end of top parallel links.
8. Remove leading arm chassis pivot bolt.
9. Remove leading arm assembly complete with hub and brake assemblies.

Front Hub

10. Unscrew dust cap and remove large washer.
11. Remove brake drum (see page **77**).
12. Remove split pin, hub nut and washer.
13. Withdraw hub from stub axle.
14. Withdraw oil seal.
15. Withdraw both ball bearings.
16. Remove distance sleeve.

Leading Arm Axle Assembly

17. Remove self-locking nut on axle shaft at vertical arm end.
18. Remove pinch bolt from vertical arm.
19. Mark vertical arm and axle shaft to record angle for reassembly.
20. Slide vertical arm off axle shaft splines.
21. Remove axle shaft spacer.
22. Remove rubber sealing ring.
23. Remove exposed thrust washer.
24. Withdraw axle shaft complete with bearing inner races and spacer.
25. Remove sealing ring and thrust washer from king pin end of axle shaft.
26. Remove bearing inner races and spacer from axle shaft.
27. Withdraw 2 needle roller bearings from leading end of leading arm.
28. Withdraw 2 rubber bushes and spacer from trailing end of leading arm.

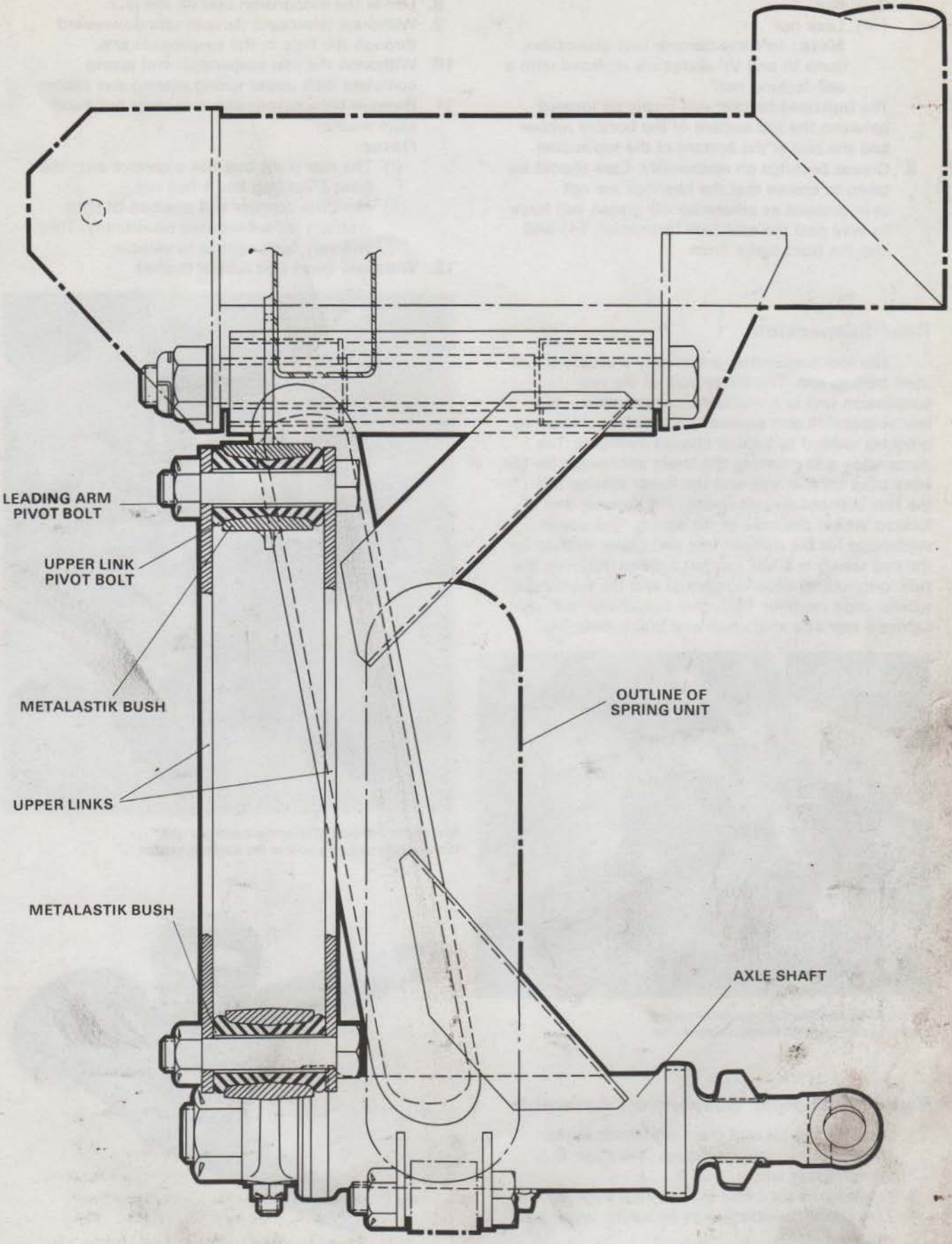
Steering Swivel Pin

29. Remove brake back plate
30. Remove cotter pin.
31. Withdraw swivel pin.
32. Withdraw fibre thrust pads.
33. Withdraw stub axle from axle shaft.
34. Withdraw bushes from stub axle.

Reassembling Front Suspension

The front suspension may be reassembled by reversing the above procedures, but the following points should be noted:

1. The needle roller axle shaft bearings (No. 27 above) should be pressed in.
2. The thrust washer tags must engage in slots on the leading arm (Nos. 23 and 25 above).
3. Ensure that marks made on the vertical arm and axle shaft correspond (No. 19 above). The pinch bolt is an easy push fit. If any force is necessary to insert it, then the vertical arm has been wrongly positioned on the splines.
4. When fitting a stub axle, after the hub nut has been tightened, drill a hole 7/64 inch diameter for split pins. Remove nut. Clean away swarf. Replace nut. Fit new 3/32 inch diameter split pin.
5. Do not tighten bottom telescopic damper unit retaining both until vehicle weight is on the road wheel.
6. Do not over-tighten the top telescopic damper unit retaining nut. This will result in spreading the spacer and damaging the rubber buffers.
7. The top retaining components for the telescopic damper unit are assembled in the following order:
   (i) Cup with small centre hole placed on damper unit stud convex side down.
   (ii) Rubber with spacing, spacer side up.
   (iii) Cup with larger centre hole, concave side up.



PARALLELOGRAM FRONT SUSPENSION

(iv) The second rubber.
(v) Cup with smaller centre hole, concave side down.
(vi) Nut.
(vii) Lock nut.

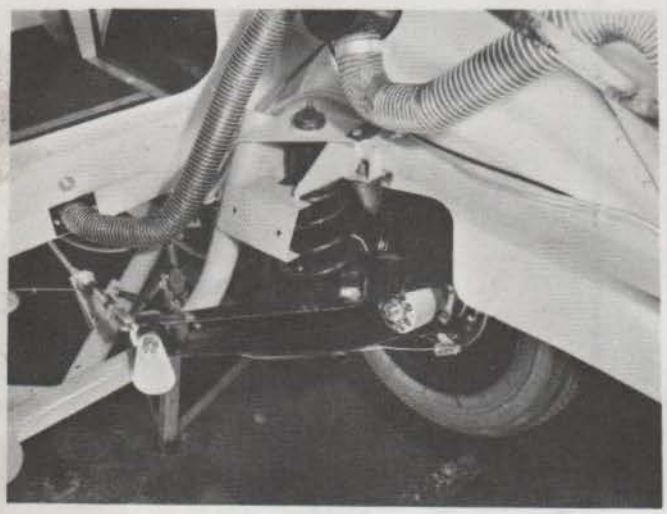
Note: In some damper unit assemblies, items VI and VII above are replaced with a self-locking nut.

The bulkhead bracket will finally be located between the top surface of the bottom rubber and the cup at the bottom of the top rubber.

8. Grease bearings on reassembly. Care should be taken to ensure that the bearings are not over-greased as otherwise the grease will force its way past the seal (see Instruction 14) and into the front brake drum.

Rear Suspension

The rear suspension is basically a standard Fiat semi-trailing arm. The framework of the rear suspension unit is a wishbone construction – the rear suspension arm assembly – which is pivoted to brackets welded to tubular chassis members. The suspension arm provides the lower anchorage for the telescopic damper unit and the lower seating for the rear suspension coil spring. The damper unit is located within the coils of the spring. The upper anchorage for the damper unit and upper seating for the coil spring is a box bracket welded between the side longitudinal chassis member and the transverse tubular drop member. Each rear suspension arm also carries a rear axle shaft, hub and brake assembly.



Semi trailing arm rear suspension showing upper mounting of telescopic damper unit.

Removal of Rear Suspension Assembly

1. Jack up vehicle and place on stands at the recommended jacking points (see page **5**).
2. Remove rear wheel.
3. Drain hydraulic brake system (see page **77**).
4. Disconnect flexible bundy hydraulic brake pipe at either end.
5. Disconnect drive shaft at hub
6. Take the weight of the suspension unit onto a jack, thereby slightly tensioning the rear suspension coil spring.
7. Remove telescopic damper unit top and bottom nuts.
8. Lower the suspension unit on the jack.
9. Withdraw telescopic damper unit downward through the hole in the suspension arm.
10. Withdraw the rear suspension coil spring complete with upper spring seating and rubber.
11. Remove both suspension arm pivot bolts and shim washer.

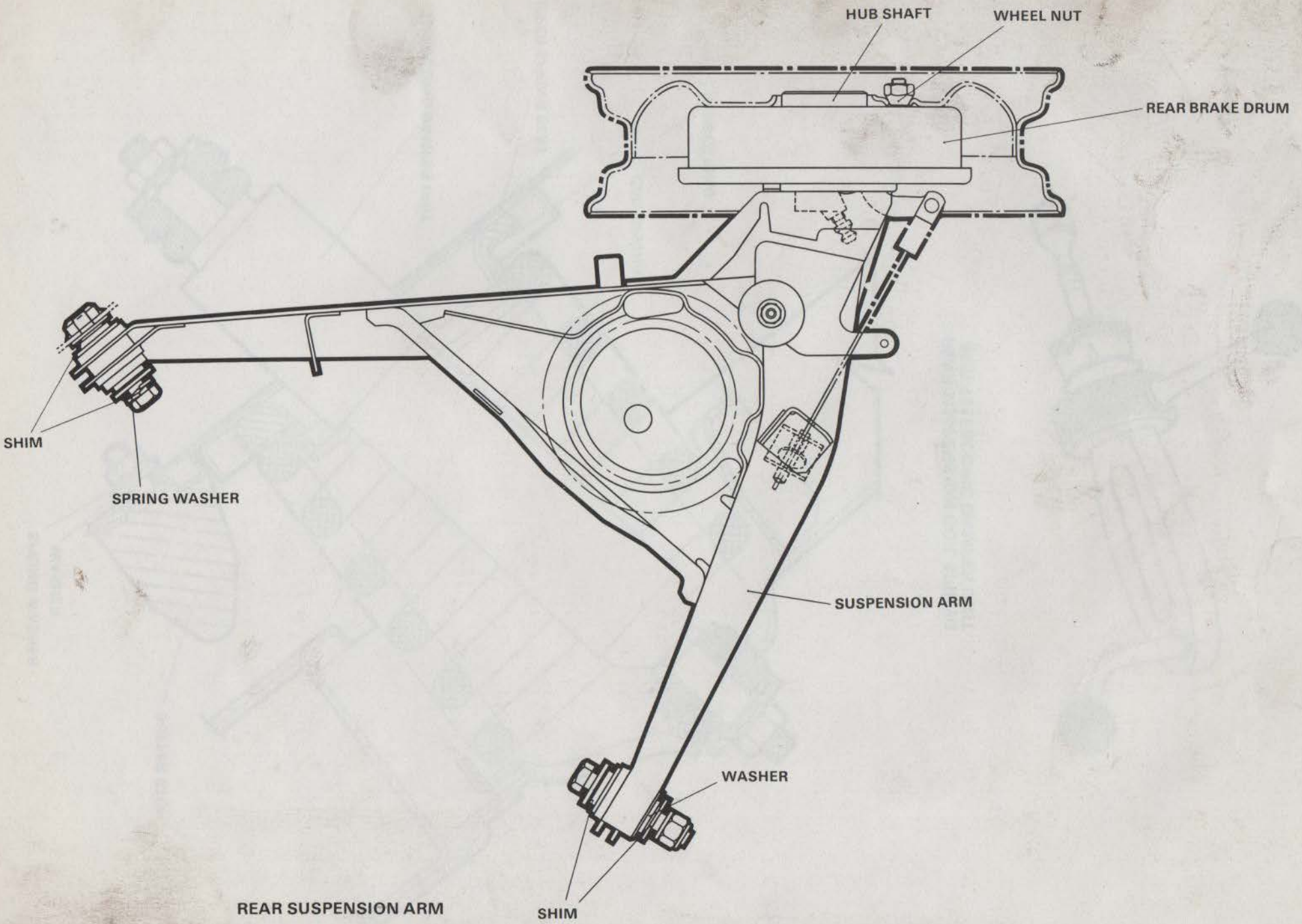
    Notes:

    (i) The rear pivot bolt has a captive nut: the front pivot bolt has a free nut.

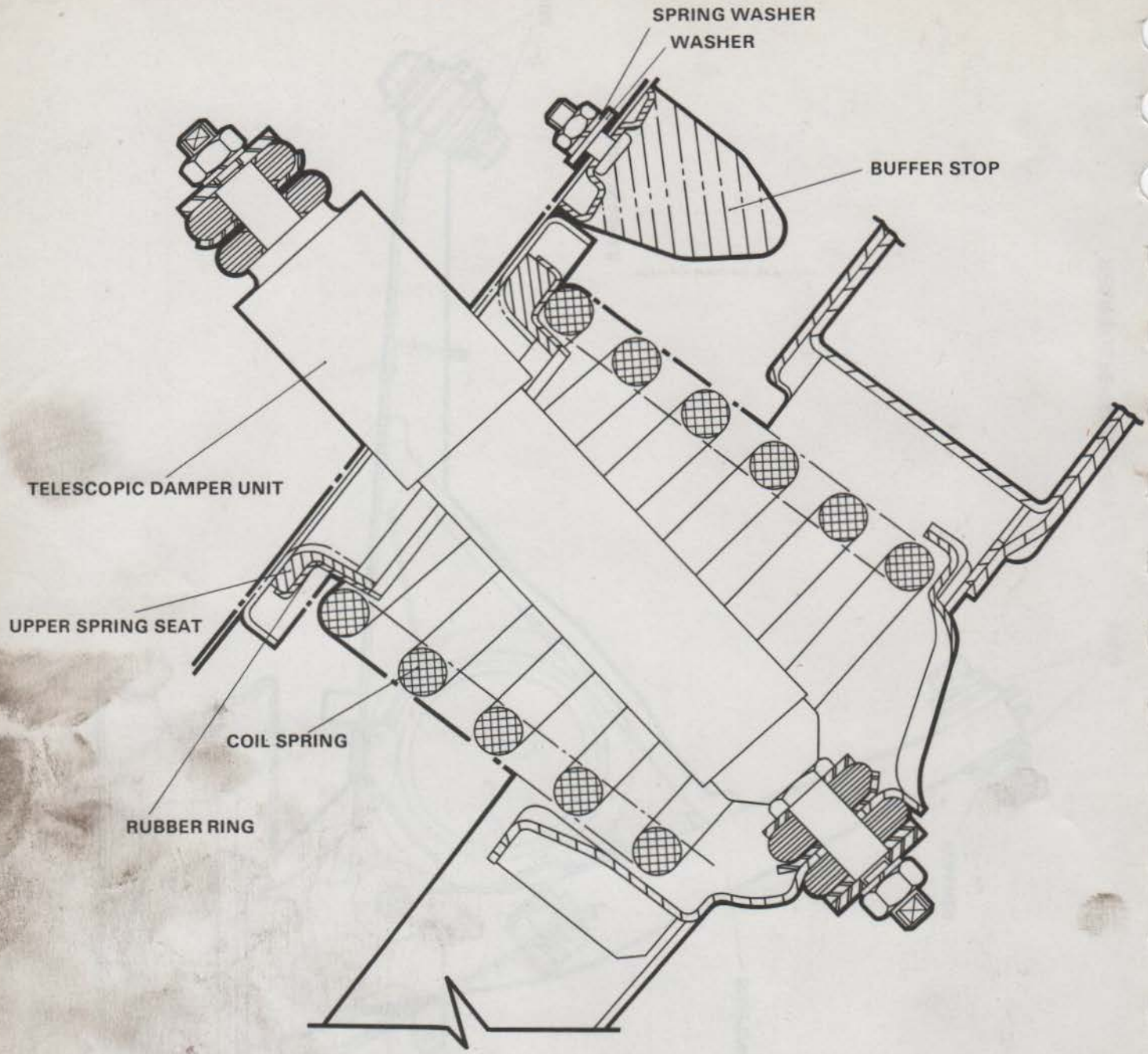
    (ii) Note the number and position of shim washers for subsequent reassembly. They will vary from vehicle to vehicle.
12. Withdraw pivot bolt rubber bushes.

Method of removal of telescopic damper unit downward through a hole in the suspension arm.

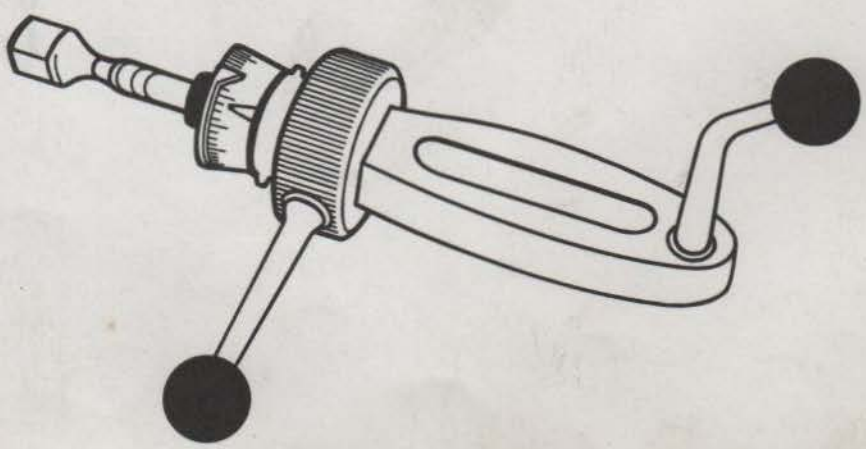
Wishbone framework of rear suspension showing coil spring in its lower mounting.



REAR SUSPENSION ARM



REAR SUSPENSION COIL SPRING
AND TELESCOPIC DAMPER UNIT



SPECIAL FIAT ROTATION TORQUE DYNAMOMETER A.95697

Reassembly of Rear Suspension

Reverse the above procedures, noting the following points:

(i) Pivot bolts should not be tightened until suspension is in its normal position when weight of vehicle is on the road wheels.

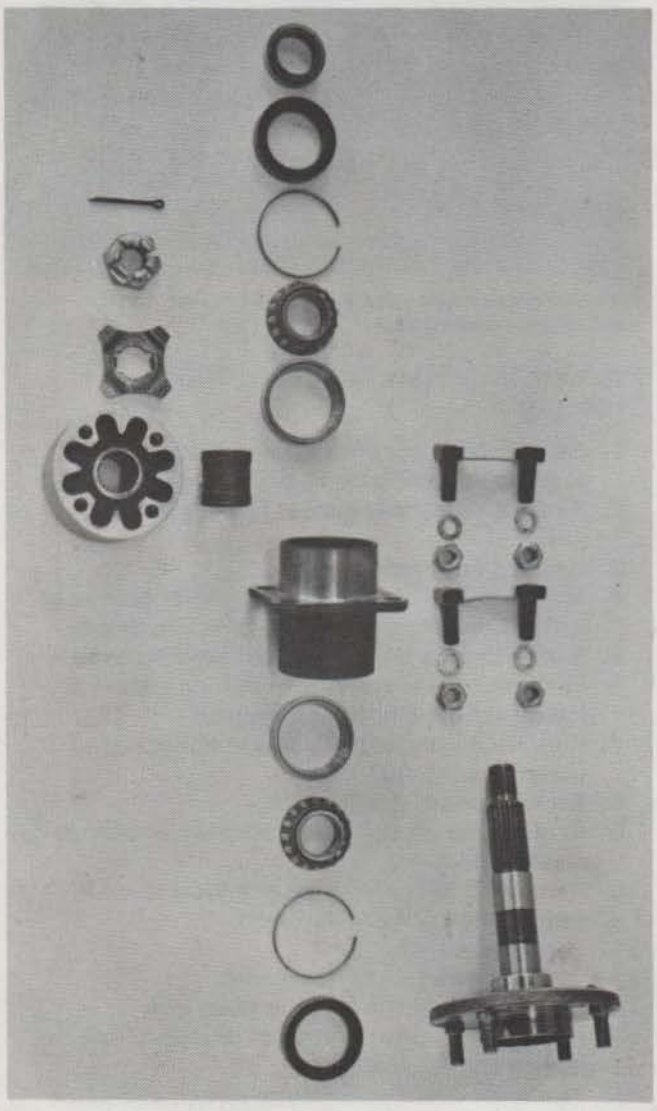
(ii) The suspension will not assume this position immediately upon lowering vehicle onto road wheels. It is necessary to roll the vehicle a few yards to normalise.

Rear Telescopic Damper Unit

This is a non-repairable item which must be replaced with a complete new unit when it becomes unserviceable.

Dismantling Rear Hub Assembly

1. Remove road wheel and brake drum.
2. Withdraw split pin to castellated nut behind drive coupling.
   Note: This nut is tightened to give a pre-determined rotational torque setting of shaft in bearings (see instructions for reassembly of Rear Hub) and should not be dismantled except when absolutely necessary.



"Exploded" view of rear hub assembly and drive coupling unit.

3. Remove castellated nut and tab washer.
4. Withdraw drive coupling unit.
5. Withdraw spacer from rear of hub unit.
6. Withdraw axle shaft complete. The inner race of the outboard taper roller bearing nearest the hub will separate from the outer race. The inner race of the inboard taper roller bearing will slide along the axle shaft.
7. Remove 2 oil seals located on either side of hub.
8. Remove 2 spring ring spacers located between the oil seals and roller bearings.
9. Withdraw 2 taper roller bearings.
10. Remove collapsible distance piece located between the oil seals and roller races.
11. Drive out 2 bearing cones.
12. Remove 4 brake backplate retaining nuts
13. Withdraw brake backplate.
14. Remove 4 bolts tabbed in pairs.
15. Withdraw hub unit.

Reassembling Rear Hub

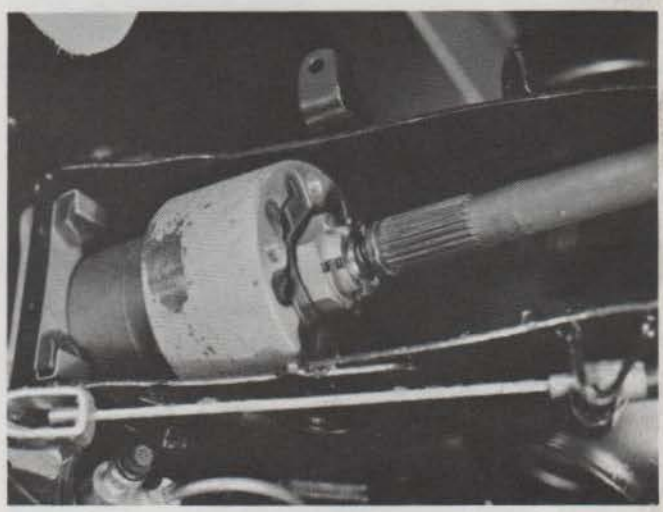
Reverse the order of the above procedures, packing the hub with grease.

Notes:

(1) The hub drive coupling unit is replaced dished side outward (away from the brake back plate).

(2) The castellated nut (2 above) must be tightened to produce a rotating torque of shaft in bearings of not more than 0·36 ft. lbs. This should be done using Special Fiat Tool: Bearing Rotation Torque Dynamometer A95697.

(3) Both seals, the tab washer under the castellated nut and the collapsible distance piece must be renewed on reassembly.



Drive coupling unit.

Road Wheels and Tyres

The road wheels are of pressed steel disc type and are interchangeable all round. They are attached to the wheel hubs by means of 4 studs and 4 wheel nuts. The two rear wheels are fitted with anodised aluminium hub caps.

The tyres are 125 × 12, 4-ply with tubes. Recommended tyre pressures are:

Front	17 psi
Rear	22 psi

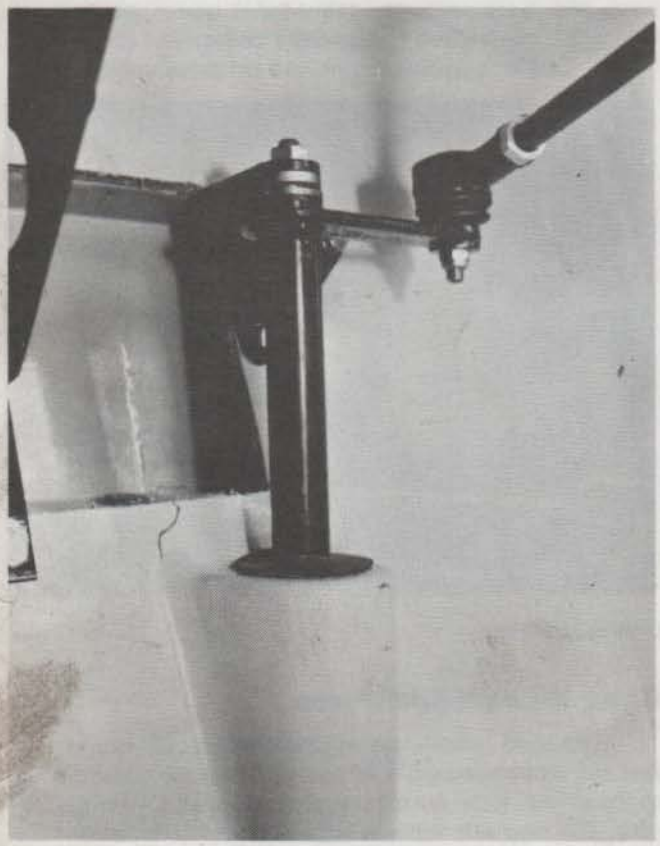
Steering

There are a very wide variety of steering systems employed in specific examples of the Model 70 Automatic Tricycle, which have been developed to cater for the varying requirements of drivers. Each of these variations will involve one of the following basic methods of steering.

(a) Steering wheel.
(b) Bicycle type handlebars.
(c) Tiller, either left or right hand operated.

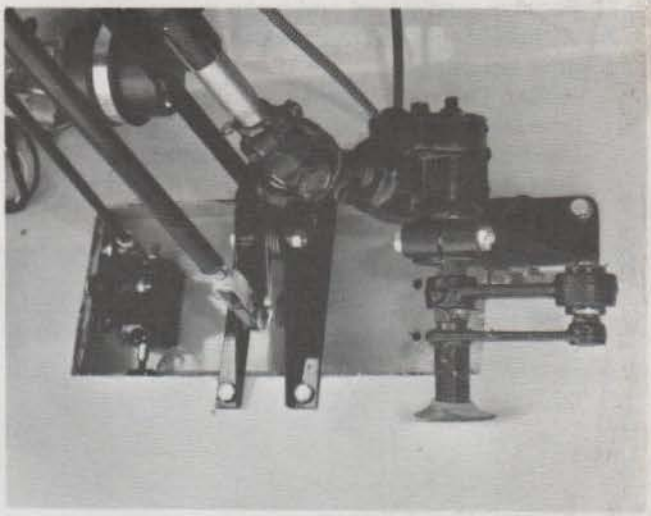
Variations include left and right hand tiller, combined with downward movement of handlebar or tiller to operate the hydraulic brakes, with or without pedal assistance: fixed handlebar or tiller columns, where braking is solely by pedal.

However, whichever steering method is employed, the drive is taken through the floor of the vehicle via a vertical shaft (the steering post) which has a steering lever welded to its upper end. The linkage from this shaft onward to the front steering lever at the front hub is common to all systems. It consists of a lower steering lever which is splined and clamped to the vertical steering post and connected to the front steering lever by a track rod fitted with two 'sealed-for-life' ball joints.



A vertical shaft (the steering post) takes the steering drive through the floor in all variations of the steering system. Picture shows basic method for tiller or bicycle type.

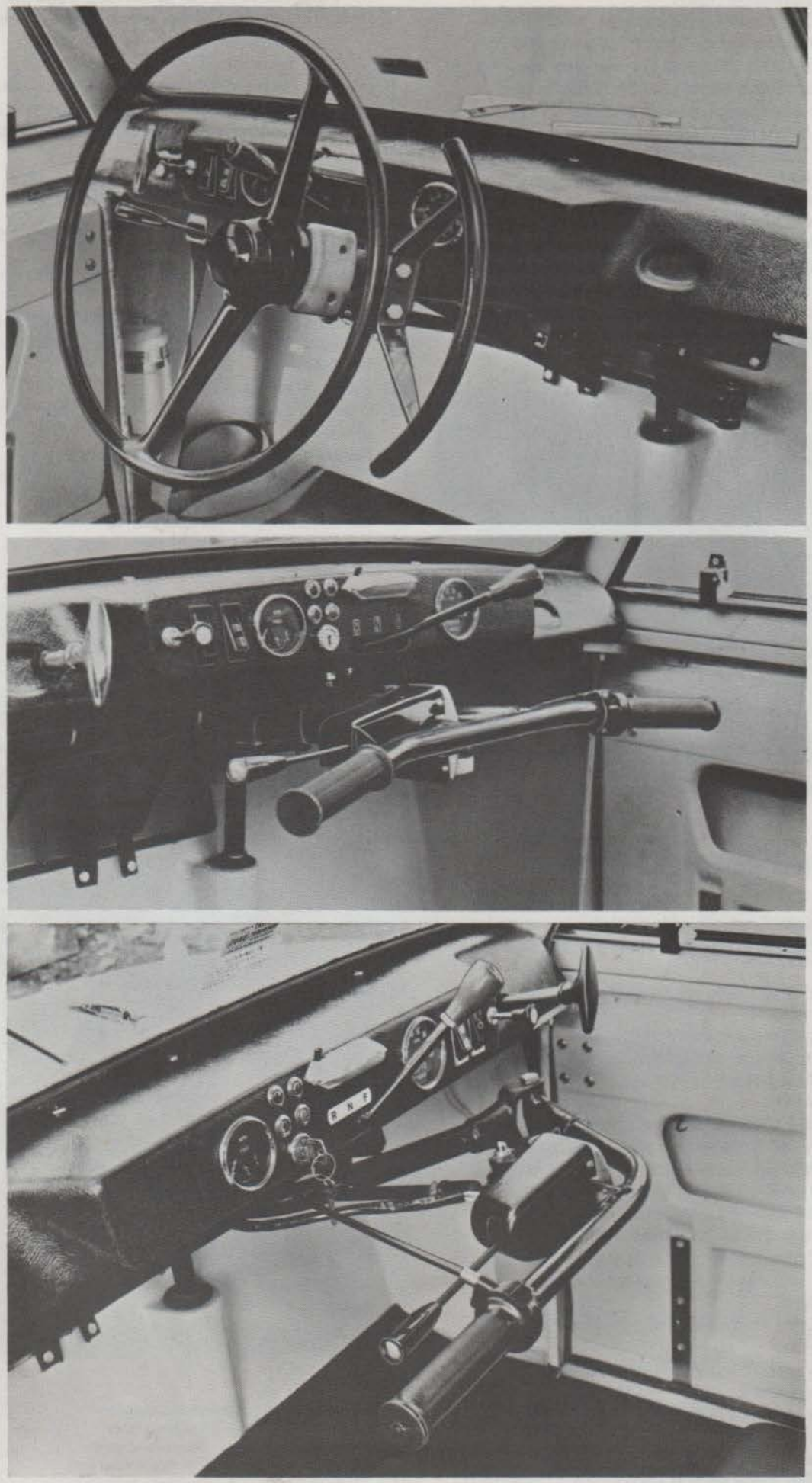
In the cases of tiller and handlebar types, the vertical steering post is actuated by a direct rod linkage from the tiller or handlebar to the upper steering lever. With a steering wheel, on the other hand, steering drive from the steering column is taken via a universal joint to a worm and segment steering box, the vertical output shaft of which is directly above the vertical steering post. The steering box output shaft is linked to the upper steering arm by means of a metalastik rubber coupling in a second arm parallel to the upper steering arm.



For steering wheel type steering a steering box is coupled to the steering post.

Dismantling Handlebar or Tiller Steering

1. Jack up front of vehicle and mount on stands at recommended jacking points (see page **viii**).
2. Remove nut to ball joint at each end of track rod.
3. Remove track rod.
4. Mark position of lower steering lever relative to vertical steering post to aid correct assembly.
5. Remove pinch bolt from lower steering lever.
6. Withdraw lower steering lever from splines at lower end of vertical steering post.
7. Remove 2 bolts at ball joints at either end of upper steering rod.
8. Remove upper steering rod.
9. Remove nut and pivot pin from top of vertical steering post.
10. Remove 3 bolts holding top vertical steering post bracket to front bulkhead.
11. Remove bracket.
12. Withdraw vertical shaft upward.
13. Disconnect throttle cable at twist grip.
14. Remove 2 screws in cover of direction indicator switch and remove cover.
15. Withdraw direction indicator switch and allow to hang on its lead.
16. Remove handlebar/tiller vertical pivot bolt.



Steering wheel, bicycle type and tiller type steering.

17. Remove handlebar/tiller.
    Note: The following instructions refer specifically to either hand or combined hand and foot braking for both tiller and bicycle type steering.
18. Disconnect brake push rod clevis pin from vertical plate welded to end of tiller.
19. Remove brake return spring.
20. Remove 2 pivot bolts attaching tiller to brackets on bulkhead.
21. Withdraw tiller unit complete.
22. Press out bushes in tiller pivot housing.
    Note: Where braking is by foot pedal, items 16 and 17 above do not apply. In this case, after item 15, simply remove bolt and washers which clamp lug on tiller to bracket on chassis cross tube. Continue dismantling with items 18, 19 and 20.

Steering system showing lower steering lever and track rod.

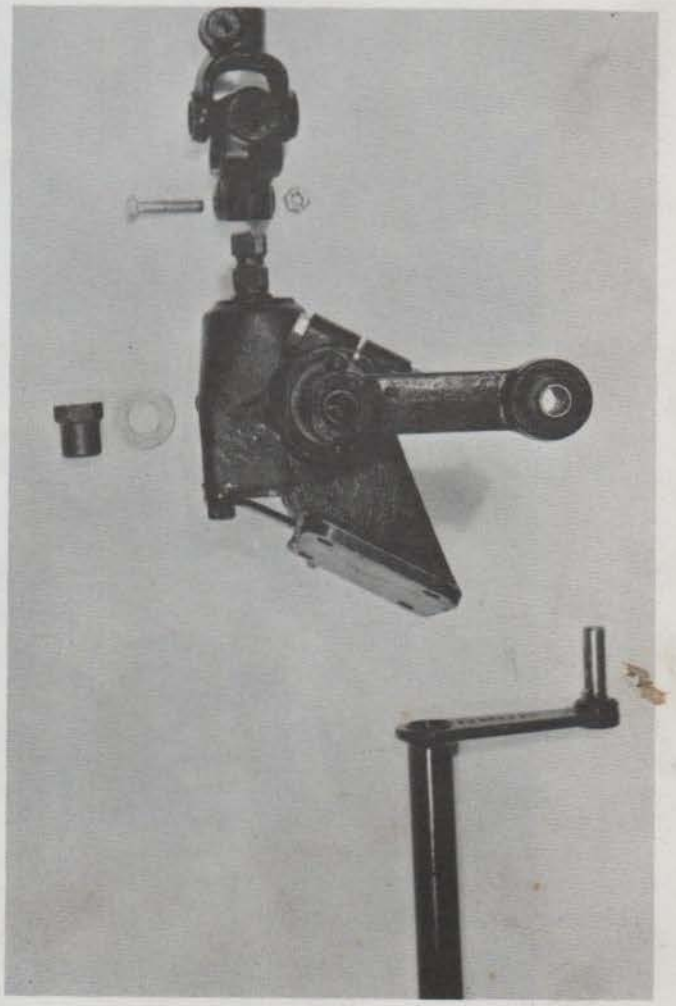
Reassembling Handlebar or Tiller Steering

These systems may be reassembled by reversing the above procedures. The following points should be noted :—

1. The lower steering lever must be fitted with the boss downward.
2. When reassembling the vertical shaft, manipulate the top bracket to a position where the shaft moves freely before tightening the bracket to the bulkhead.
3. If the marks made under Item 4 or dismantling procedure are not visible, to ensure that the lower steering lever is correctly positioned on the lower splined end of the vertical shaft, adopt the following procedure:
   (a) Fit track rod to front steering arm.
   (b) Fit lower steering lever to track rod.
   (c) Set handlebar/tiller to straight ahead position.
   (d) Set front road wheel to straight ahead position.
   (e) Slide rear steering arm onto splines of vertical shaft.
   (f) Slide in pinch bolt, which should engage easily in a groove in the vertical shaft.
   Note:
   (1) No force should be used in operation (f) above. If the pinch bolt does not slip in under finger pressure only, then the rear steering arm is incorrectly positioned on the splines.
   (2) The straight-ahead position of the top steering arm will vary according to the control variant fitted to any particular vehicle.

Dismantling Wheel Type Steering

1. Follow procedures 1 – 5 as for dismantling handlebar/tiller steering.
6. Remove pinch bolt from universal joint on steering column.
7. Withdraw steering column from universal joint.
8. Remove 4 bolts securing steering box bracket to bulkhead.
9. Remove steering box.
10. Steering column may also be withdrawn if required.
11. Remove universal joint from steering box.
12. Knock back tab washer locking spigot nut on output shaft of steering box.
13. Remove spigot nut and tab washer.
14. Withdraw steering arm from steering box.



In wheel-type steering, the steering column carries a universal joint which splines onto the steering box input shaft. The output shaft carries an arm which engages with a similar arm at the upper end of the steering post.

15. Press out rubber bush from steering arm.
16. Remove pinch bolt on steering box bracket.
17. Remove steering box from bracket.
18. Remove tie bracket from steering box.
    Note: The steering box is a non-repairable item. It should be replaced with a completely new unit when it becomes unserviceable.

Reassembling Wheel Type Steering

Reassemble by reversing the above procedures, noting points listed under REASSEMBLING HANDLEBAR OR TILLER TYPE STEERING, above.

Fitting a New Steering Box

1. Fit tie bracket to new box.
2. Fit new box to steering bracket.
3. Insert pinch bolt into steering box bracket but do not tighten.
4. Centralize steering box mechanism – i.e. count the number of turns from stop to stop and turn back half this number.
5. Ensure that register mark on steering cross shaft end is in line with the point at which the steering box commences to taper.
6. Fit steering arm to steering cross shaft with flat on boss away from the steering box.
   Note: Centre line of steering arm must be a continuation of a line drawn between the reference points mentioned in No. 5 above.
7. Fit tab washer.
8. Fit and tighten spigot nut.
9. Bend one side of tab washer into flat on steering arm and other side up onto one flat of the spigot nut.
10. Refit universal joint and install, reversing dismantling procedure.
11. Tighten pinch bolt in steering box bracket.

Amendment 1/83

SETTING THE STEERING GEOMETRY - HANDLE BAR AND TILLER STEERING

It is essential when setting the steering Geometry that all levers are in the correct angular relationship and that the link rods have sufficient thread engagement with the ball joints.

All adjustments are to be made with the front wheel in the "straight ahead" position and the steering control lever central. When adjustment is completed the steering rods should have approximately the same amount of thread showing at both ends (although the actual amount may differ between top and bottom rods).

SETTING THE UPPER STEERING LEVER

A) Bicycle Type Steering

Set to 3" ± 1/16" measured in the horizontal plane, from the axis of the ball joint at the lower face of the lever, to the front bulkhead.

B) Left Hand Tiller

Set to $3\frac{3}{4}$" ± 1/16" measured in the horizontal plane, from the axis of the ball joint at the lower face of the lever, to the front bulkhead.

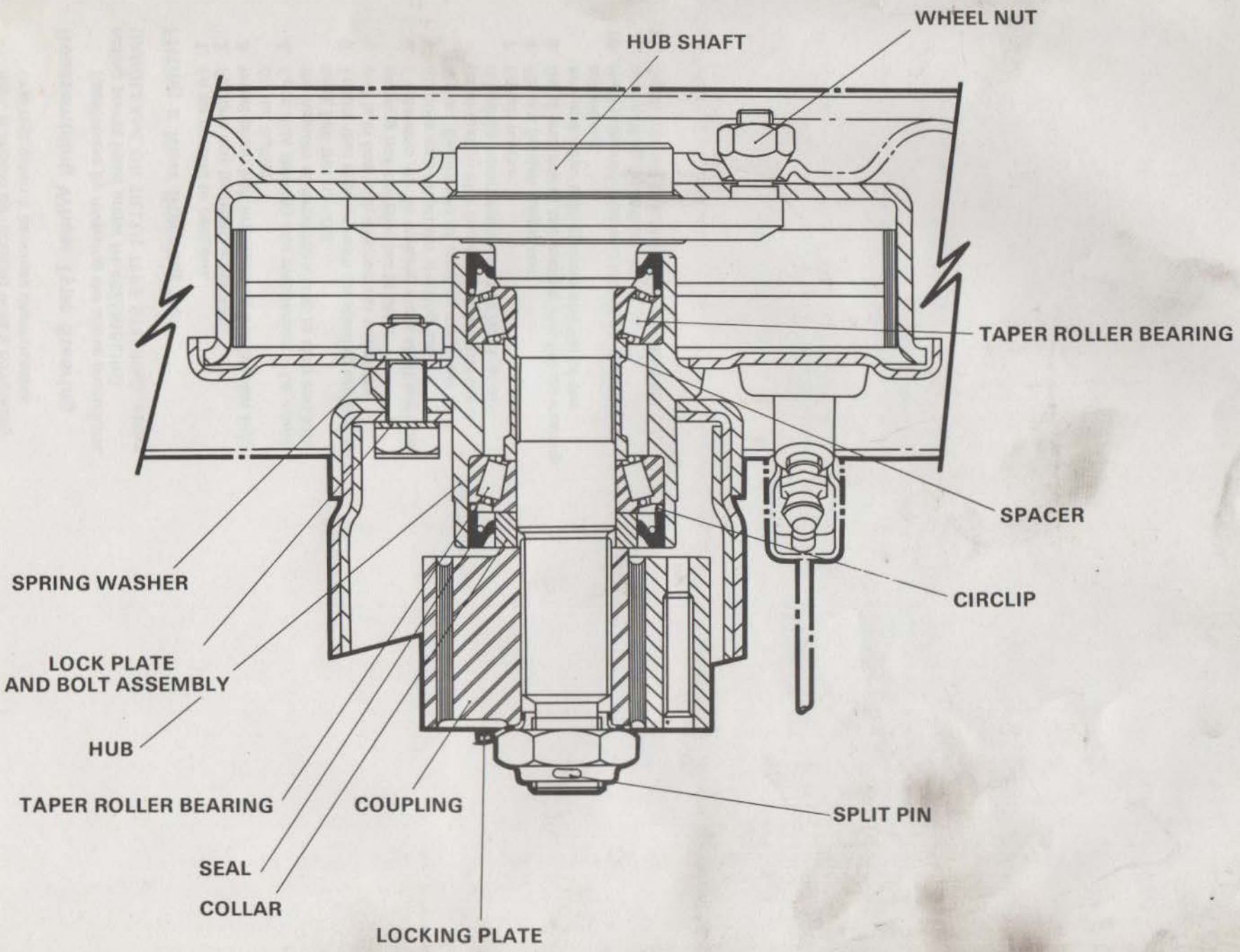
C) Right Hand Tiller

Set to 5" ± 1/16" measured in the horizontal plane, from the axis of the ball joint at the lower face of the lever, to the front bulkhead.

SETTING THE LOWER STEERING LEVER

This operation is to be carried out after the top lever has been set, with the steering control maintained in the "straight ahead" position. It is applicable to ALL types of steering including Steering Wheel.

Set to $3\frac{3}{8}$" ± $\frac{1}{2}$" measured in the horizontal plane from the axis of the ball joint to the front face of the chassis cross member.



AXLE SHAFT AND BRAKE

Brakes

The Girling hydraulic braking system operates on all three road wheels, each of which is fitted with identical 7" drum assemblies having one leading shoe and one trailing shoe. The independent mechanically operated parking brake operates on the two rear wheels only, the handbrake lever mechanism on the single front wheel therefore before left unconnected.

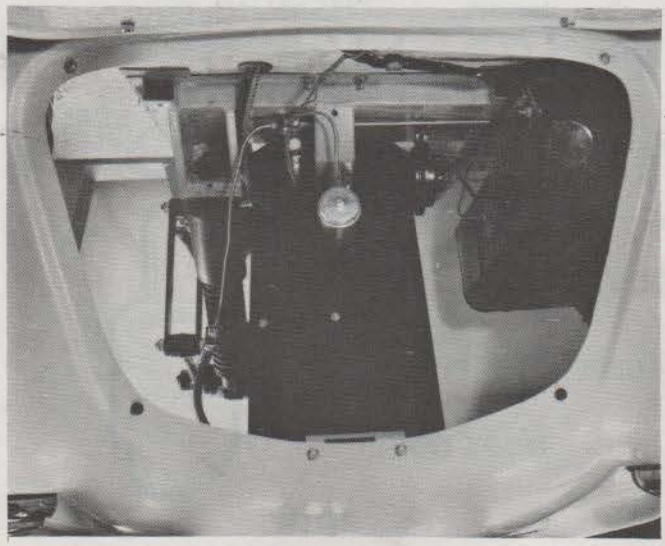
The hydraulic brake (in most motor vehicles known as the 'footbrake') in the Model 70 three wheeler may be either foot or hand-operated by pushing a lever or depressing the tiller or a combination of these according to control system. For the sake of clarity in this section, however, foot operation is assumed.

The brake pedal (lever/tiller) is mechanically coupled to a hydraulic master cylinder. Pipes and flexible hoses connect the master cylinder to the brake operating cylinders in each brake. The master cylinder acts as a pump when pressure is applied via the brake pedal.

When the brake is 'off' there is no effective pressure in the system. When the brake pedal is depressed, the movement of the plunger in the master cylinder creates a pressure which is transmitted through the brake fluid in the pipes and flexible hoses equally to all road wheels.

The pressurised fluid tends to push each piston out of its wheel cylinder and this moves each leading brake shoe onto its drum. At the same time, the 3 cylinder bodies slide on their backplates to operate the trailing shoes.

The handbrake lever is connected to the two rear brakes by a cable and lever system in such a way that a mechanical advantage of 8 : 1 is achieved and each brake is equally engaged despite unequal wear/adjustment of the brake shoes. The rear section of the handbrake linkage is connected on each rear brake to an external lever which moves the cylinder body and with it the trailing shoe. A ratchet mechanism on the parking brake handlever control ensures that the brake remains in the 'on' position until released by the driver.



Location of brake master cylinder in front compartment.

The wheel cylinder is held to the backplate by spring clips which permit the lateral sliding movement which is essential for brake operation.

The brake adjuster is bolted firmly to the backplate, and slots are machined in the adjuster links to allow centralisation of the shoes as necessary during the life of the lining.

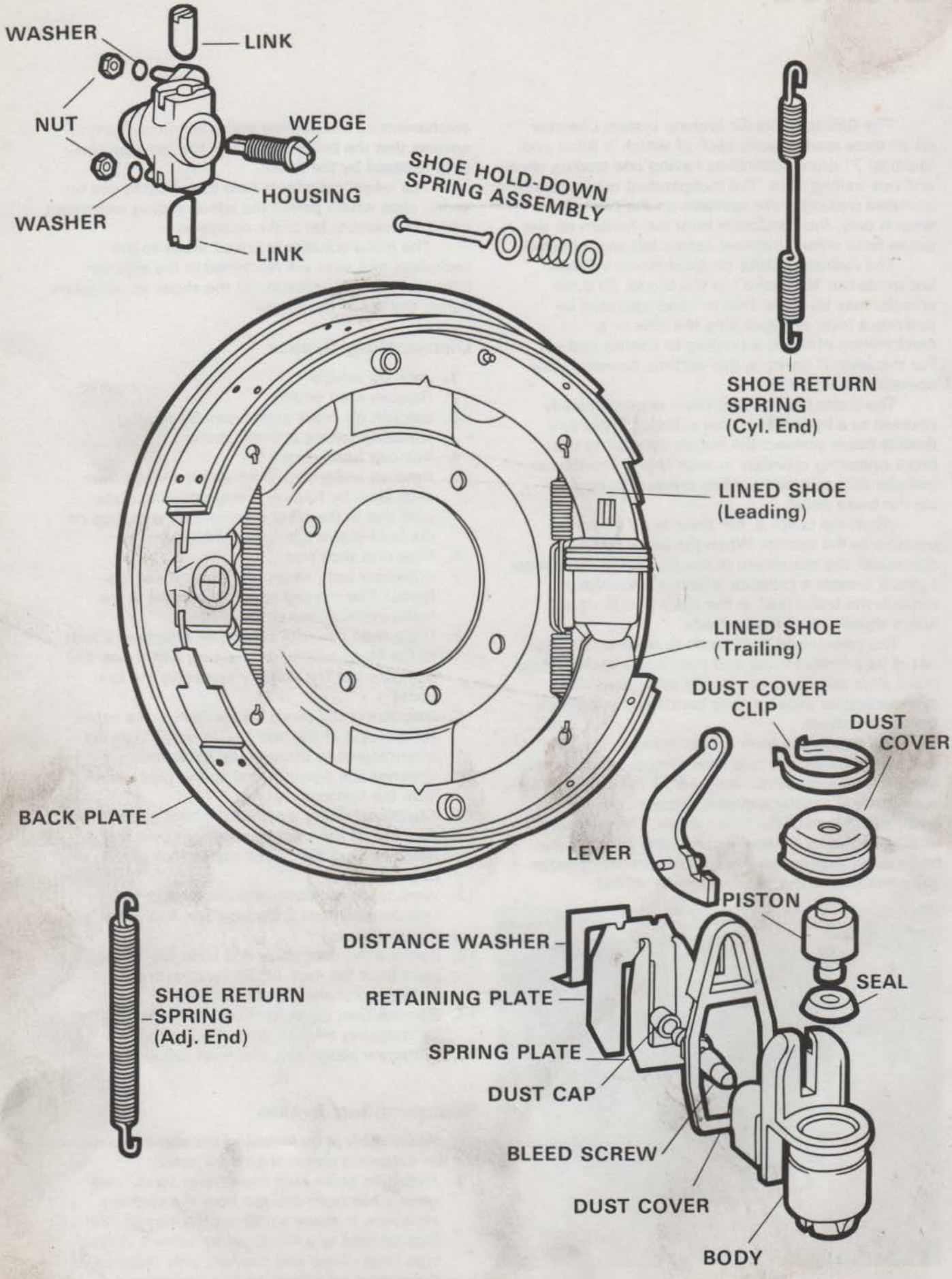
Dismantling Brakes

1. Jack up vehicle.
2. Remove road wheel.
3. Slacken off brake adjustment by turning adjusting square anti-clockwise.
4. Remove brake drum.
5. Remove brake shoe hold-down springs from each shoe by turning spring retaining plate until slot in the plate corresponds with lugs on the hold-down spring assembly pin.
6. Prise one shoe free.
7. Withdraw both shoes and pull-off springs.
   Note: The red coil spring is located at the brake cylinder end of the shoes.
8. Drain fluid from the system by attaching a tube to the bleed nipple, unscrewing half a turn and pumping out the fluid by operating the foot pedal.
9. Disconnect the clevis on the handbrake cable (in the case of the rear brakes only) from the lever projecting through the backplate.
10. Unscrew the pipe nut and spring pipe away from the cylinder.
11. Tap the retaining plate on the back plate from the neck of the cylinder, easing it over the raised ends of the spring plates (see picture on page **78**).
12. Work the lever pivot from underneath the cylinder and push it through the dust cover on the backplate.
13. Remove the dust cover and slide the spring plate from the neck of the cylinder and withdraw cylinder from backplate.
14. Remove dust cover from end of brake cylinder by springing off dust cover body clip.
15. Withdraw piston and seal from cylinder.

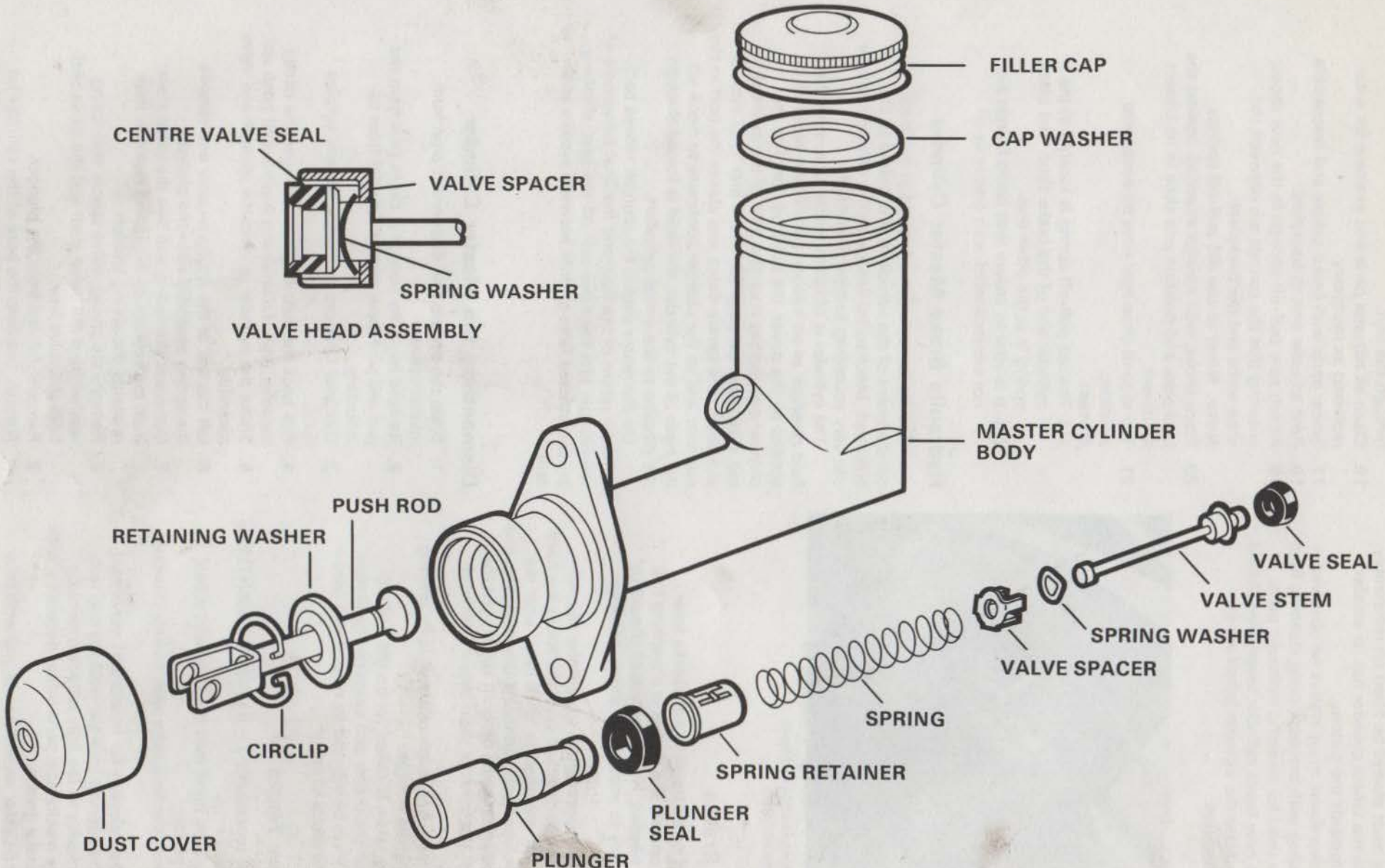
Reassembling Brakes

Reassembly is by reversing the above procedure, but the following points should be noted:

1. Hydraulic brake fluid must never be re-used once it has been drained from the system. However, in many situations the loss of fluid may be kept to a minimum by using a Girling type hose clamp and draining only that part of the system on which work is being done. Under no circumstances must mole grips or any



EXPLODED VIEW OF HYDRAULIC BRAKE WHEEL ASSEMBLY



EXPLODED VIEW OF MASTER CYLINDER

similar grip be used on the flexible pipe.
2. New seals must always be fitted on reassembly. The seal in the wheel cylinder has its smaller diameter towards the piston.
3. Extreme cleanliness must always be observed when dealing with brakes. Girling cleaning fluid should be used for cleaning hydraulic parts.
4. Complete new brake cylinder assemblies should be fitted unless the cylinder hoses are in perfect condition.

Front brake showing flexible hydraulic fluid line and brake adjuster.

Adjusting Brakes

Increased pedal travel or handbrake lever movement to operate the brakes is a warning that adjustment is needed. However, brakes should be adjusted regularly to ensure that these warnings do not occur.

Method of adjustment is to turn the adjuster head in a clockwise direction until the shoes are hard against the drum, and then to 'click back' until the wheel just revolves freely without drum-drag. The one adjuster per brake operates on both shoes, and the squared end of the adjuster stem projects through the backplate.

Note: Never adjust the rear brakes by altering the handbrake linkage.

Whenever work is called for on the braking system, remove the drums and examine the linings. They should never be allowed to wear down below 1/16" from the metal shoe.

Fitting New Shoes

Carry out procedures 1 – 8 under DISMANTLING BRAKES, page **77**.

9. Slip an elastic band over the hydraulic wheel cylinder piston.
10. Wipe down the backplate with Girling cleaning fluid.
11. Check the cylinders for freedom of movement.
12. Check the adjuster for easy working and turn anti-clockwise to the fully retracted position.
13. Lubricate mechanical parts when necessary with Girling brake grease.
14. Remove adjuster retaining nuts and withdraw adjuster unit from backplate.
15. Remove adjuster links and screw wedge right through the unit.
16. Clean all adjuster parts and examine for wear, replacing as necessary.
17. Smear parts with brake grease and reassemble.
18. Refit adjuster unit to backplate.
19. Attach new pull-off springs to the new shoes, ensuring that the springs are between the shoe webs and the backplate.
    Note: Never re-use old pull-off springs.
20. Place shoes, with springs attached, against the backplate and position one shoe in its correct abutment.
21. The second shoe may now be eased into position.
    Notes:
    (1) The red pull-off spring is located at the cylinder end of the brake shoe. The black spring is at the other end.
    (2) It is vital to ensure that brake linings are not contaminated with grease or oil.

Hydraulic Brake Master Cylinder

The master cylinder is located in the front compartment of the vehicle and is bolted to the bulkhead. Mechanical linkage to the driving controls can vary according to type of control.

The cylinder is of centre valve type, with the fluid reservoir as an integral part. When pressure is applied by the driver, the pushrod contacts the plunger and pushes it up the bore of the cylinder – see illustration on page **79**. In the first 1/32 inch of movement the centre-valve seal closes the port to the reservoir and as the plunger continues to move up the hose of the cylinder, the fluid is forced through the pipeline to the wheel cylinders.

On the return stroke, the plunger moves back with the return of the fluid and the final movement of the plunger lifts the valve seal off the seat, allowing an unrestricted flow of fluid between system and tank.

Dismantling the Master Cylinder

1. Drain the system and disconnect pipe from master cylinder.
2. Remove securing bolts and clevis pins from the jaw and withdraw master cylinder from its mounting.
3. Unscrew filter cap and drain out any surplus fluid.
4. Pull back the dust cover and remove the circlip together with the retaining washer and push rod.
5. Shake the cylinder to eject the plunger and valve assembly.
6. Lift the leaf of the spring retainer and remove the spring assembly from the plunger.
7. Compress the spring and free the valve stem from the keyhole of the spring retainer, thus releasing the spring tension.
8. Remove the spring, valve spacer and spring washer from the valve stem and the valve seal from the valve head.
9. Remove the seal from the plunger.
   Notes: Examine the bore of the cylinder for scores and ridges, and check that it is smooth to

the touch. If there is the slightest doubt as to the condition of the bore, a new cylinder assembly must be used.
Examine the plunger for burrs and ridges and renew if necessary.

Reassembly of Master Cylinder

1. Fit the plunger seal to the valve head with the smaller diameter against the head.
2. Fit the valve seal, smaller diameter leading, to the valve head.
3. Position the spring washer on the valve stem so that it 'flares' away from the valve stem shoulder.
4. Follow with valve spacer (legs first) and spring.
5. Fit the spring retainer to the spring and compress the spring until the valve stem passes through the keyhole slot and engages in the centre.
6. Fit the spring immediately to the plunger and press home the leaf of the spring retainer to secure.
7. Liberally lubricate the seal and the plunger bore with *unused* Castrol-Girling brake and clutch fluid.
8. Insert the plunger assembly (valve end leading) into the cylinder body plunger bore, easing the entrance of the plunger seal. The smaller diameter of the seal butts against the plunger.
9. Position the push rod and retaining washer and fit the circlip to secure.
10. Smear the lips of the dust cover with Girling Rubber Grease and fit.
11. Fit the cap washer and screw the filter cap on to the cylinder.
12. Remount the cylinder to the front bulkhead, and reconnect the hydraulic pipe.

Bleeding the Hydraulic System

"Bleeding" is necessary whenever any part of the system has been disconnected, or the level of fluid in the supply tank has been allowed to fall so low that air has been drawn into the master cylinder.

When seals are worn it is possible for air to enter the wheel cylinders without any sign of leaking fluid and cause a "spongy" pedal which is the usual indication of bubbles of air in the system.

Use of the Girling Brake Service Hose Clamp considerably facilitates the bleeding procedure by accurate diagnosis of the exact location of air in the system, therefore, saving time by (a) locating the hydraulic fault, and (b) saving fluid when servicing the wheel cylinders.

Providing the brake hose is in reasonable condition, damage cannot be caused using the hose clamp. But the use of other tools to clamp the hoses must not be attempted as damage can be caused internally to the hose without it being noticed externally.

Release the clamp screw and fit the clamp so that the flexible hose is between the rods at the pivot end, squeeze the rods together, apply the screw clamp and tighten.

With clamps fitted on the front and rear hoses the pedal action should be perfect with no indication of "spongyness". If under these circumstances a spongy pedal is apparent, a new master cylinder assembly must be fitted and bled and the test repeated.

Remove one rear clamp and if the pedal is spongy, the air must be in the rear cylinder. However, if the pedal action is good then the air must be in the front cylinder. The remaining clamps should be removed one at a time and the system repeatedly tested in this way.

For wheel cylinder servicing, only the appropriate hose need be clamped. This keeps the loss of fluid to a minimum and after the service is satisfactorily completed, only the affected parts require bleeding.

It is vital that absolute cleanliness is maintained throughout the entire bleeding operation. Never use a rag of linty texture and ensure that no dirt or grit enters the system – especially at the supply tank. All equipment to be used must be entirely free from petrol, paraffin, or any form of mineral oil, as mineral contamination spreads rapidly in the hydraulic system, causing a dangerous deterioration of the rubber seals. Always replace the rubber cap on each bleedscrew to prevent dirt entering the bleed tube during any subsequent bleeding operation.

Never, under any circumstances, use the fluid which has been bled from a system to top up the supply tank as it may be aerated, have too much moisture content, and/or be contaminated.

When bleeding the front brake, the adjusters on front brake should be slackened right off (anti-clockwise) and the adjusters on rear drum brakes should be locked hard (clockwise). This reduces the space in the cylinder and economises in time and fluid.

Reverse the procedure for the rear brakes.

It is recommended that a commercial brake bleeding system be used. This ensures that efficient bleeding is carried out, that the master cylinder is automatically filled and that a minimum of labour and time is used.

Bleeding should start at the rear left-hand side wheel. Unscrew the bleedscrew enough to allow the fluid to be pumped out (half a turn is normally sufficient) and close the bleedscrew immediately after the last downward stroke of the pedal when bubbles no longer appear from the end of a flexible hose which is connected at one end to the bleed screw and has the other end immersed in brake fluid. Repeat this procedure at each wheel in turn and ending with the front wheel.

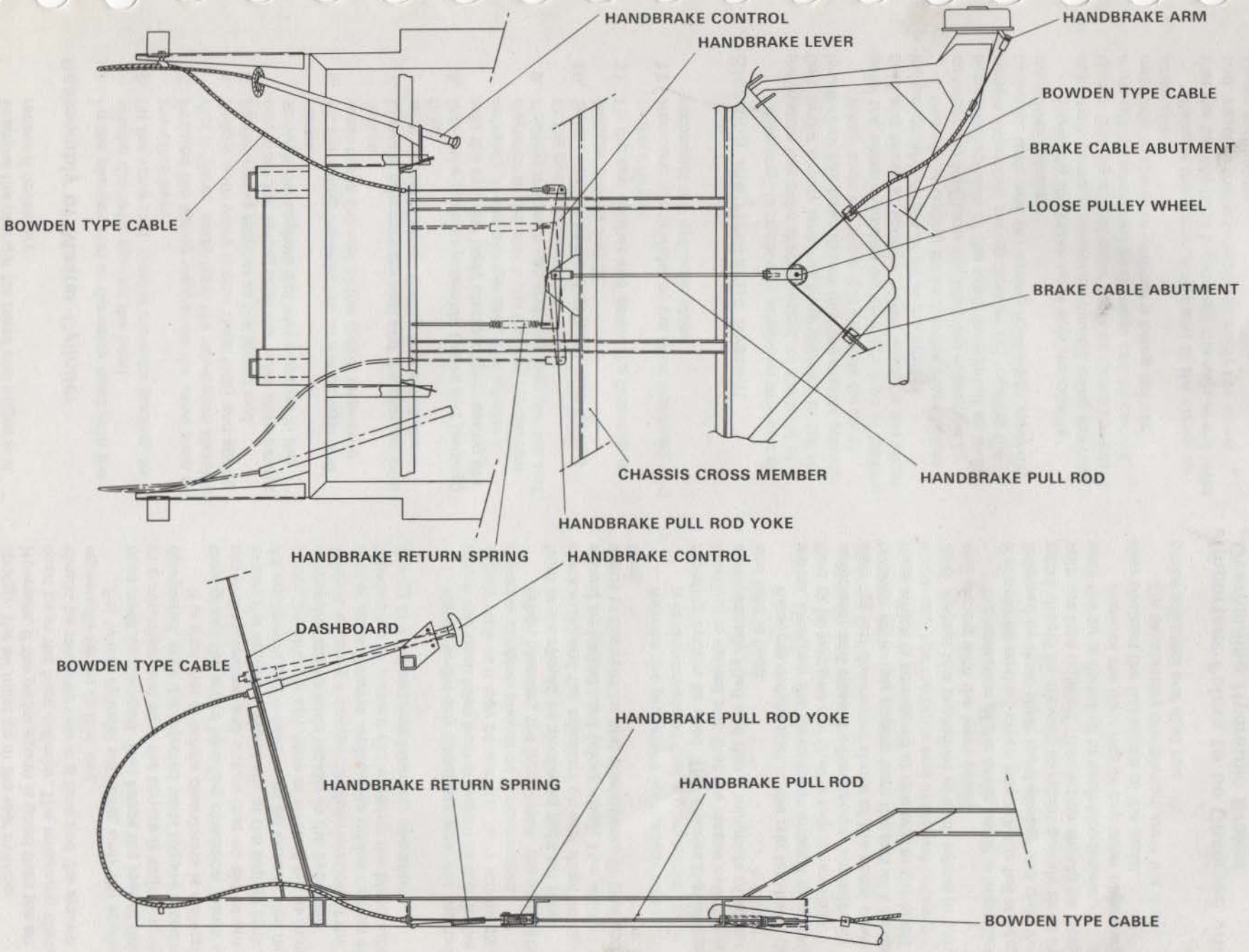
The operation of the brake pedal is important. It should be pushed down through the full stroke, followed by three short rapid strokes and then the pedal should be allowed to return quickly to its stop with the foot right off. This action should be repeated until the air is dispelled at each bleedscrew.

Remove the floor mat or any other object which may obstruct the full stroke of the pedal.

On satisfactory completion, reset the drum brake adjusters and road test.

Important Points to be Observed when Overhauling Hydraulic Brakes

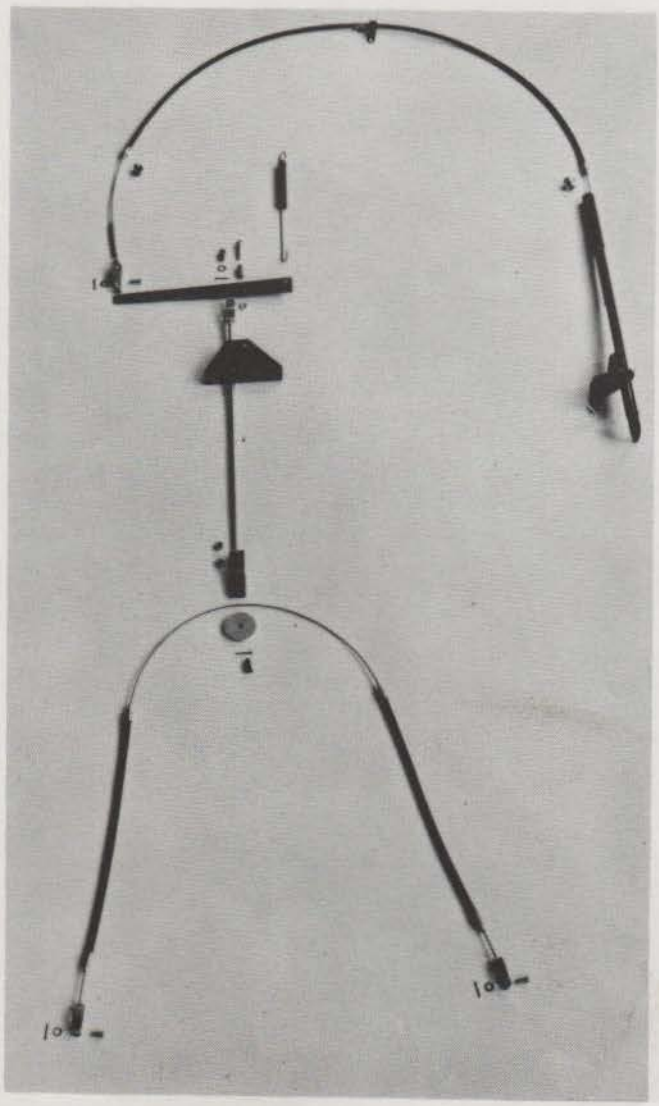
1. Always ensure that the system is fully charged with fluid and free of air *immediately* after work on the brakes is completed.
2. Always exercise extreme cleanliness when



GENERAL ARRANGEMENT OF HANDBRAKE SYSTEM
(dotted outline of handbrake and lever assemblies, etc show alternative positions for left-hand operation)

dealing with any part of the hydraulic system.

3. Never handle rubber seals or internal hydraulic parts with greasy hands.
4. Always use Girling Cleaning Fluid for cleaning internal parts of the hydraulic system. The use of other fluids can be dangerous.
5. Never use a master cylinder or wheel cylinder if the bore or piston has become scored or ridged.
6. Always pack the protective rubber boots on the master cylinder and wheel cylinders with Girling Rubber Grease. Never use brake grease or any other mineral grease for this purpose as it will contaminate the system.
7. If the system has become contaminated with mineral oil, the master cylinder, reservoir and wheel cylinders should be stripped down and the metal parts thoroughly washed in Girling Cleaning Fluid. New seals and gaskets should be fitted. The pipe lines should be similarly flushed out and new rubber hoses fitted.
8. Never re-use hydraulic fluid which has been in a system.
9. Never contaminate brake linings with oil or grease.
10. It is recommended that a proprietory bleed system be used, for safety, to save time and facilitate efficient hydraulic brake bleeding.



"Exploded" view of handbrake system.

Handbrake

The handbrake operates on the rear wheels only and is independent of the hydraulic system. The pull-type handbrake control is located in the dashboard on either the left or right hand side according to driver-requirements. It is linked by Bowden type cable to the handbrake lever mounted on a chassis cross-member under the vehicle. This gives a considerable mechanical advantage between the handbrake pull control and the wheel cylinders. This lever is yoked to a rod (the handbrake pull-rod) at the opposite end of which there is a sheath housing a loose pulley wheel.

A second cable terminates at each end at the handbrake arms projecting from the two rear brake backplates. The centre section of this cable passes over the loose pulley.

The action of pulling the handbrake control actuates the handbrake lever and therefore the handbrake pull-rod which moves forward with its pulley. This movement tensions the cable which passes over the pulley and applies the brake equally to both of the rear wheels.

Dismantling Handbrake

1. Remove handbrake return spring located at handbrake lever.
2. Remove clevis pin connecting front handbrake cable to handbrake lever.
3. Withdraw pin from pulley sheath on handbrake pull-rod.
4. Remove pulley.
5. Remove lock nuts attaching sheath to pull-rod.
6. Withdraw sheath.
7. Unbolt brake lever assembly from chassis and remove assembly.
8. Remove split pins and clevis pins from hand-brake arms at rear brake backplates.
9. Withdraw outer cable cover from abutments on diagonal tubular chassis members and rear suspension units.
10. Knock out vertical pin from bottom of handbrake control ratchet through small hole in outer casing.
11. Pull handbrake control slightly and rotate.
12. Disconnect cable from bottom of handbrake control ratchet.
13. Remove clips, outer cable-to-chassis.
14. Withdraw inner and outer cables.
15. Pull handle and ratchet from body of handbrake control.
16. Unbolt handbrake control bracket from cross member behind dashboard.
17. Push control through dashboard and downward to clear dashboard.
18. Withdraw control from below dashboard.

Reassembling Handbrake

The handbrake may be reassembled by reversing the above procedures. The following points should be noted:

1. The rear brakes should be locked by fully tightening the brake adjusters before commencing to reassemble.
2. When replacing the rear handbrake cable casing in its abutments (No. 9 above) it should pass

over (not under) the diagonal tubular chassis members.

3. The handbrake lever should be positioned as detailed in item No. 3 below (Adjusting Handbrake).
4. The handbrake should be adjusted as soon as possible after reassembly as a safety measure.
5. The ratchet stops must be depressed to clear ratchet on reassembly.

Handbrake outer cable cover located in abutment on diagonal tubular chassis member.

Adjusting Handbrake

1. Lock rear brakes by fully tightening adjusters.
2. Set handbrake control to fully OFF position.
3. Set handbrake lever by means of a distance piece so that the distance between the centre of the end hole in the lever and the rear face of the chassis cross member is $1\frac{1}{4}$".
4. Remove pulley retaining pin from pulley sheath.
5. Adjust pulley sheath lock nuts until pulley sheath pin is an easy fit when rear handbrake cable is just taut.
6. Insert pulley pin, washer and split pin.
7. Loosen rear brakes 4 "clicks" of adjusters.
8. The handbrake should now lock the wheels when the handbrake control is pulled 6 "clicks" of the ratchet.

Body

The body is of glass reinforced plastic (GRP) with the blue colour impregnated in the material. It is moulded in three pieces.

1. Front Section. 2. Rear Section.
3. Hard Top.

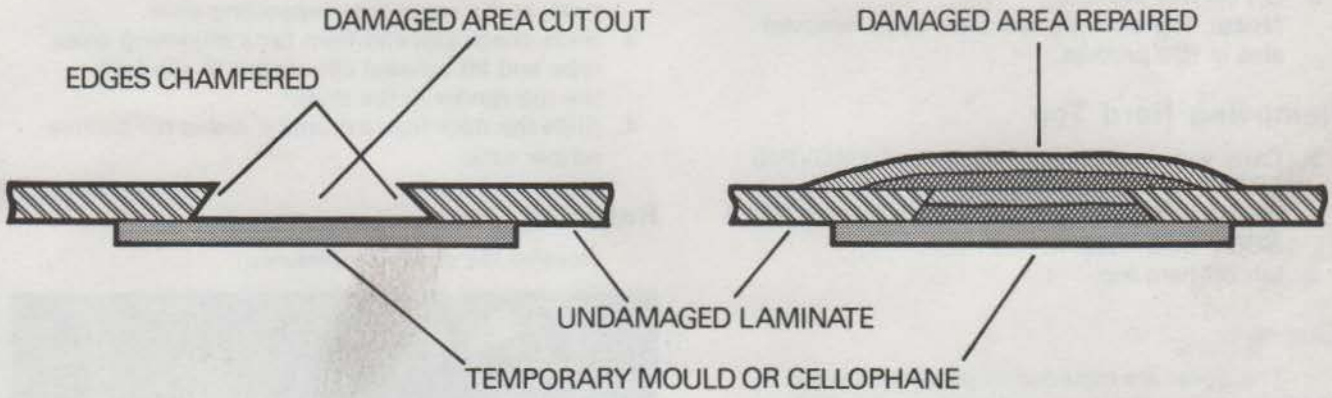
The sections are bolted together with sealing compound and sealing strip being inserted in the joins. The front and rear sections are fixed to the chassis by means of bolts, screws and rivets.

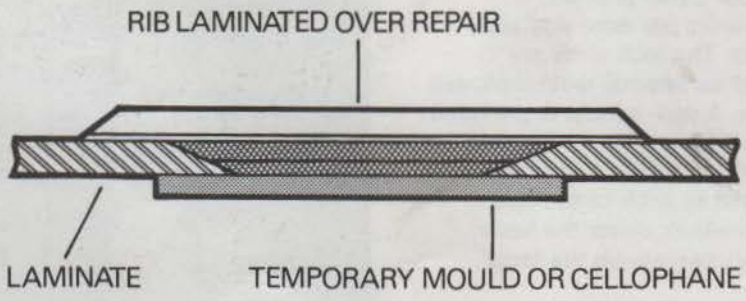
The body will not have to be removed for any mechanical servicing of the vehicle and most accidental damage to the body itself will be repairable with the body in situ. In case of severe damage necessitating the replacement of a body section, the dismantling procedures detailed on page **86** should be followed.

Repairs to Body

Normal resin-glass techniques should be used in body repairs and these are fully covered in standard text-books on the subject. The following notes are therefore intended merely as a guide.

1. All loose resin and glass reinforcement must be removed and the affected area thoroughly cleaned and dried.
2. If necessary the surrounding area should be roughened to obtain better adhesion.
3. For superficial damage to the surface (gel) coat only, activated resin should be applied to the damaged area and allowed to set.
4. The repaired surface may be covered with a film of cellophane to help keep the resin in position and to give a smooth finish to the repair.
5. Resin shrinks in setting, so a thicker film than is finally required should be applied.
6. When hardened the repair may be dressed back to the correct contour.
   Note: If this is done the panel may require painting due to loss of the top gel coat and its associated gloss.
7. In the case of heavier damage, resin and glass fibre should be laid up. Edges of successive mats should overlap at least 2 inches to ensure good adhesion.
8. In the case of fractured laminates, the whole of the damaged area should be removed and the edges of the hole chamfered (see drawing on this page).
9. Where the damaged area is of considerable size a temporary supporting mould should be built to the exterior surface and release agent should be applied to it and allowed to dry





Dismantling the Body

Where a body section has to be replaced through accident damage, firstly all wiring and piping which might interfere with its removal or might be damaged in the process of removal should itself be disconnected and removed. All fitments such as lights, controls, dashboard instruments, etc., should be removed if they are located in the section of body to be removed. Details of removal procedures for these items will be found in their respective headings in this manual.

Removing Front Body Section

1. Remove 9 bolts from transverse screen rail at the top of the windscreen.
2. Remove 2 bolts retaining windscreen de-mister nozzle and withdraw de-mister nozzle.
3. Remove interior mirror.
4. Remove 5 bolts attaching front bulkhead to chassis platform.
5. Remove 6 rivets attaching front section sides to chassis platform.
6. Remove 2 bolts attaching front section sides to chassis.
7. Lift off front section.

Removing Rear Body Section

1. Remove 4 bolts and 5 rivets and 2 screws attaching section to chassis platform.
2. Remove 5 screws attaching rear of the section to the chassis.
3. Remove 8 bolts attaching hard top to rear section.
4. Carry out procedures 1 – 3 under REMOVING FRONT BODY SECTION.
5. Lift off rear section.
   Note: The hard top will have been removed also in this process.

Removing Hard Top

1. Carry out procedures 1 – 3 under REMOVING FRONT BODY SECTION.
2. Carry out procedure 3 under REMOVING REAR BODY SECTION.
3. Lift off hard top.

Doors

The doors are moulded in glass reinforced plastic and have an inner and an outer panel. Steel window frame units are bolted to the leading and trailing edges. Each window frame has two sliding windows of toughtened glass. Each window has a locking catch. The inner door panel provides a mounting for the two lock units per door and also for the door runner brackets. The lock units are actuated by an external and an internal lever mounted centrally in the door panels. A pull-handle is provided to the inner door panel.

The doors are mounted on tufnol rollers which run on a tubular rail mounted to each of the side longitudinal chassis box members under the body. A door check arm (the stay) swivels on the facia mounting cross tube.

The doors open in two movements:

(1) When either the interior or exterior unlocking lever is pressed, the door may be swung outward to the extent of the check arm, the door pivoting on the bottom runner.

(2) This allows the door to be slid forward along the bottom runner, thus giving access to the saloon.

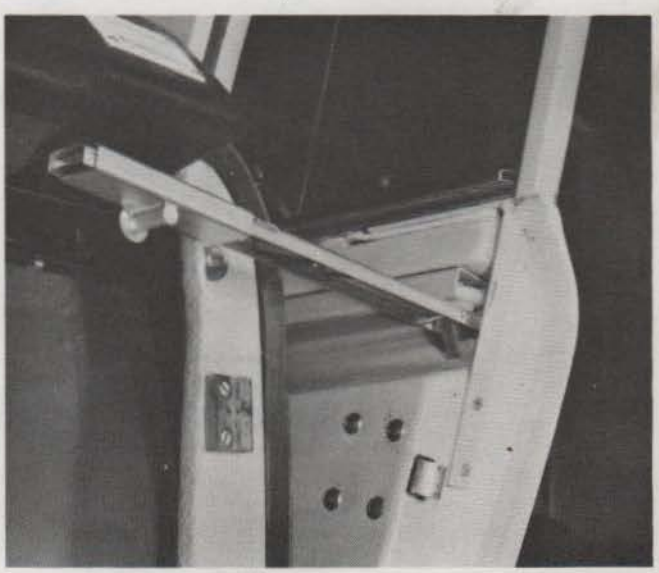
Vehicle door.

Removal of Door

1. Remove front door stop clamp from tubular bottom runner.
2. Unbolt check arm from facia mounting cross tube, at the same time supporting door.
3. Slide check arm end from facia mounting cross tube and lift upward allowing it to slip from the top runner in the door.
4. Slide the door forward until it clears the bottom runner tube.

Refitting Door

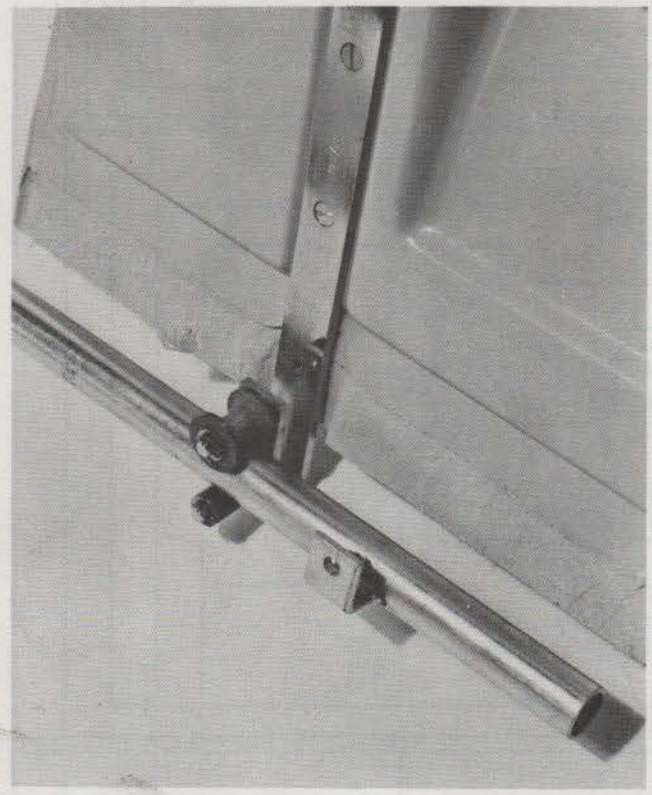
Reverse the above procedures.



Door check arm.

Removal of Door Lock Units

1. Remove retaining screw from interior lock handle.
2. Withdraw handle.
3. Remove 2 retaining screws to exterior lock handle.
4. Withdraw handle.
5. Remove 4 screws retaining centre lock plate to door.
6. Remove 4 screws retaining each bolt plate to door.
7. Withdraw unit from door.



The doors are mounted on tufnol rollers which run on a tubular rail.

Removal of Bottom Door Runner Brackets

1. Remove 4 screws from each bracket.
2. Withdraw brackets.

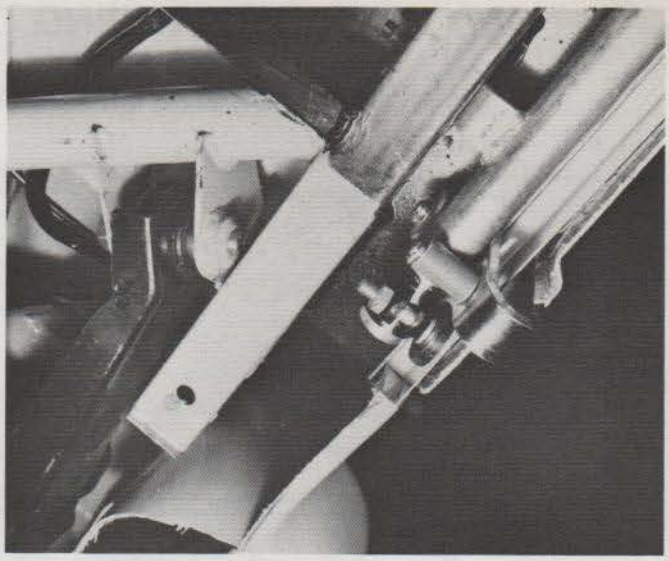
Note: The tufnol rollers can be removed by removing the split pins from the roller running pins and sliding rollers off pins.

Removal of Side Window Glass

1. Remove 5 screws from bottom window runner.
2. Withdraw bottom window runner toward the inside of the vehicle, supporting the glass at the same time.

Refitting Side Window Glass

1. Inset bottom edges of glass in bottom window runners.
2. Offer glass and runners to the window frame from the inboard side of door.
3. Engage glass in the top runners.
4. Locate the bottom runners in door.
5. Replace 5 screws in the bottom runners, thus retaining them in the door.



Method of retaining bottom door runners to chassis.

Replacement of Windscreen

In the event of a windscreen being broken, the old glass should be completely removed together with the rubber mounting channelling. New channelling should be used when fitting the new screen, and the following procedure should be followed.

1. Remove insert fillet from rubber channelling.
2. Position channelling around screen.
3. Offer screen with channelling in place to vehicle body and position correctly.
4. Refit insert fillet to channelling, thus securing screen in place. Use of a proprietary tool simplifies this operation.

Driver's Seat

The driver's seat consists of a vinyl upholstered foam pad in a spring wire cradle mounted in a tube-and-girder frame. The back has three adjustments for angle and the whole seat assembly has four front height adjustments and two rear adjustments.

The assembly is mounted in two runners, the rear runner being attached to the rear bulkhead by two bolts with packing washers. The front runner is riveted to the floor.

The seat slides across the width of the vehicle and a spring loaded lock engages in slots in the front runner giving a choice of three set positions.

The centre position is to retain the seat in the driving position. There are two rectangular slots on either side of this to prevent much movement of the seat if, for any reason, the main seat lock becomes disengaged. The two outside positions are to retain the seat while the driver is entering or leaving the vehicle.

Removal of Seat Back

1. Remove 2 bolts from each side of the seat framework.
2. Withdraw seat back.

Removal of Seat

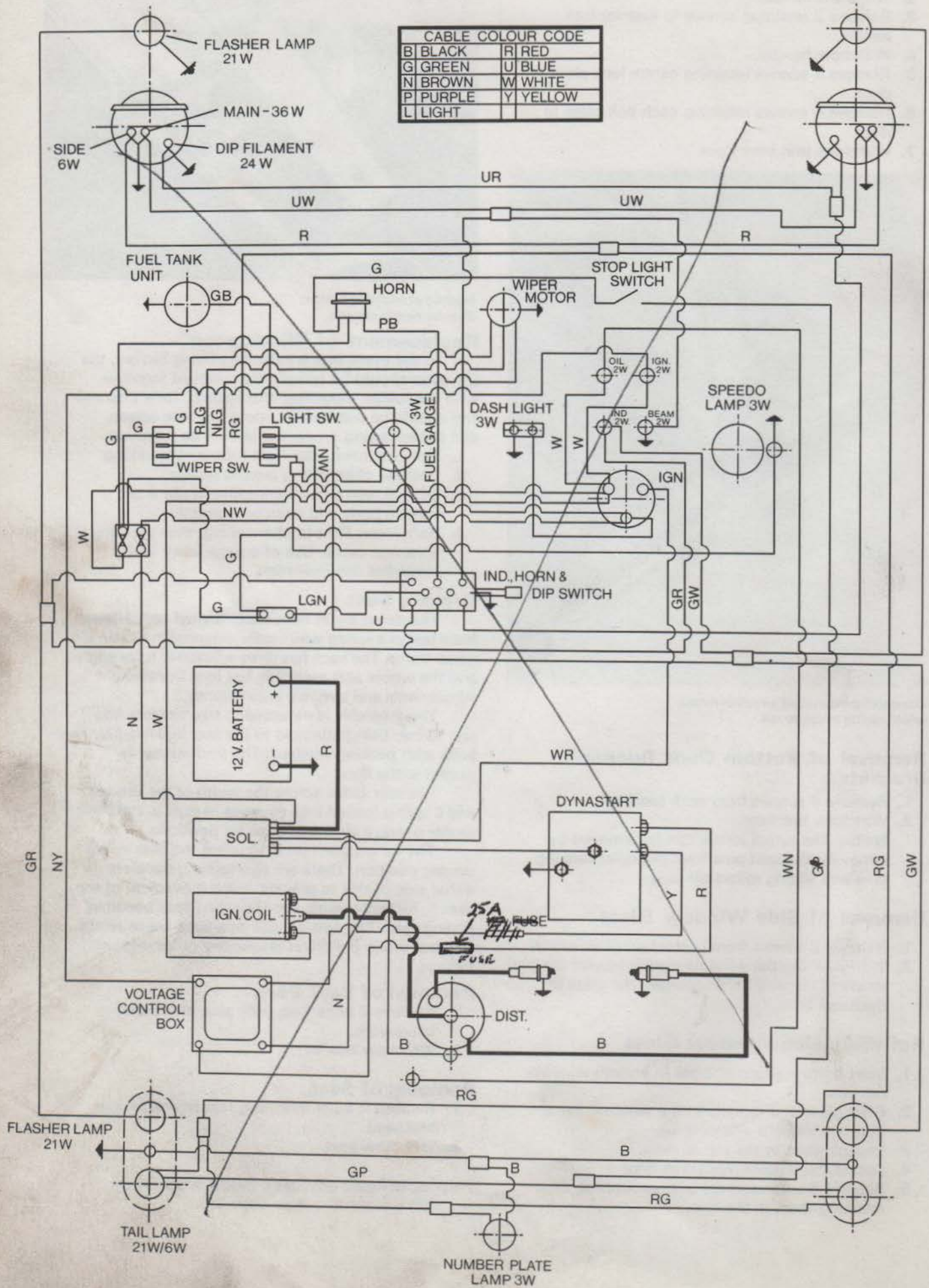
1. Remove 2 bolts attaching rear runner to rear bulkhead.
2. Withdraw seat.

Replacement of Seat Back and Seat

Reverse the above procedures.

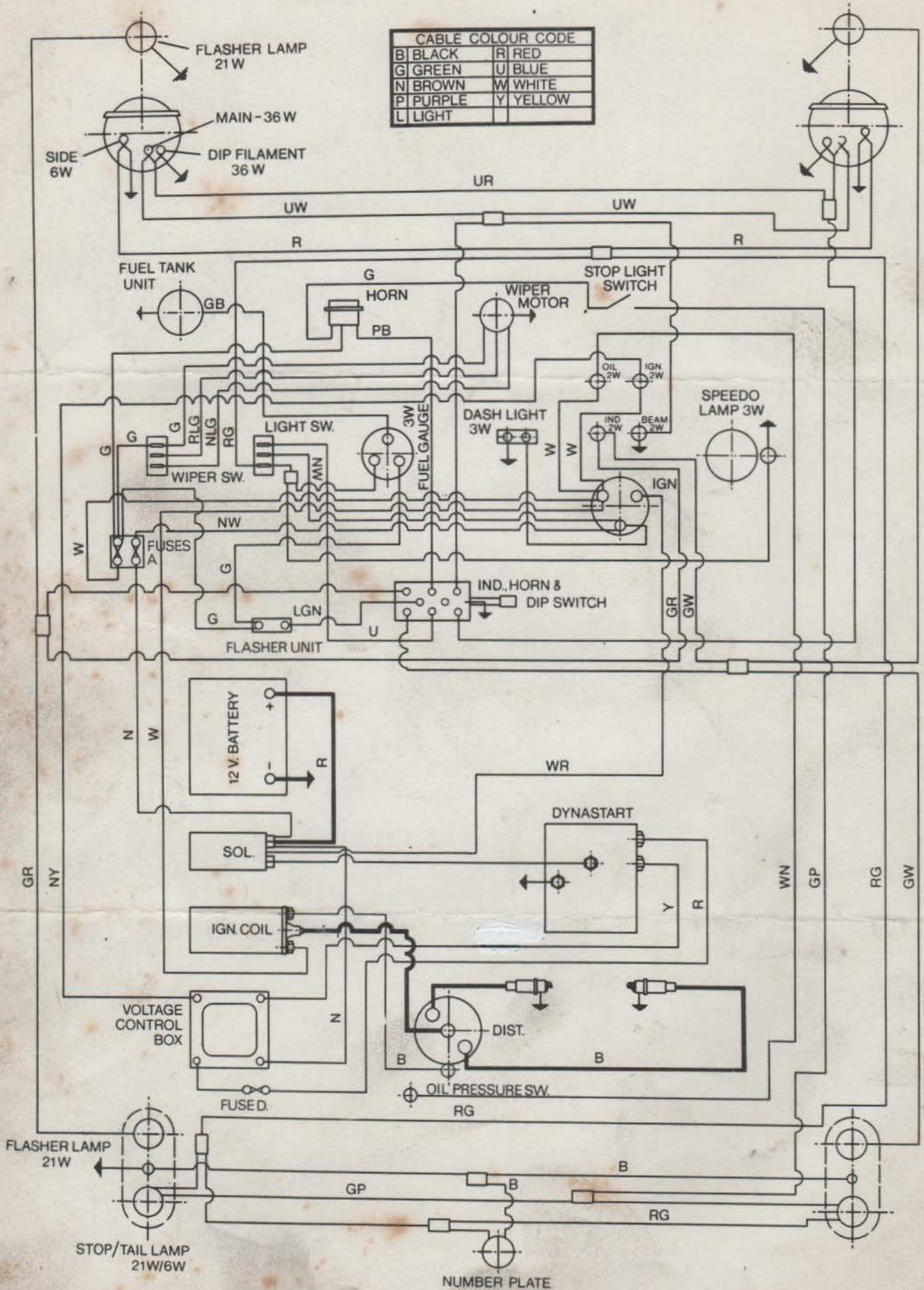
WIRING DIAGRAM

WIRING DIAGRAM FOR 70 MARK 1



WIRING DIAGRAM

WIRING DIAGRAM FOR 70 MARK 1



FUSE LOCATIONS A – NEARSIDE OF FOOTBOARD – BULKHEAD
D – IN ENGINE COMPARTMENT – NEAR REGULATOR BOX

Electrical Systems

The electrical system is of single wire 12V type, and incorporates a 30 Amp hr Exide battery with negative terminal earthed. This is charged by a Bosch dynastarter through a Bosch Voltage Controller, the charging line being fused at 12 amp. The Lucas headlamps are semi-sealed, adjustable for aim and with dipping facility. The tail light incorporates a brake warning light and there is a rear number plate light. Flashing indicator lights are fitted front and rear. The windscreen wiper is of single speed self-parking design. An electric horn is fitted.

Switches for head and side lights, windscreen wiper, ignition and starter, together with an interior dash lamp are located on the facia panel. The horn, dip and turn indicator switches are on the steering column or tiller.

A fusebox is located on the bulkhead behind the facia panel. It is fitted with a 35 amp main fuse and a 25 amp fuse for the auxiliary circuits. The wiring loom follows the British Standard colour code.

All bulbs are single pole 12V and are rated as follows:—

Headlamp	36 ~~24~~ – 36 watt.
Side lamp	6 watt.
Front indicator + rear	21 watt.
Rear stop and tail	6 – 21 watt.
Rear number plate	3 watt.
Speedometer	3 watt.
Dash light	3 watt.
Fuel gauge lamp	3 watt.
Ignition warning	2 watt.
Oil warning	2 watt.
Dashboard Indicator light	2 watt.
Dashboard beam warning	2 watt.

A wiring diagram is given on page **88**.

Servicing details for the dynastarter, voltage regulator and ignition system are given in the engine section of this Manual (see page **31**). Other items of electrical equipment are dealt with below.

Headlamps

Removal of Headlamp Unit

1. Disconnect from loom by parting snap connector at front bulkhead.
2. Insert screwdriver between bezel and lamp unit at bottom of lamp to release spring catch.
3. Remove bezel.
4. Remove 4 screws retaining unit to vehicle body.
5. Withdraw unit complete with sealing ring.

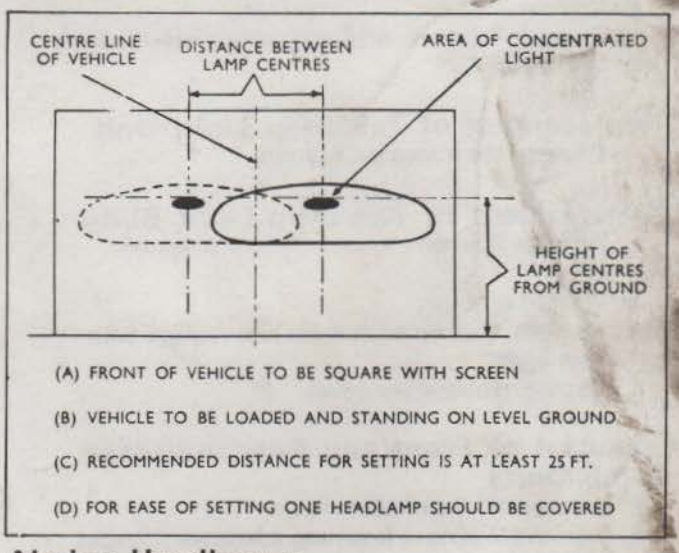
Replacement of Headlamp Unit

Reverse the above procedures to No. 3, snapping bezel into position over spring catch. Reconnect.

Replacement of Headlamp Bulb

1. Remove bezel (procedures 2 and 3 above).
2. Remove 3 screws in glass-retaining ring.
3. Withdraw glass complete with sealing ring.
4. Remove unserviceable bulb and replace with new bulb.
5. Replace sealing ring, glass, glass retaining ring and bezel.

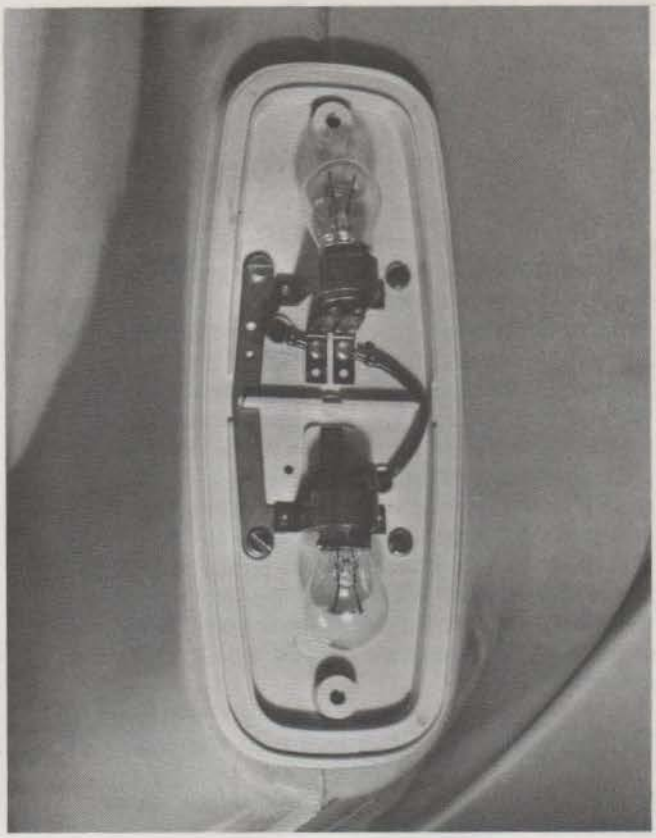
Headlamp with bezel removed and showing bezel retaining spring at 6.0 o'clock.



Aiming Headlamps

Ideally, replaceable bulb lamps are set with optical beam-aiming equipment. However, when such equipment is not available, the lamps may be set by marking off a smooth wall or screen as shown in the drawing on this page. Aim the main beams squarely against it from a level distance of 25 ft. while the vehicle is carrying its normal load. Keep each lamp covered in turn while resetting the other. Check the aim of the beam when dipped.

Headlamp removed and showing location of fixing screws.



Tail/Stop Light Unit with red transparent cover removed.

Removal of Tail/Stop Light Unit

1. Disconnect from loom by parting snap connector in rear compartment of vehicle.
2. Remove 2 screws retaining red transparent cover.
3. Withdraw cover.
4. Remove 4 screws retaining unit to vehicle body.
5. Withdraw unit.

Replacement of Tail/Stop Light Unit

Reverse the above procedures.

Replacement of Tail/Stop Light Bulbs

1. Remove 2 screws retaining red transparent cover.
2. Withdraw cover.
3. Remove unserviceable bulb and replace with new bulb.
4. Replace transparent cover.

Removal of Front and Rear Indicator Lamp Units

1. Disconnect from loom.
2. Remove 2 screws retaining transparent amber dome.
3. Withdraw dome.
4. Remove 3 bolts retaining unit to vehicle body.
5. Withdraw unit.

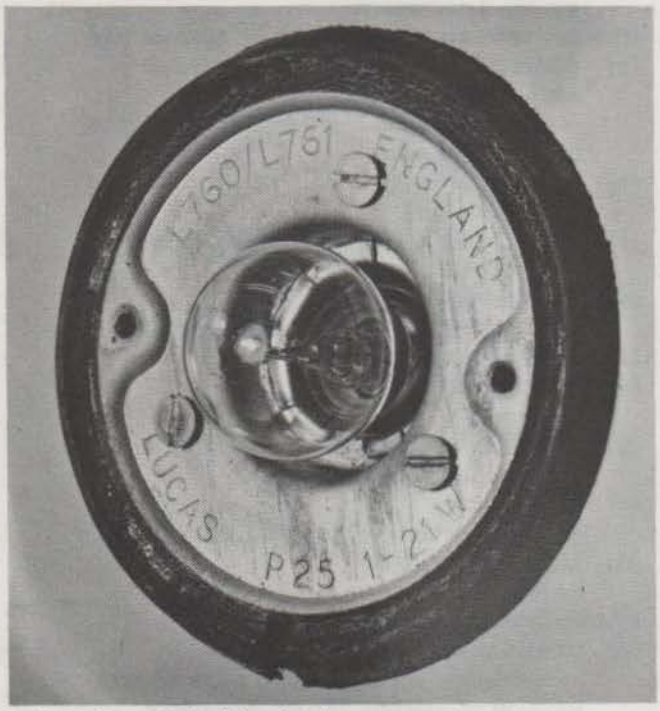
Tail/Stop Light Unit removed.

Replacement of Front and Rear Indicator Lamp Units

Reverse the above procedures.

Replacement of Indicator Unit Bulbs

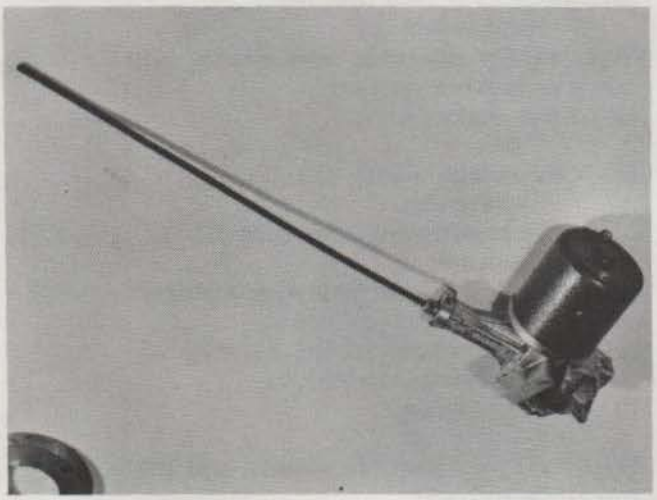
1. Remove 2 screws retaining transparent amber dome.
2. Withdraw dome.
3. Remove unserviceable bulb and replace with new bulb.
4. Replace dome.



Indicator Lamp Unit with amber dome removed.

Windscreen Wiper

The windscreen wiper unit is located on the rear face of the front bulkhead, behind the dashboard. Drive is transferred to the wheel box and thence to the blade via a flexible drive within a metal outer tube. The wiper is self-parking.



Windscreen Wiper Unit.

Replacement of Wiper Blade

1. Lift the wiper arm away from windscreen.
2. Turn old blade in towards arm.
3. Disengage arm from slot in the blade.
4. Slide the end of the wiper arm into the slotted spring fastening in new blade.
5. Push the blade firmly home.

Removal of Wiper Arm

1. Ensure that wiper is in "parked" position.
2. Pivot the arm back away from windscreen.
3. Withdraw arm from splined drive shaft.

Replacement of Wiper Arm

Reverse the above procedures, ensuring that arm is correctly positioned on the splines in the "parked" position.

Removal of Windscreen Wiper Motor/ Gearbox Unit

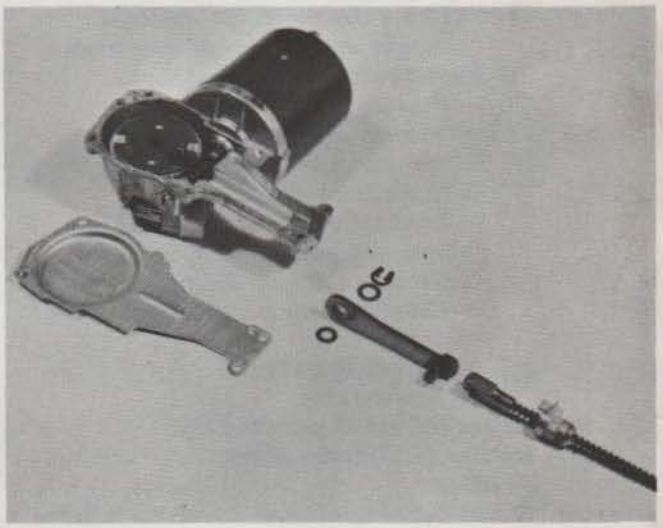
1. Disconnect motor.
2. Remove wiper arm (see above).
3. Remove 2 windscreen wiper motor retaining screws.
4. Free flexible drive tube from gearbox by loosening hexagon nut.
5. Withdraw motor/gearbox unit complete with flexible drive.
6. Remove ring nut outside vehicle body retaining wheel box.
7. Withdraw wheel box.

Replacement of Windscreen Wiper Motor/Gearbox Unit

Reverse the above procedures.

Renewing Windscreen Wiper Flexible Drive

1. Remove motor/gearbox unit as instructed above.
2. Remove gearbox coverplate.
3. Remove circlip from crank arm.
4. Remove drive arm complete with flexible drive.
5. Withdraw flexible drive from spindle on drive arm.
6. Fit new flexible drive.
7. Reassemble unit and refit, reversing above procedures 4 to 1.



'Exploded' view of Windscreen Wiper Unit.

Fuel Gauge

Removal of Fuel Gauge Tank Unit

1. Drain tank.
2. Disconnect unit by parting the connector at the unit.
3. Remove 6 hexagon head screws and earthing tag.
4. Withdraw unit complete with cork sealing ring.

Replacement of Fuel Gauge Tank Unit

Reverse the above procedures, noting the following points: (1) The contact faces of tank and unit (if the old unit is being refitted) must be cleaned up and a new cork scaling ring fitted with petrol proof sealing compound on each face. (2) The unit should be positioned with marking TOP at 12 o'clock. (3) When replacing the 6 hexagon head retaining screws, the earthing tag must be positioned at 9 o'clock.

Battery

The battery is of 30 Amp hr capacity and the negative terminal is earthed. The specific gravity of electrolyte in each cell should be as follows:

STATE OF CHARGE	SPECIFIC GRAVITY READINGS (corrected to 15°C (60°F))
Fully charged	1·270 – 1·290
70% charged	1·230 – 1·250
Discharged	1·110 – 1·130

Electrical Fault Finding and Correction

1. Starter motor fail to turn

Test for voltage at starter motor.

(i) *No Voltage present at starter motor.*

(a) Battery discharged or faulty.
— Charge or replace.

(b) Battery connections loose or earth strap loose at chassis.
— Tighten all leads.

(c) Faulty starter circuit (loose or broken connections).
— Check the circuit for electrical continuity and tighten all connections.

(d) Starter switch or solenoid faulty.
— Replace faulty component.

(ii) *Voltage present at starter motor.*

(a) Starter motor brushes worn or sticking: or brush connections loose.
— Examine and replace, clean or tighten connections as necessary.

(b) Commutator dirty or worn.
— Clean or replace unit if badly worn or burnt.

(c) Motor windings faulty.
— Replace unit.

2. Starter motor turns only slowly

(a) Battery insufficiently charged.
— Charge.

(b) Starter motor brushes or commutator faulty.
— See notes 1(ii) (a) and (b) above.

(c) Loose connections in starter circuit.
— See note 1(i) (c) above.

3. Starter motor turns without turning engine

(a) Fan belts loose in pulleys.
— See Engine Section on page **10**.

(b) Pulleys loose on shafts.

4. Battery fails to hold charge

(a) Battery defective.
— Replace battery.

(b) Electrolyte level low or weak due to leakage.
— Top up electrolyte to $\frac{1}{8}$" above the plates, check specific gravity against values on page 92 : add acid to bring up to correct gravity if necessary.

5. Battery fails to charge fully in normal use

(a) Battery terminals loose or corroded or earth contact poor.
— Check terminal and earthing connection: tighten if necessary.

(b) Dynastarter faulty.
— Replace unit.

(c) Short circuit causing continual drain.
— Check all circuits and rectify.

(d) Voltage regulator faulty.
— Check setting or replace if necessary.

6. Lights fail to operate

(a) Battery discharged.
— Charge.

(b) Bulb filament broken.
— Replace bulb.

(c) Circuit faulty.
— Check circuit, tighten all connections.

(d) Light switch faulty.
— Replace.

7. Wiper motor fails to operate

(a) Blown auxiliary fuse.
— Replace – see Section 13 page **93** for location of fusebox. If fuse repeatedly blows, check auxiliary circuits for short circuit.

(b) Wire connections loose.
— Check wiper wiring and tighten all connections.

(c) Motor brushes badly worn.
— Remove and fit new brushes.

(d) Armature or field coils faulty.
— Replace unit.

8. Wiper motor operates very slowly and takes excessive current

(a) Commutator dirty.
— Clean.

(b) Commutator burnt.
— Replace unit.

(c) Drive to wheelbox unlubricated.
— Lubricate.

(d) Wheelbox spindle binding or damaged.
— Lubricate or replace unit.

(e) Motor rotor bearings dry or unaligned.
— Lubricate or replace unit.

(f) Armature faulty.
— Replace unit.

9. Wiper motor operates slowly and takes too little current

(a) Brushes badly worn.
— Replace brushes.

(b) Commutator dirty or badly burnt.
— Clean if dirty: replace unit if badly burnt.

10. Wiper motor operates but wiper blade remains stationary

(a) Driving cable rack disengaged or rack or cable faulty.
— Replace as necessary.

(b) Wheelbox spindle worn or damaged.
— Replace unit.

(c) Wiper motor gearbox components badly worn.
— Replace unit.

11. Horn operates continuously

(a) Horn switch earthed or faulty.
— Disconnect battery, check switch, rectify or fit new switch as necessary.

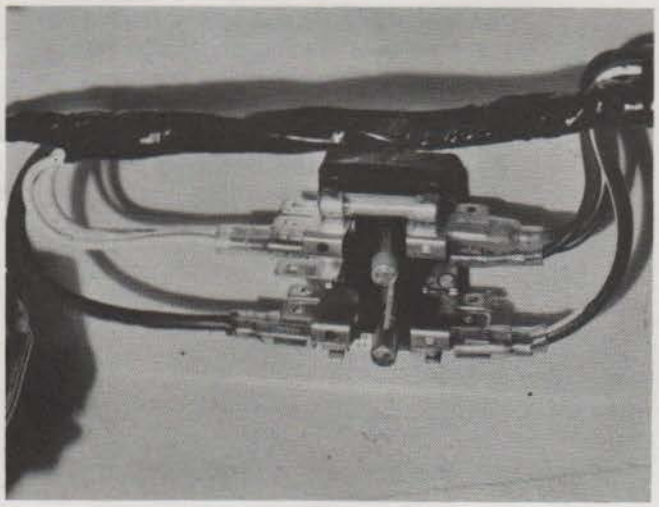
(b) Horn cable earthed.
— Disconnect battery, check circuit and rectify.

12. Horn fails to operate

(a) Blown auxiliary fuse.
— Replace – see Section 13, below, for location of fusebox. If fuse repeatedly blows, check auxiliary circuits for short circuit.

(b) Cable or connectors loose, broken or disconnected.
— Check circuit for electrical continuity and rectify.

(c) Horn unit faulty.
— Replace unit.



Fusebox with two spare fuses.

13. Fusebox

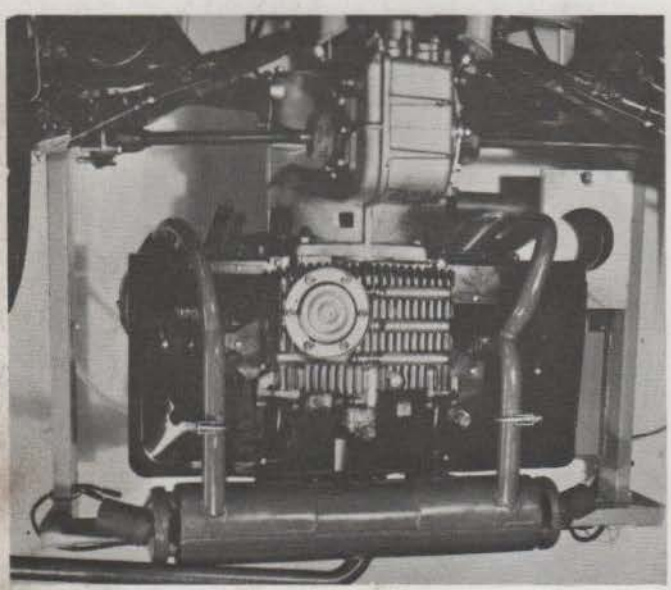
The fusebox is located on the rear face of the front bulkhead behind the facia panel and on the left-hand side of the vehicle. It contains 2 fuses: Main fuse – 35 amp capacity.
Auxiliary fuse – 25 amp capacity.
If a fuse repeatedly blows, this indicates too high a current flow, usually caused by a short circuit. It is vitally important that the cause of repeated fuse-blowing be immediately found and rectified as excessive current flow results in circuit overheating and can cause fire.

Exhaust System

Exhaust gas passes through a down pipe from each cylinder. The majority of this gas passes directly to the silencer and thence to air through the tail pipe. However, a certain amount flows initially through the left hand branch pipe to pre-heat the inlet gasses, and then through the right hand pipe before joining the exhaust gas from the right hand cylinder just before the silencer.

The silencer is cylindrical in section and is of baffled type with a central expansion chamber. The down pipes enter the silencer at either end, whilst the tail pipe is welded to a port in the central chamber. The tail pipe is bent through an angle of 90° and exhausts to the right of the vehicle.

Passing through the silencer are three tubes which terminate at each end in a flat, circular plenum chamber. The entrance port to the left hand plenum chamber is connected to a length of flexible ducting carrying air which has been bled off from the engine fan near the cylinder barrels: the exit port to the right hand plenum chamber is connected to a second length of flexible ducting which ducts the hot air to the heater distribution box.



The Exhaust System

Removal of Exhaust System

1. Jack up rear of vehicle at recommended jacking points (see page **viii**).
2. Disconnect heater ducting from each end of silencer.
3. Remove U clamps from rear tubular engine bearer.
4. Remove 4 bolts from inlet gas preheater pipe flanges.
5. Remove 2 nuts from each exhaust manifold flange to cylinders.
6. Withdraw silencer and down pipes.
7. Remove U clamps at down pipes to silencer.
8. Withdraw down pipes from silencer.

Reassembling Exhaust System

The system may be reassembled by reversing the above procedures. New gaskets should always be fitted to down pipe flanges.

Note: **CAUTION**

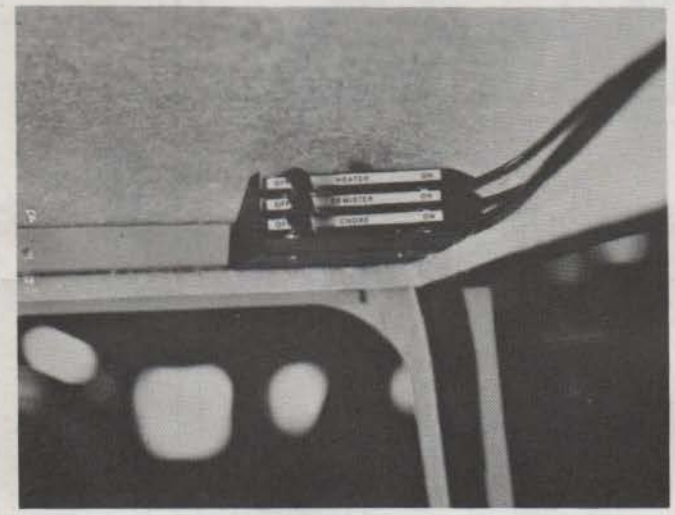
As the silencer also acts as a heat exchanger and carries heated fresh air to the interior of the vehicle, repairs (e.g. welding on plates to cover corrosion holes) must not be attempted on damaged silencers.

Replace damaged silencers with new replacement units.

Saloon Heating

Provision is made to heat the saloon and also to de-ice or de-mist the windscreen. Fresh air is bled off the engine fan and is then ducted through three heating tubes in the exhaust silencer where it is further heated. A flexible duct carries the heated air to the heater box which allows for its distribution between the saloon and windscreen in any desired proportion.

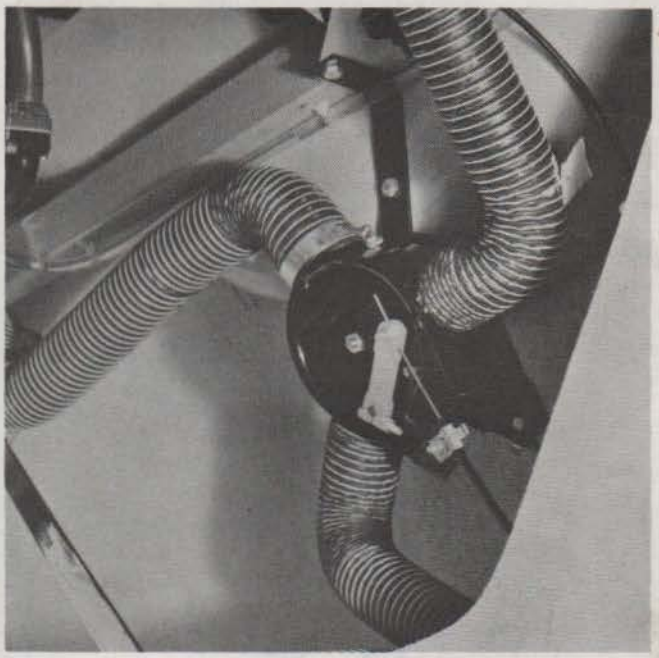
The heater box is attached to the right hand wheel arch by a bracket. The box has an inlet and two outlet ports. Each outlet is controlled by a flap valve actuated by a control lever which is connected by a cable to the heater control. The heater controls, together with the choke control, are located above and on the right of the windscreen. The hot air outlet for saloon heating is located at floor level under the driver's seat. The de-icing/de-misting outlet is above and in the centre of the windscreen.



Heater/Choke Control Unit, located above and on the right of the windscreen.

Removal of Heater Box

1. Remove 2 control cables.
2. Remove inlet pipe and 2 outlet pipes.
3. Remove heater box retaining nut to support bracket.
4. Withdraw heater box.



The Heater Box

Dismantling Heater Box

1. Remove either nut from stud retaining the circular cover plates.
2. Slacken nuts on pinch bolts and remove control levers.
3. Remove circular cover plates.
4. Withdraw flap valves complete with their shafts.

Reassembly of Heater Box

Reverse the above procedures.

Dismantling Heater/Choke Control Unit

1. Remove 3 control unit retaining screws to transverse screen rail above windscreen.
2. Withdraw unit.
3. Remove 2 lever plate clamping screws and 6 spacers between lever mounting plates.
4. Withdraw lever mounting plates.
5. Remove 3 cable clamp plates.
6. Detach cable ends from levers.

Reassembly of Heater/Choke Control Unit

Reverse the above procedures.

CHASSIS ALIGNMENT CHECKING

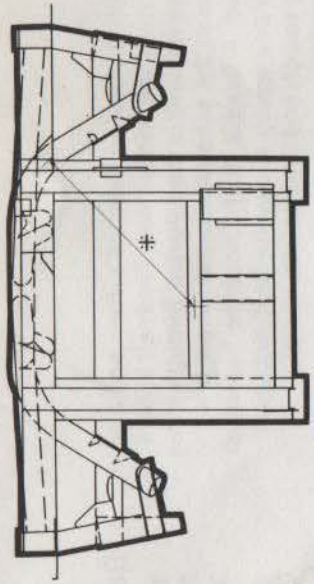


Fig.A

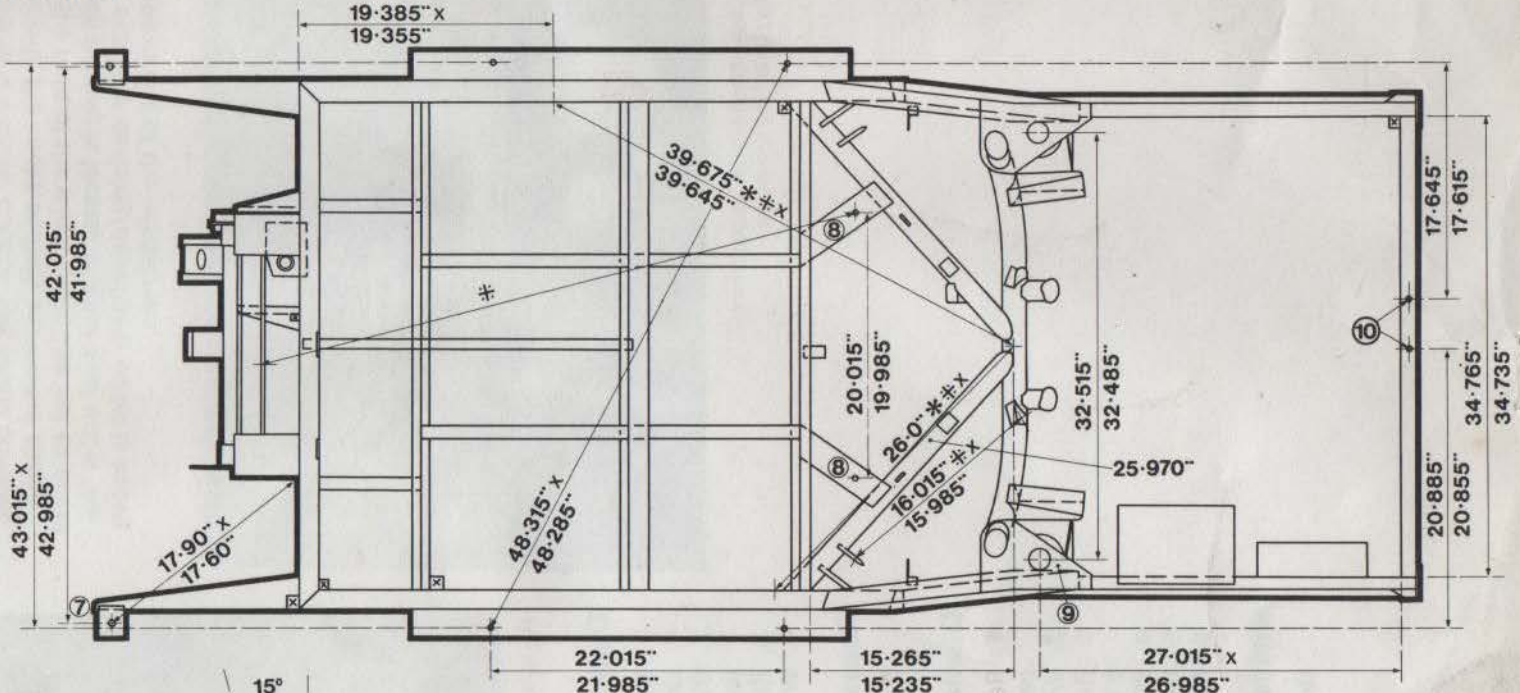


Fig.B

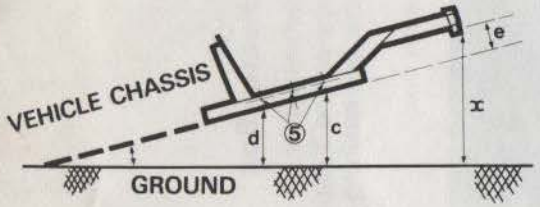


Fig.D

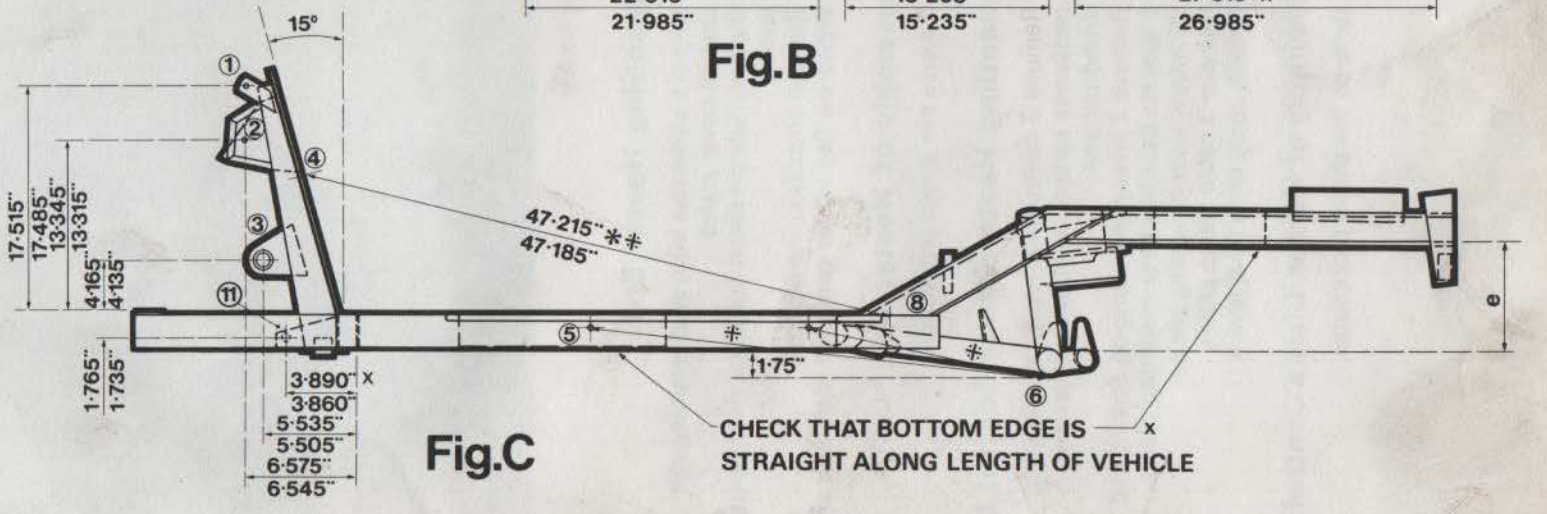


Fig.C

CHASSIS ALIGNMENT CHECKING

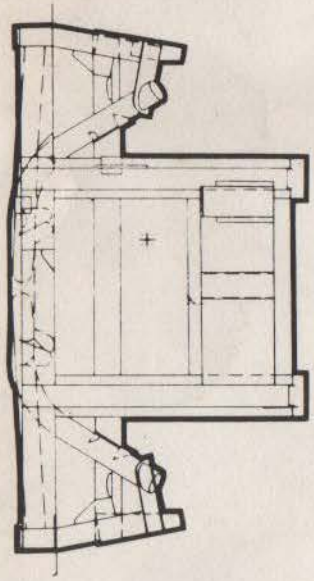


Fig. A

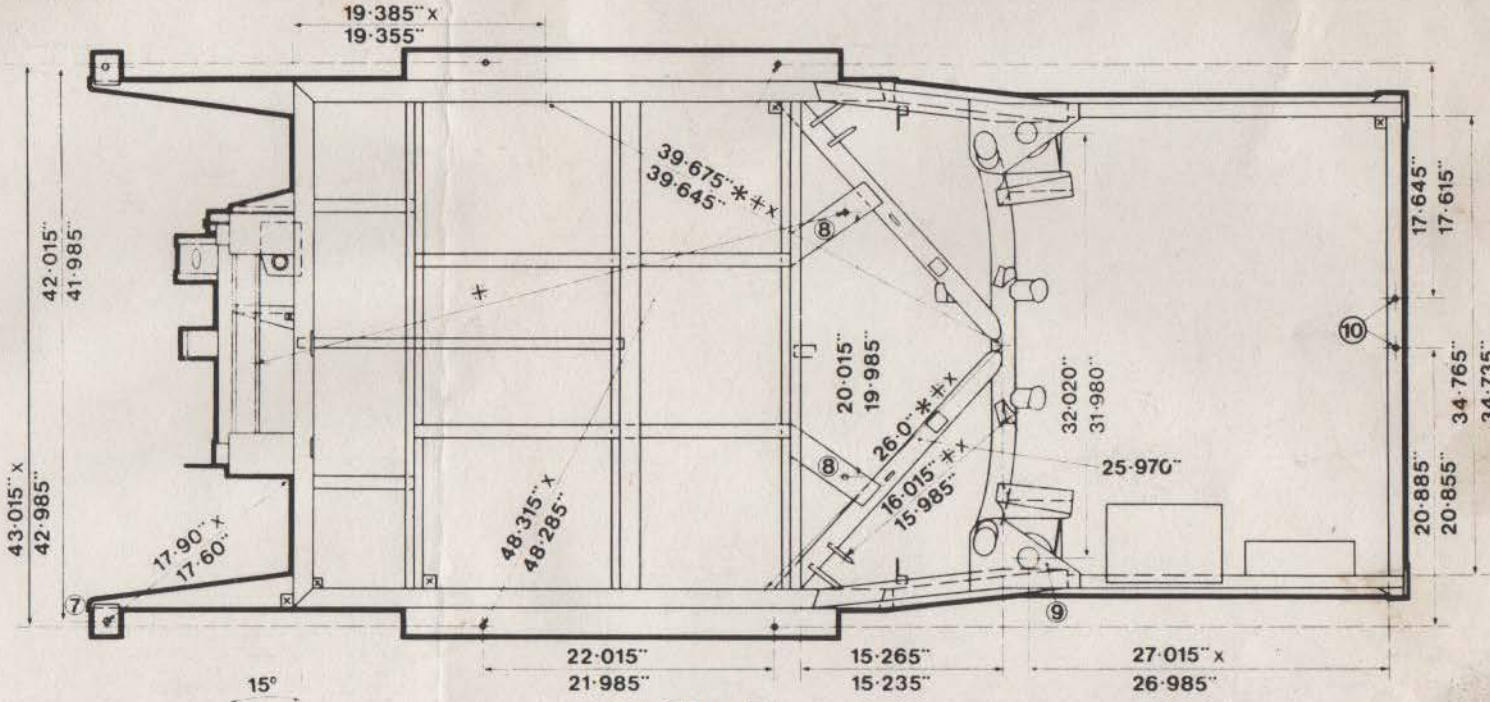


Fig. B

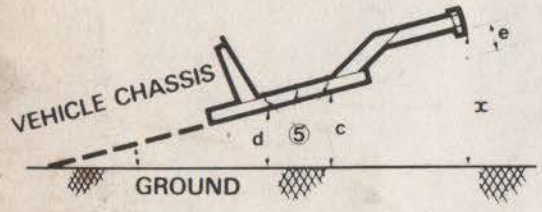


Fig. D

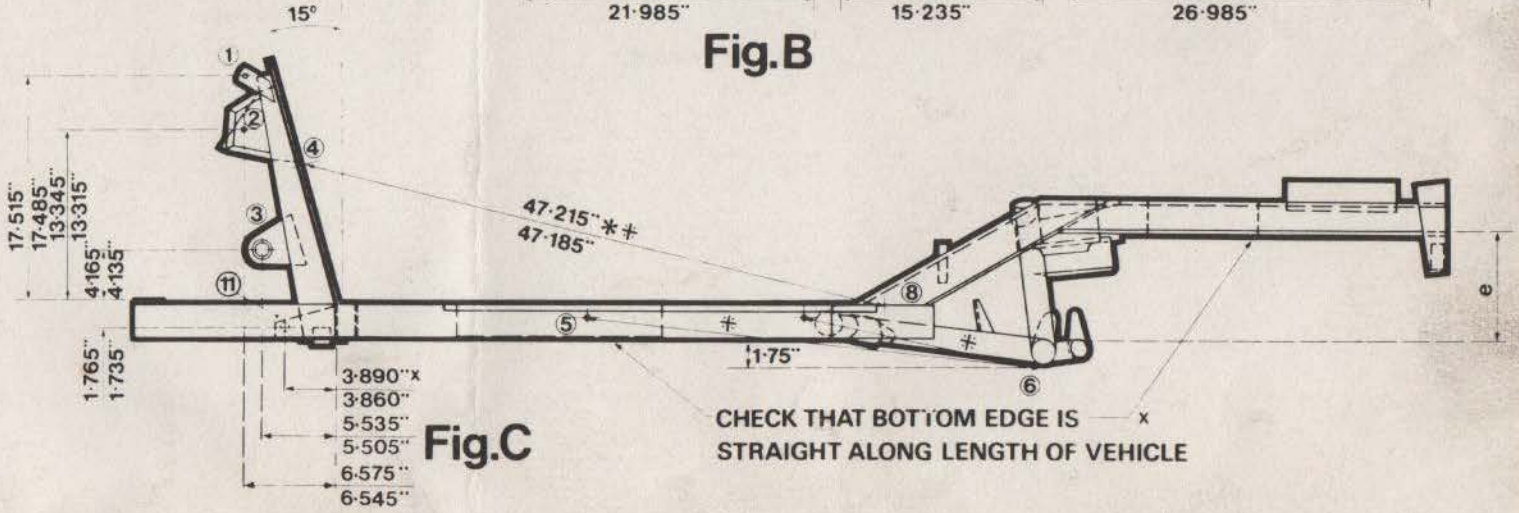


Fig. C

Chassis Alignment Checking

The drawing on page 96 gives information required for checking the alignment of the chassis. A long straight-edge will be required to check that the bottom edges of the chassis are straight along the length of the vehicle. A large set square and a tape measure are also required.

The dimensions indicated on the drawing, Figs. A, B and C should be measured to ensure that they fall within the tolerances given. A tape measure will be adequate for the purpose. Keys to the symbols employed and the numbers indicating the relative chassis positions are given below.

Finally, the vehicle should be stood on level ground. It will probably be found that the chassis floor is not parallel to the ground due to slight differences in weight distribution on the three wheels. This is shown diagrammatically as a side view in Fig. D.

Then (i) measure dimensions *x* and *d* in inches. (ii) Multiply dimension *d* by 1·45 and (iii) add the answer to dimension *x*. (iv) Measure dimension *c* in inches and multiply it by 2·45. Take this answer away from the figure obtained from (iii) above, giving a final figure which will be dimension *e* in inches.

This can be expressed as an equation:

$$e = x + (1{\cdot}45'')d - c(2{\cdot}45'')$$

The value of *e* should be 8·42". If this figure is obtained from the resolution of the equation above, then the chassis is not out of alignment.

Key to Symbols Used on Chassis Alignment Checking Drawing

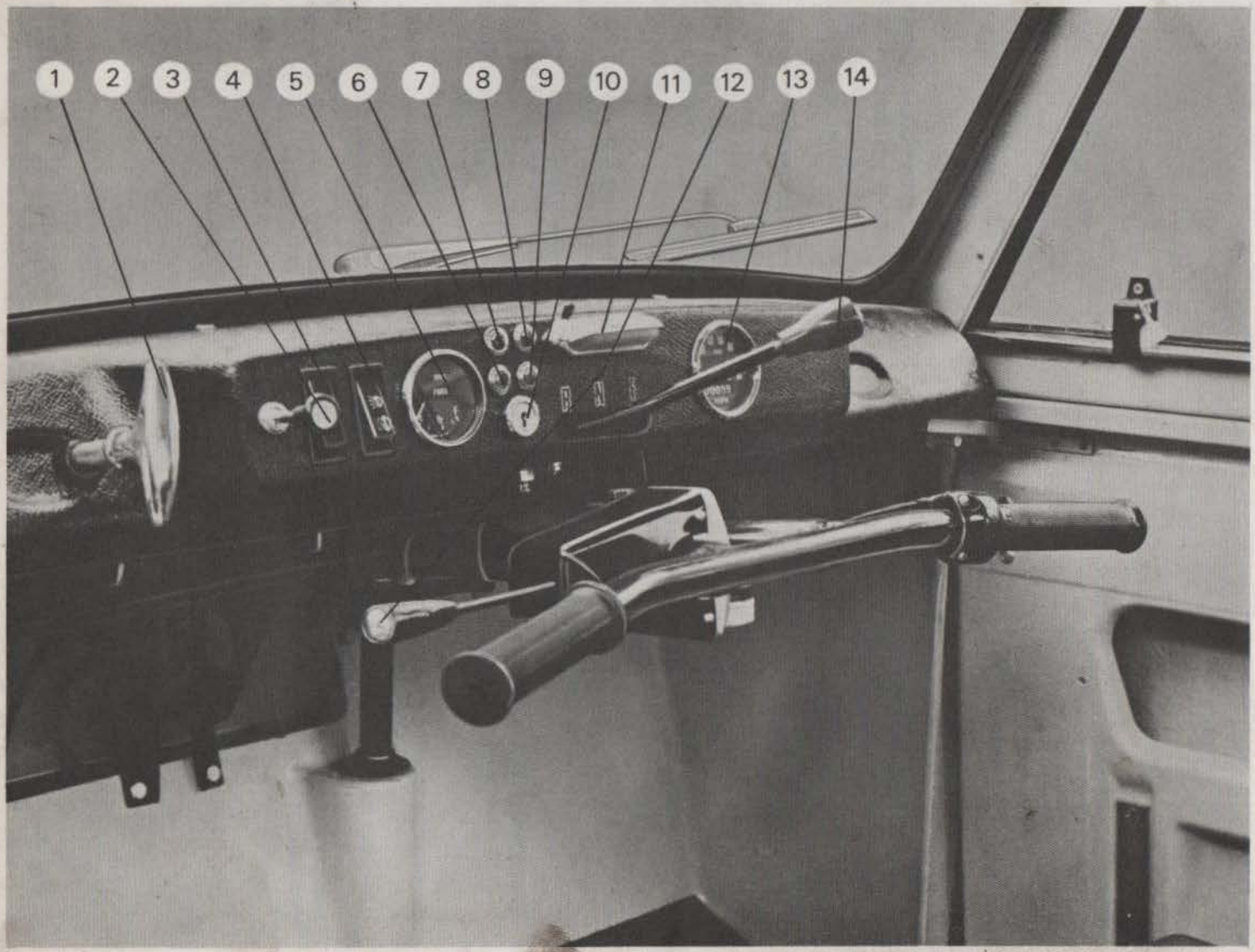
- ✻ Indicates that a dimension is arrowed a number of times but dimensioned only once.
- ⌗ Indicates where dimensions are not measured in horizontal or vertical planes.
- X Indicates that dimensions are to be checked in symetrically opposite positions.
- ⌙ Indicates that chassis members are to be at 90° to each other.

Key to Relative Chassis Positions shown on Chassis Alignment Checking Drawing

1. Petrol Tank Mounting Bracket
2. Top Damper Mounting Bracket
3. Suspension Top Link Bracket
4. Steering Pivot Mounting – L.H. Lower
5. Door Runner Mounting Bracket Positions
6. Cross Tube
7. Body Support Mounting Bracket
8. Seat Belt Attachment Plate
9. Damper Mounting Position – top of stud
10. Engine Mounting Holes
11. Lower Suspension Pivot Location

The centre position is to retain the seat in the driving position. There are two rectangular slots on either side of this to prevent much movement of the seat if, for any reason, the main seat lock becomes disengaged. The two outside positions are to retain the seat while the driver is entering or leaving the vehicle.

Instruments & Controls

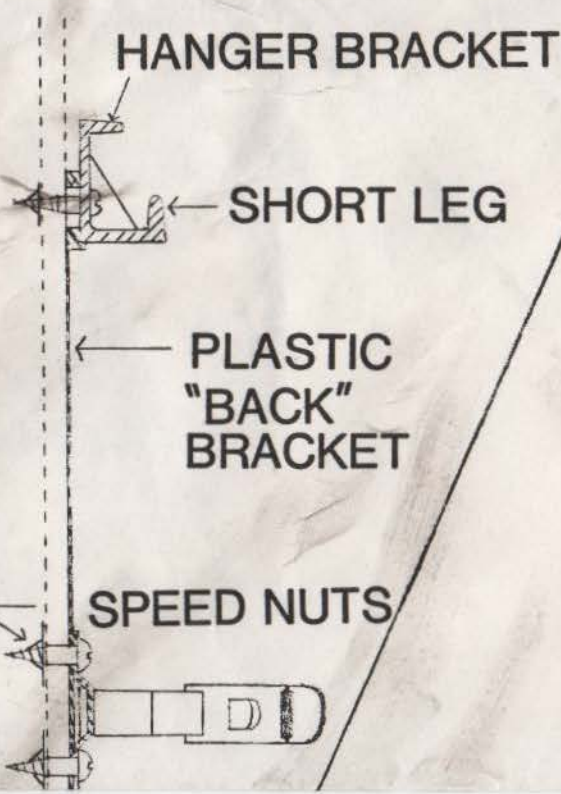


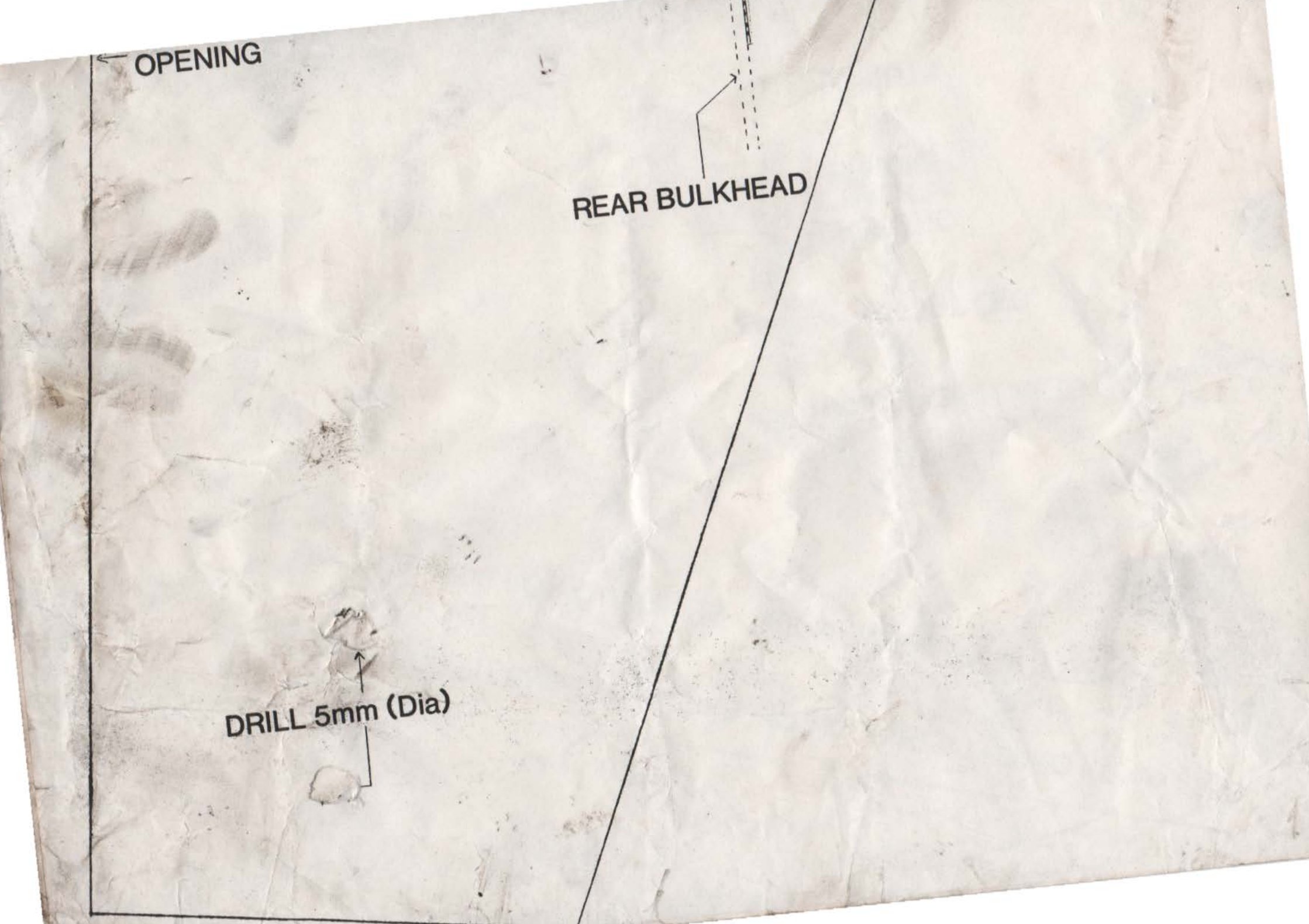
1 PARKING BRAKE
2 WINDSCREEN WASHER PLUNGER
3 WIPER SWITCH
4 HEAD AND SIDE SWITCH
5 FUEL GAUGE
6 AMBER INDICATOR LIGHT
7 GREEN OIL WARNING LIGHT
8 RED IGNITION LIGHT
9 BLUE MAIN BEAM LIGHT
10 IGNITION AND STARTER SWITCH
11 INTERIOR DASH LAMP
12 HORN AND INDICATOR SWITCH
13 SPEEDOMETER
14 FORWARD AND REVERSE LEVER

TOP

TEMPLATE FOR FITTING CHUBB FIRE EXTINGUISHER FITTING KIT No 1058

USE THIS SIDE FOR O/S FIXING - TURN OVER FOR N/S FIXING




OPENING
REAR BULKHEAD
DRILL 5mm (Dia)

March 1975 Amendment Sheet No 7

DEPARTMENT OF HEALTH AND SOCIAL SECURITY

WORKSHOP MANUAL FOR MODEL 70 'AUTOMATIC' THREE-WHEELER

1. The enclosed reprinted pages should be inserted in the Workshop Manual and the obsolete pages cancelled.

Page 60. General assembly of gearbox.

Page 96. Chassis Alignment Checking.

NOTE: The text on pages 59 and 95 is still relevant.

2. Any enquiries about these amendments should be addressed to Mr M Boak, Department of Health and Social Security, Room 111A, Government Buildings, Warbreck Hill Road, Blackpool FY2 0UZ, telephone Blackpool 52311, ext 454.

27 MAR. 1975

HAD 632/268/4/3

To: All Holders of the Workshop Manual
for the Model 70 'Automatic' Three-wheeler

-2 FEB 1973

Department of Health and Social Security
Government Buildings Warbreck Hill Road Blackpool Lancs
FY2 0UZ

Telephone Blackpool 52311 ext

Your reference

To: All Approved Repairers

Our reference
HAD 220/312
ARL 1/73

Date 29th January 1973

Dear Sirs,

MODEL 70 TRANSMISSION

1. Your attention is drawn to the parts of pages 55 and 57 of the Workshop Manual for the Model 70 which deals with the main drive chaincase.

2. The distance of 10.250 ins between centres of No. 1 and No. 2 pulley shafts is critical and the provision made for varying the setting of the chaincase in relation to the gear box should not be used to alter this distance.

3. Will you please bring this to the notice of any of your staff whom it may concern.

Yours faithfully,

T. JENKINSON.

Department of Health and Social Security
Block 1 Government Buildings Warbreck Hill Road Blackpool FY2 0UZ
Telephone 0253-52311 ext 432

To: All Approved Repairers

GRAYSTONE GARAGE LTD.
(INVALID CARRIAGES)
169 TANKERTON ROAD
WHITSTABLE. KENT.
TELEPHONE NUMBER (WHITSTABLE) 266251

Your reference ARL 14/80
Our reference WHG 6035/1
Date 8 September 1980

Dear Sirs

MODEL 70 THREE-WHEELERS - SIDE TILLER OPERATED

1. A certain amount of confusion has arisen about the content of ARL 11/80, particularly regarding the part of the tiller steering which is to be examined. The letter should accordingly be regarded as cancelled and action should be taken as indicated in the following paragraphs.

2. It has been discovered that a number of Model 70 three-wheelers fitted with side tiller type steering were fitted with a tiller arm and fork assembly (Store No 2893) manufactured from thinner 16 gauge tubing rather than 14 (0.08"/2.03 mm) gauge as specified. Experience has shown that this thinner gauge of tubing is not strong enough to withstand normal braking and steering pressures and it is essential that any tiller arm and fork assemblies of this type are replaced as quickly as possible by tiller arms of the correct specification.

3. Our investigations indicate that the fault is probably confined to a small batch of vehicles manufactured by Invacar some time during the "R" registration year. Nevertheless, in view of the potentially serious nature of any fault occurring in the tiller mechanism it is felt that checks should be made on all Model 70 side tiller vehicles (left and right hand) irrespective of the make or registration mark.

4. The first priority, however, is the "R" registered Invacar series and each client in possession of one of these vehicles is again being instructed to contact their Approved Repairer as quickly as possible to arrange an early inspection and, where necessary, replacement of the tiller arm on his vehicle.

5. The inspection procedures, which should not exceed the time elements indicated at (i) and (j), should be carried out as follows:

a. Remove tiller arm and fork assembly (Store No 2893) clamp bolt, tiller arm through bolt, tiller bar pivot bolt and associated fittings in order to release the tiller arm from its mounting point.

b. Remove any burrs from the end section of the tiller arm tube indicated at 'A' on the attached Drawing No 1.

c. Measure thickness of tiller arm tube wall.

d. Where the wall thickness is below 14 gauge (0.08" or 2.03 mm) the tiller arm must be destroyed and a replacement part fitted.

e. Dependent on the inspection result either refit the original tiller arm and fork assembly or fit a replacement unit.

f. It is not necessary at this time to check the gauge of tubing of the tiller bar assembly (Store No 2890, indicated at 'B' on the attached Drawing No 2). It is known that some of these bars are of 16 gauge tubing but at present they are not suspect and can remain in service. However the welds at points indicated at 'A' on the attached Drawing No 2 should be closely examined for any signs of cracking or flaking of paintwork or distortion or damage in the area adjacent to the welds. If there are any such signs the tiller bar must be removed and replaced, the suspect bar being handed over to the visiting Professional and Technology Officer.

g. Rebuild the complete assembly. Ensure that all appropriate controls operate satisfactorily and carry out a short road test.

h. To identify completion of this instruction, the reassembled tiller arm and fork assembly and tiller bar must be ringed with white paint at item 'B' on the attached Drawing No 1 and item 'C' on the attached Drawing No 2.

i. It is anticipated that the above work on:

a. Model 70 complete with standard side tiller features but not coupled directly to the Brake master cylinder will not exceed 0.75 hours;

b. Model 70 complete with standard side tiller features and coupled directly to the Brake master cylinder will not exceed 1.25 hours.

j. Where it proves necessary to exchange a tiller bar, then 0.25 hours should be claimed in addition to labour factors at Item (i).

6. All other AC Cars and Invacar Model 70s fitted with a left or right handed side tiller should also be checked in the manner described in paragraph 5 above at the earliest opportunity, ie as soon as they are in your premises for servicing or repair. All reserve vehicles in this category and any that may be on your premises at the present time should also be checked and replacement parts fitted, if necessary.

7. There is normally a very limited demand for replacement tiller arm and fork assemblies and also for the tiller bar assembly and in consequence, our stocks are maintained at low level. Pending both supplies becoming available, existing stocks are being reserved for specially adapted vehicles and therefore, where

a side tiller three-wheeler requires replacement parts, a reserve vehicle should be provided. If sufficient vehicles are not available for this purpose you should telephone the Manager of the Artificial Limb and Appliance Centre immediately and he will arrange for additional vehicles to be made available. It is essential that where the examination indicates one of the faults described the vehicle should be retained at your premises until a replacement is fitted.

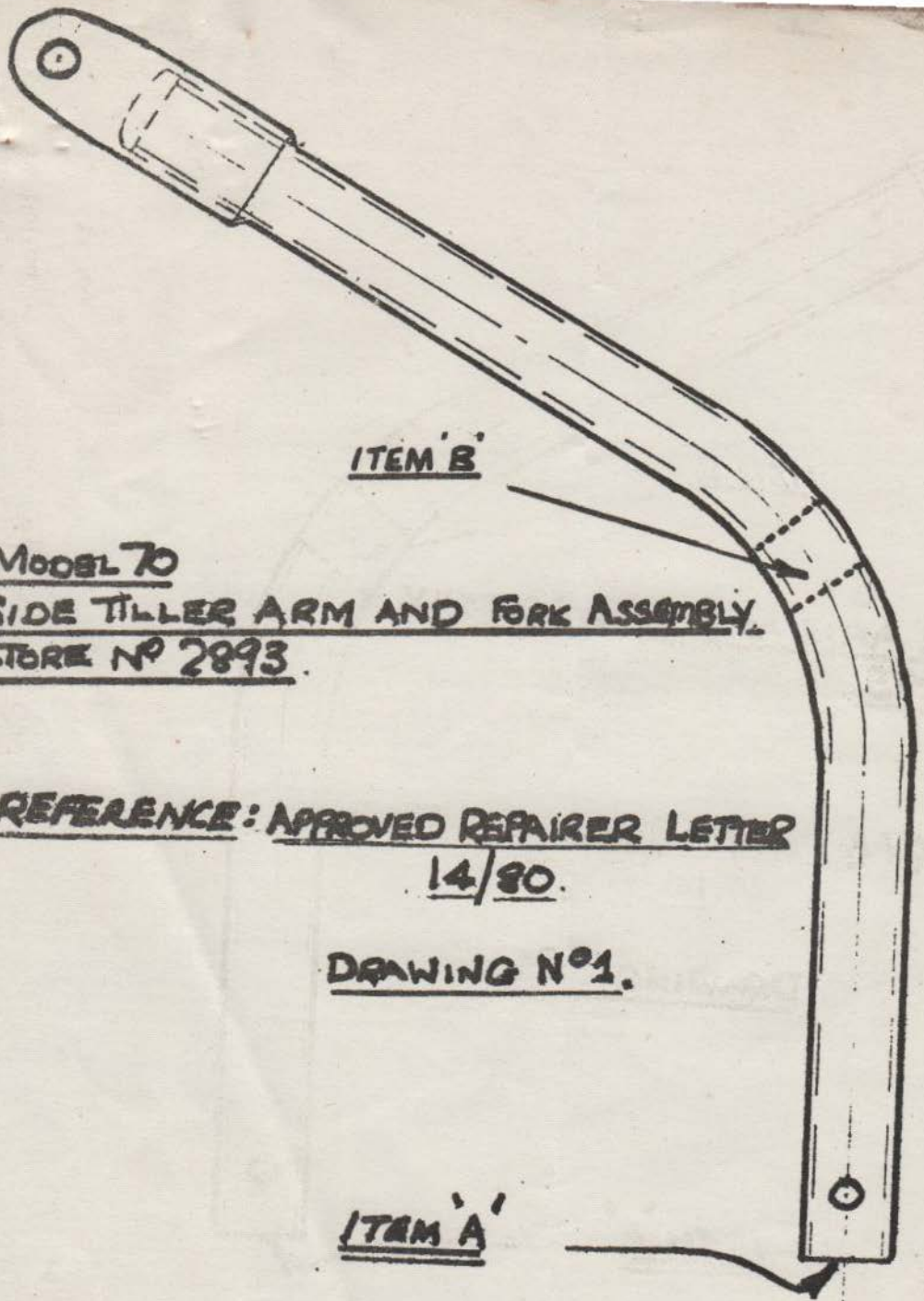
8. Where replacement parts are required for an otherwise specially adapted Model 70, the Manager of the Artificial Limb and Appliance Centre should be advised by telephone and arrangements will be made with our Central Store to despatch the item(s) required to your premises by 1st Class post as soon as possible.

9. Accounts in respect of the work should be clearly noted 'ARL 14/80' invoicing at the rate appropriate to the job.

10. Thank you for your co-operation in this matter.

Yours faithfully

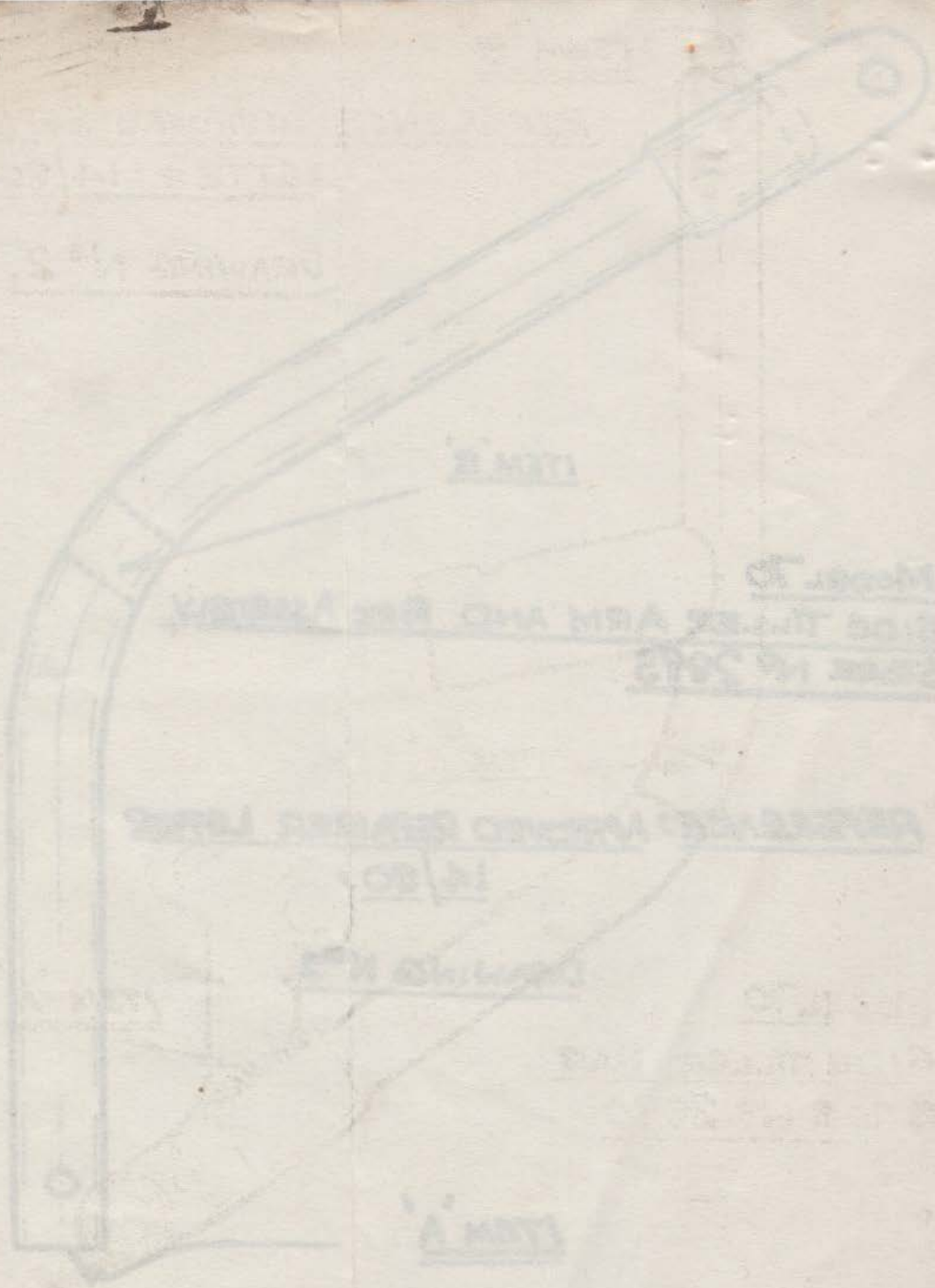
I L LEA



MODEL 70
SIDE TILLER ARM AND FORK ASSEMBLY.
STORE Nº 2893.

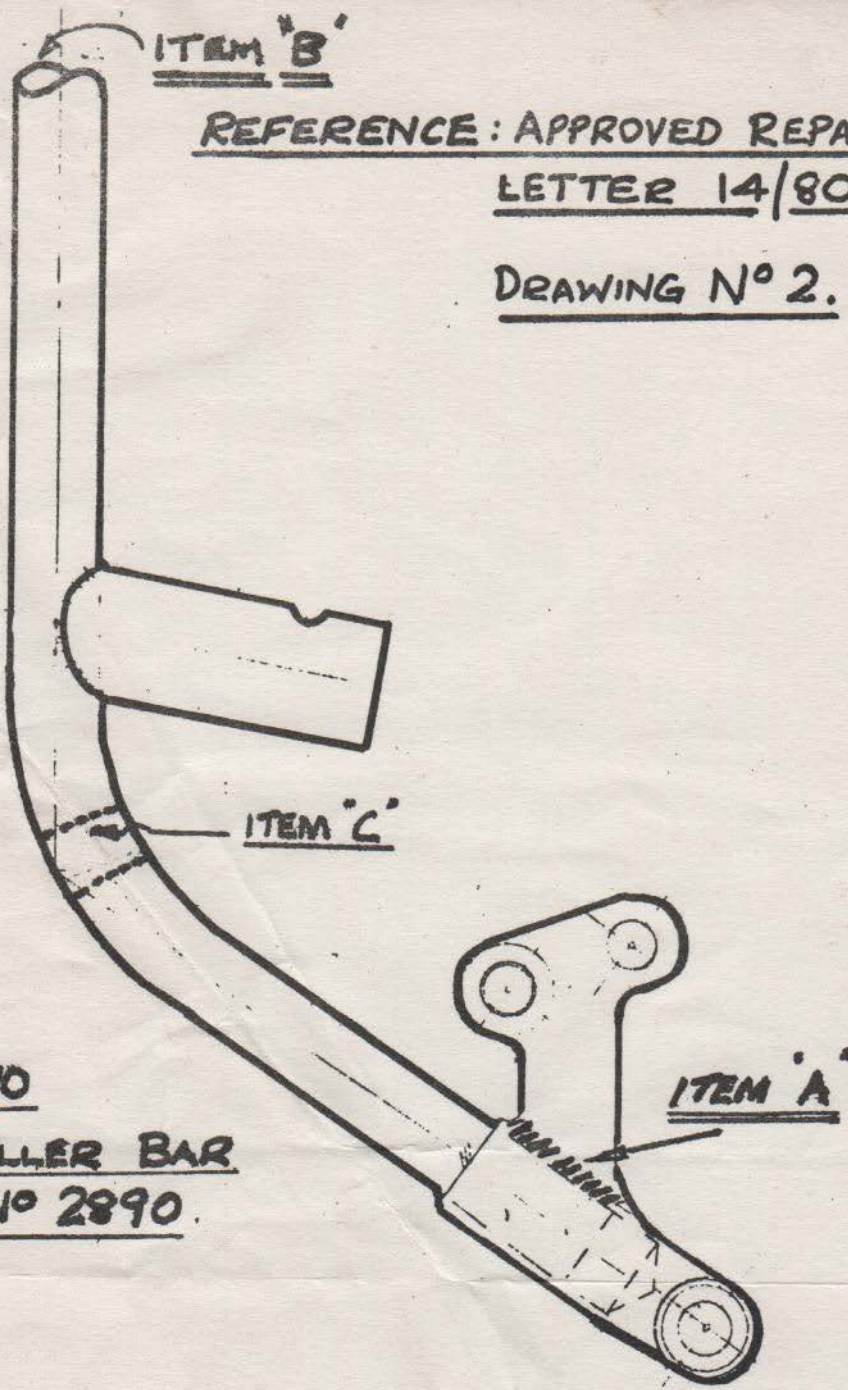
REFERENCE: APPROVED REPAIRER LETTER 14/80.

DRAWING Nº 1.



REFERENCE: APPROVED REPAIRER
LETTER 14/80

DRAWING Nº 2.



MODEL 70
SIDE TILLER BAR
STORE Nº 2890.

ITEM	DRAWING No	NAME	No OFF	REMARKS
1	TSD 5430	CLAMP-FUEL BUNDY	1	COULD BE MADE UP LOCALLY (SEE SHEET 5)
2	TSD 5434 N/D	6 M/M O/D STEEL BUNDY 29 INCH FREE LENGTH	1	
3	TSD 3056 N/D	CLIP LUCAS TYPE 187028	1	
4	ND	TRANSPARENT PETROL RESISTANT PVC TUBE $\frac{3}{8}$" O/D, x 3/16" T/D x 8' LONG	1	
5	ND	" x $1\frac{1}{4}$" LONG	1	WHEN SOLEX FUEL PUMP FITTED
6				
7				
8	TSD 2656 N/D	CABLE STRAP - ROSS COURTNEY TY-RAP No TY 38M OR SIMILAR	5	)SUPPLIED FROM)STORE
9	TSD 7391 N/D	5/16" DIA SELF ADHESIVE CLIP MAKERS PART NUMBER SAC 8	2	)) SEE APPENDIX H
10			1	
11	TSD 2963 N/D	$1\frac{1}{8}$ DIA 'U' BOLT CLAMP	1	
12	ND	HEX HEAD SCREW No 2 BAX $\frac{1}{2}$" LONG STEEL, ZINC OR CAD PLATED	1	
13	ND	HEX HEAD NUT No 2 BA STEEL ZINC OR CAD PLATED	1	
14	ND	No 2 BA SPRING WASHER	1	
15	TSD 3091 N/D	$\frac{3}{8}$" DIA PETROL PIPE CLIP	6	
5/A	ND	TRANSPARENT PETROL RESISTANT PVC TUBE $\frac{3}{8}$" O/D, x 3/16" I/D, x 12" LONG	1	WHEN WEBBER FUEL PUMP FITTED
	TSD 7090	ENGINE RESTRAINING PLATE (REQUIRED FOR ITEM 1)	1	COULD BE MADE LOCALLY (SEE SHT 3)
	TSD 7048 N/D	M 12 - 1.75 PITCH x 55 MM LONG ENGINE MOUNTING BOLT	1	COULD BE OBTAINED LOCALLY

SEE 5/A FOR ALTERNATIVE

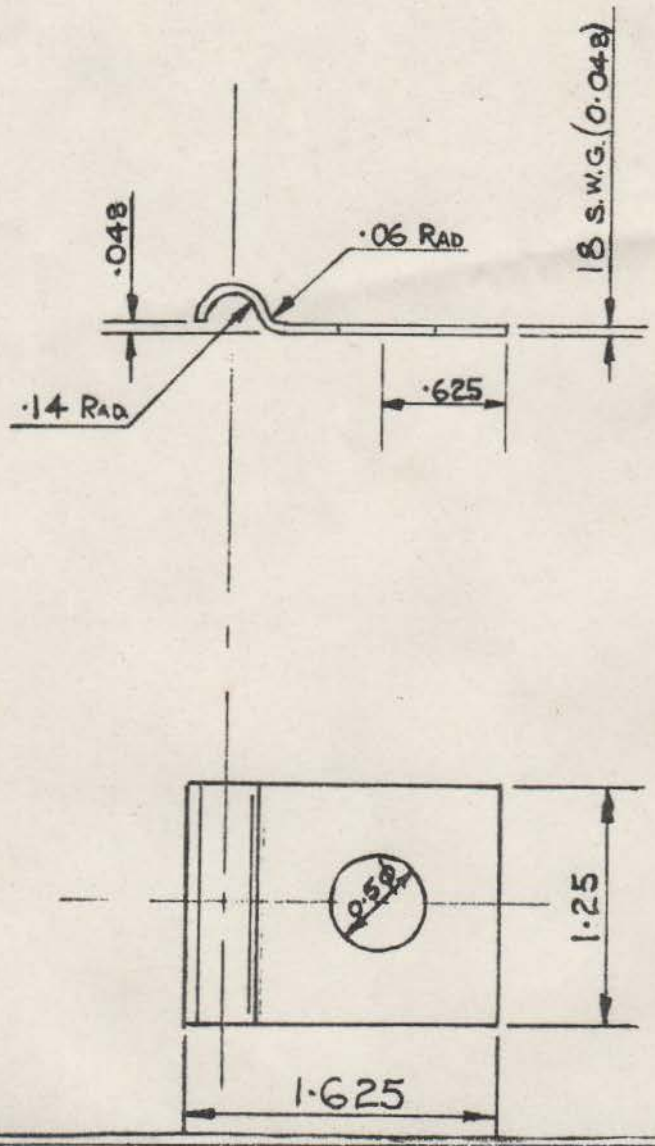
DRAWING NUMBER

T.S.D. 5430.

USED ON

THIRD ANGLE PROJECTION

FOR EXPLANATION OF DIMENSIONING, ETC. SEE B.S. ...
UNLESS OTHERWISE STATED - (1) ALL BURRS AND SHARP EDGES TO BE REMOVED. (2) A RADIUS OR CHAMFER OF .02 (MAX) IS PERMITTED (3) THE CORNERS OF BLIND HOLES ... (4) ...



MATERIAL B.S. 970:- EN2A OR EQUIVALENT	PROTECTIVE FINISH PAINT BLACK TO SPEC Nº TSS/V/110054				
		UPDATED FOR GENERAL ISSUE	1143	B	4-8-75
		CHANGE	Mod. No.	Issue	DATE
EST. WT.		CERT'D.		A	23-4-75
DIMS. IN INCHES	SURFACE ROUGHNESS	TOLERANCES ± .01			
SCALE FULL SIZE					

CHECKED

TRACED

SUPPLY DIVISION—DEPT. OF HEALTH & SOCIAL SECURITY

SERVICE LETTERS

CONTRACTOR

CONTRACTOR'S DR'G REF.

TITLE

CLAMP - FUEL BUNDY.

DRAWING No.

T.S.D. 5430

APPENDIX C
SHEET 5.

SIZE A