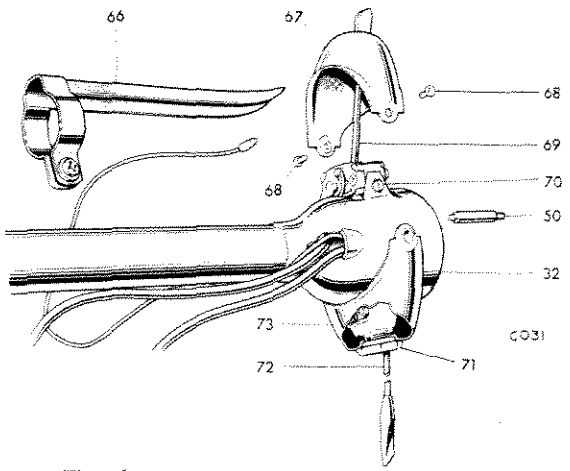


Fig. 16. Direction indicator switch and overdrive switch attachment

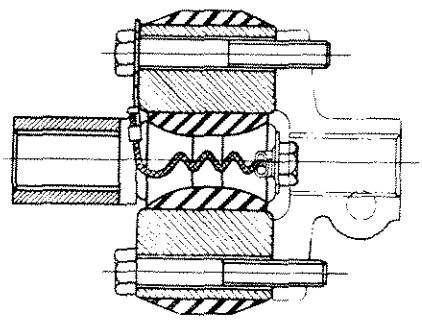


Fig. 17. Section through steering coupling

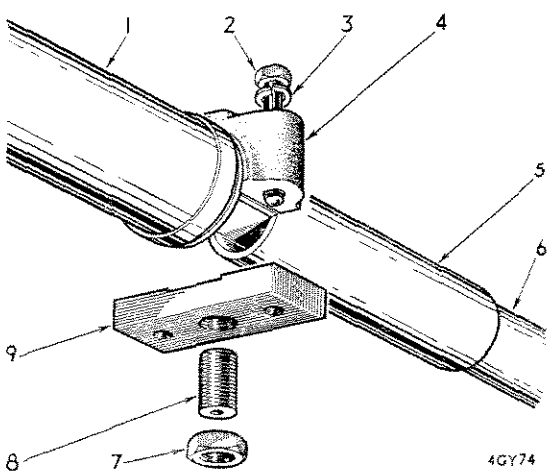


Fig. 18. Impact clamp details

Insert the inner column (24), into the outer column (32) taking care not to dislodge the bushes.

Feed the cables of the overdrive and direction indicator switches through the apertures in the upper end of the outer column, and retain the switches in position by fitting the attachment screws (70) and lock-ring (71). Fit the switch covers and retaining screws (68).

Insert the horn contact plunger (50) into the steering wheel boss and fit the horn button assembly (52) (Fig. 12).

Fit the adaptors (2), (7), (12) and (17) with earthing cables (3) and (14) to the joints (5) and (15) and secure with bolts (9) and (19). Wire-lock each pair of bolts together.

Refitting

Fit the steering column to the vehicle, passing it through the facia and rubber grommet in the bulkhead. Fit the cable trough (66), securing with the screws (56), spring washer and nut (60).

Fit the upper half of the upper support clamp (40) with felt (44), the tie rod (59), bolts (39), washers and nuts (61) (leave the nuts slack). Secure the stay (41) with spring washer (38) and nut (36).

Attach the lower clamp (35) felt (33) and (50), bolts (34), washers (57) and nuts (58) (leave the nuts slack).

Fit the lower column (10) to the coupling adaptors (7) and (12) and secure with the bolts (6) and (11) and nyloc nuts (25) and (13).

Refit the washer (26) to the column (24).

Insert the lower column assembly into the inner column (24).

Refit the impact clamp as follows :—

(a) Slacken the locknut (22) and using a $\frac{1}{8}$" A/F Unbrako hexagon wrench, unscrew the Allen screw (21) two complete turns.

(b) Turn the column (20) to bring the machined flat in line with that machined aperture in the column (24).

(c) Fit the impact clamp (54) and (23), retaining bolts (55) and washers (53).

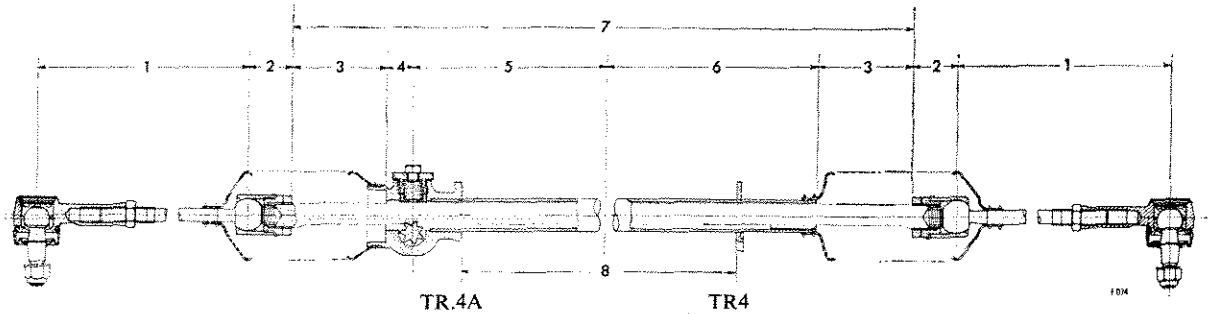
With the road wheels and steering wheel (48) in the straight ahead position fit the lower coupling adaptor (2) to the steering unit pinion shaft. Fit and tighten the retaining bolt (4) and nut (1).

Move the steering column to the desired height. To lower, push down on the steering wheel. To raise, pull on the outer column.

Tighten the upper and lower clamp nuts (58) and (61) and bolts (34) and (39).

Using the $\frac{1}{8}$" A/F Unbrako hexagon wrench, tighten the Allen screw (21) as much as possible without bending the wrench, then tighten the locknut (22).

Refit the horn and direction indicator cables at their snap connectors, and reconnect the battery.



TR.4A		TR4	
1	8·42″ (213·87 mm.).	1	8·55″ (217·17 mm.).
8	12·65″ (321·31 mm.).	2	1·42″ (36·06 mm.).
		3	3·09″ (78·5 mm.).
		4	0·88″ (22·35 mm.).
		5	8·00″ (203·2 mm.).
		6	8·88″ (225·55 mm.).
		7	23·94″ (60·81 cm.).

Fig. 19. STEERING UNIT DIMENSIONS

Inner Ball Joints

Assembly and Adjustment

Slide the cup nut (28) over the tie-rod (26) and insert the thrust ring (25) into the cup (28). Position the lockplate (23) over the sleeve nut (22) and screw this fully into the cup nut.

With the cup nut held in a vice, pull and push the tie-rod to estimate the approximate amount of "ball-lift". Prepare a shim pack (42) slightly thicker than the estimated "ball-lift" and insert this between the thrust ring (25) and the sleeve nut (22).

Add or remove shims to obtain the requisite ·002″ (·05 mm.) ball-lift when the sleeve nut is firmly screwed into the cup nut.

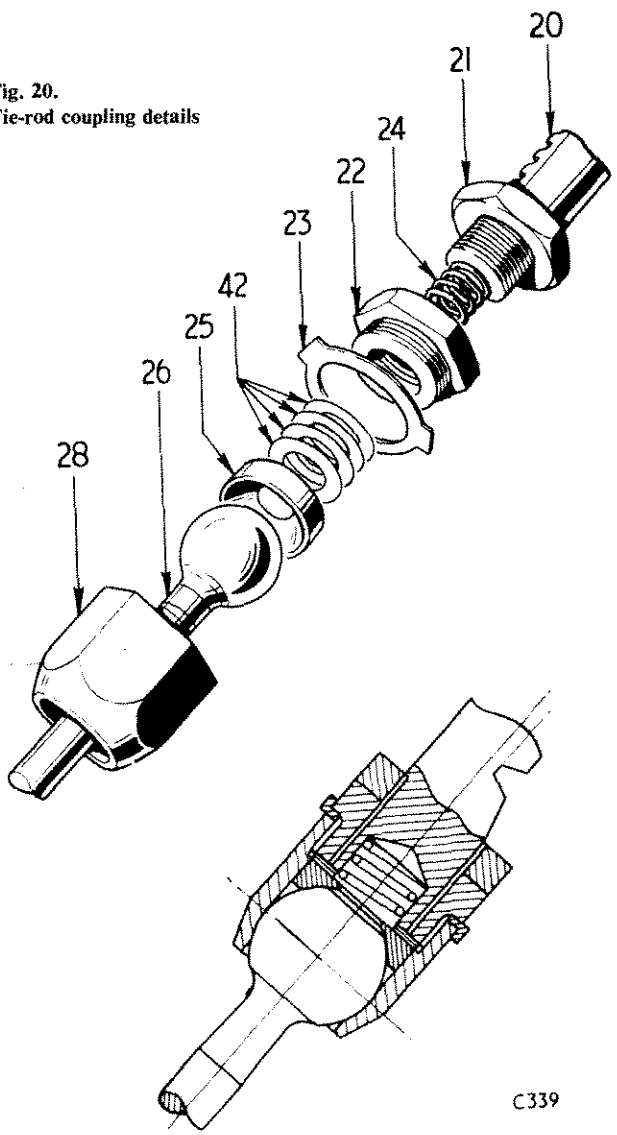
IMPORTANT. The ball should now move freely in the joint. If tightness occurs at any point, increase the shim thickness sufficiently to overcome this.

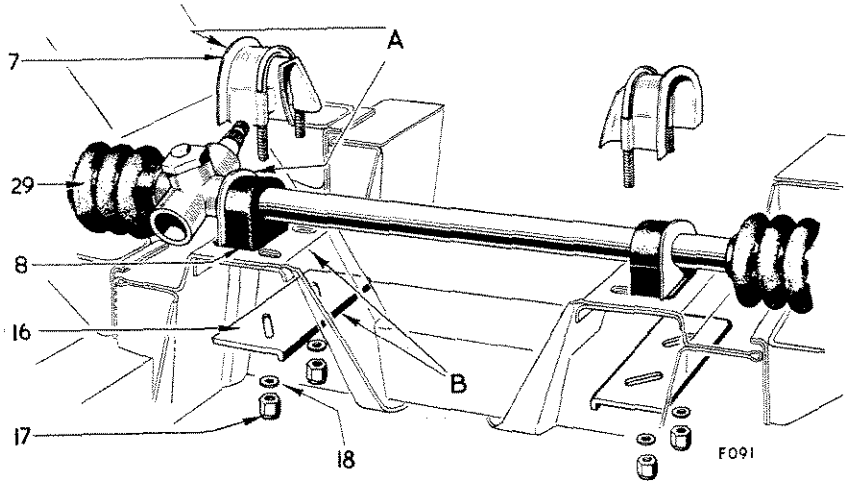
When adjustment is satisfactory, lock the assembly by bending the lockplate (23) over the sleeve nut (22) and the cup nut (28). Assemble the opposite tie-rod by repeating the foregoing procedure.

Fit a locknut (21) and spring (24) to each end of the rack (20), and screw on each outer tie-rod assembly. Adjust the position of the tie-rod assemblies on the rack (20) to dimension 7 Fig. 19. Tighten the locknut to maintain this position.

Fit the bellows (15) and (29) securing them with clips (27) and (31). Assemble the locknuts (30) and tie-rod ends (14) and (32) to the tie-rods.

Fig. 20.
Tie-rod coupling details





A Distance between flanges must be $\frac{1}{8}$" (3·17 mm.)
B Flange of item (16) must contact innermost flange of frame

7	"U" bolt	17	Nyloc nut
8	Rubber bush	18	Plain washer
16	Locating plate	29	Rubber gaiter

Fig. 21. Steering unit attachments

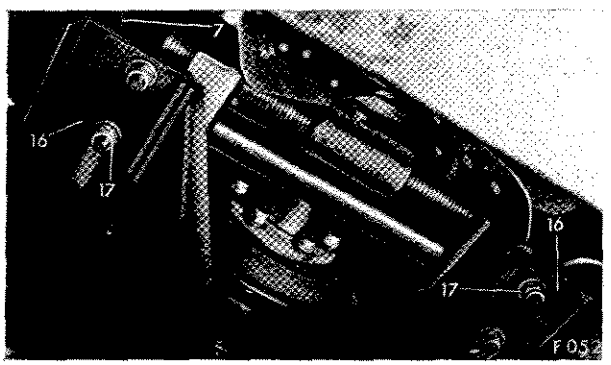


Fig. 22. Expander fitted to compress rack mounting rubbers

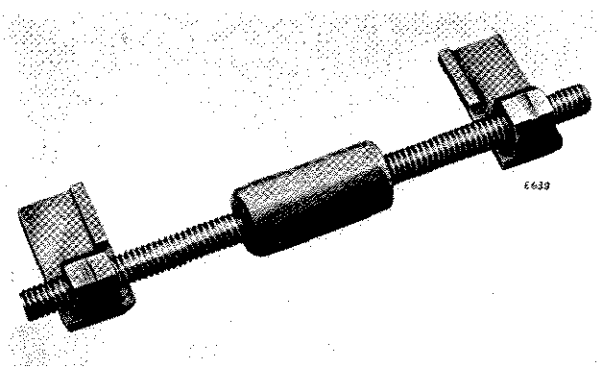


Fig. 23. Expander tool for use when fitting steering rack

STEERING UNIT

Removal of Steering Rack (Fig. 21)

Raise the front of the car onto stands, remove the road wheels and take out the pinch-bolt which retains the universal fork on the rack pinion.

Remove the engine cooling fan and detach the tie-rod ends from the steering arms.

Remove nuts (17), washers (18), locating plates (16) and "U" bolts (7). Bring the rack forwards and manoeuvre the unit from the vehicle.

Refitting

Fit new rubber bushes (8) and manoeuvre the rack onto the crossmember brackets. Fit the "U" bolts (7), plates (16) and washers (18), loosely securing them with the nuts (17).

Move one "U" bolt outwards to the ends of the elongated holes in the crossmember bracket. Slide the locating plate inwards until the flanged edge of the plate completely contacts the side of the bracket. If necessary, further elongate the holes in the locating plate. Tighten the two nyloc nuts to the correct torque. Avoid overtightening.

Compress the rubbers to give a clearance of $\frac{1}{8}$" (3·175 mm.) between the flange plates on the rack tube and the retainers welded to the "U" bolts whilst securing the other locating plate.

Refit the tie-rod ends to the steering arms, refit the wheels and remove the stands. Tighten the wheel nuts and refit the wheel trim and nave plates. Refit the engine cooling fan and check the front wheel toe-in.

Set the front wheels in the straight-ahead position and secure the steering couplings with the upper column and the steering wheel in the straight-ahead position.

Steering

Steering geometry and Suspension geometry

The term "steering geometry" refers to the lay-out of the steering mechanism and any of its dimensions, linear or angular, which contribute to the required behaviour of the steering system. The steering system is always designed to comply with the specification of the front suspension, in order that the best possible steering behaviour is obtained under all conditions.

For example, Toe-in and Camber are classed as suspension geometry K.P.I.; and Castor are classed as steering geometry.

Departure from any steering/suspension dimensions may result in unsatisfactory steering and/or abnormal wear of tyres, steering and suspension components.

NOTE: Poor steering and tyre wear is often caused by unbalance of the tyres themselves.

To avoid using jigs for rear wheel alignment, it is recommended that optical equipment (e.g. Optiline, Optoflex, etc.) be used, enabling the front and rear wheels to be aligned simultaneously. This equipment projects a beam of light in a plane at right angles to each individual wheel axle, on to a graduated screen. The various angles and dimensions may be read directly and accurately off the screens.

Steering Axis Inclination (Fig. 24)

This is the angle in front elevation between the steering axis 'A' and the vertical line 'B'. The steering axis is the continuation of the lower trunnion centre line through the centre point of the upper ball swivel, and it is about this axis that the wheel pivots as it is turned for control of vehicle direction.

Camber (Fig. 24)

Positive camber is the amount in degrees that the front wheels are tilted outwards at the top 'C', from the vertical line 'B'.

Castor (Fig. 25)

Castor is the angle in side elevation between the steering axis 'A' and the vertical line 'B'. It is considered positive when the steering axis is inclined rearwards.

Wheel Alignment

To ensure parallel tracking when the vehicle is moving, the recommended static setting is parallel to $\frac{1}{16}$" (1·6 mm.) toe-in.

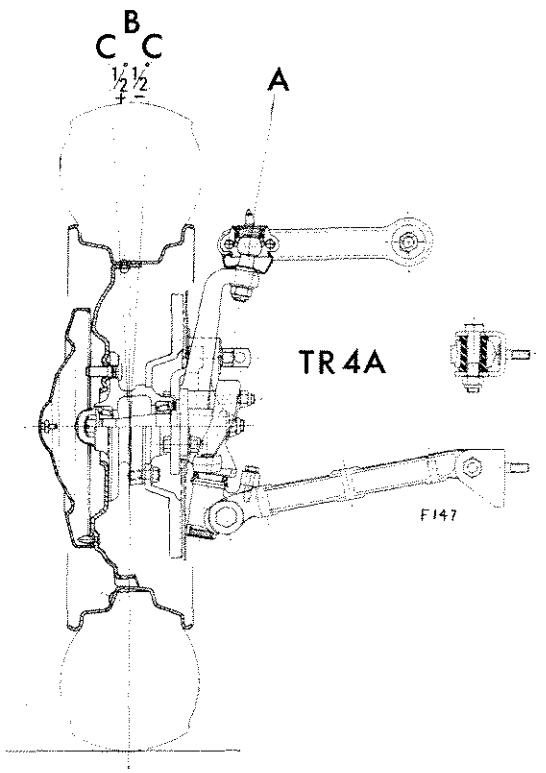


Fig. 24. Steering axis inclination and camber angle

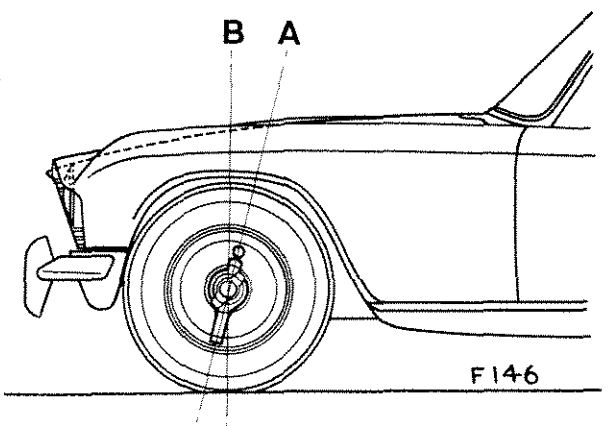


Fig. 25. Castor angle

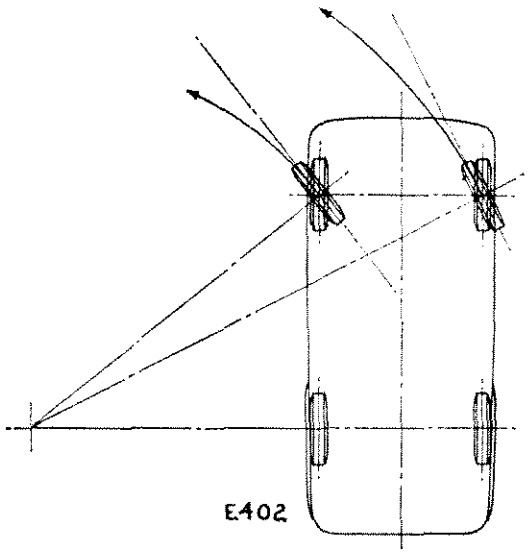


Fig. 26. Showing the relative angles of the front wheels when making a turn

TR.4A Turning Radius Angles (Fig. 26)

Outside wheel	Inside wheel
20 degrees	21½ degrees
26½ degrees max.	31½ degrees max.

Toe-out on Turns (Fig. 26)

This is the alignment of the front wheels relative to each other as they are turned to the left or right.

To eliminate scuffing when the vehicle is making a turn, each front wheel must be at right angles to the radius from its point of contact with the road to the centre of the returning circle. Thus the inner wheel toes-out relative to the outer wheel.

Unfortunately, using simple steering mechanisms, it is not possible to obtain the exact toe-out at every position through the complete turn from straight-ahead to full lock. However, scuffing can be minimised by careful positioning of the steering components.

Static Laden

The steering dimensions illustrated on Figs. 24 and 25 apply to a vehicle when static laden.

This condition is obtained by placing a 150 lb. (68 kg.) weight on each front seat and two similar weights on the rear seat.

OPTICAL ALIGNMENT EQUIPMENT

General Recommendations

To obtain the greatest accuracy from optical alignment equipment, it is necessary to comply with the following instructions:

(a) Assemble the equipment in accordance with the manufacturers' instructions.
(b) Set the screen parallel and at right angles to a level floor.
(c) Set the car square to the screen with the centre of the front wheels 5 ft. 7 in. from the face of the screen.
(d) Adjust the tyre pressures and load the vehicle to the static laden condition.

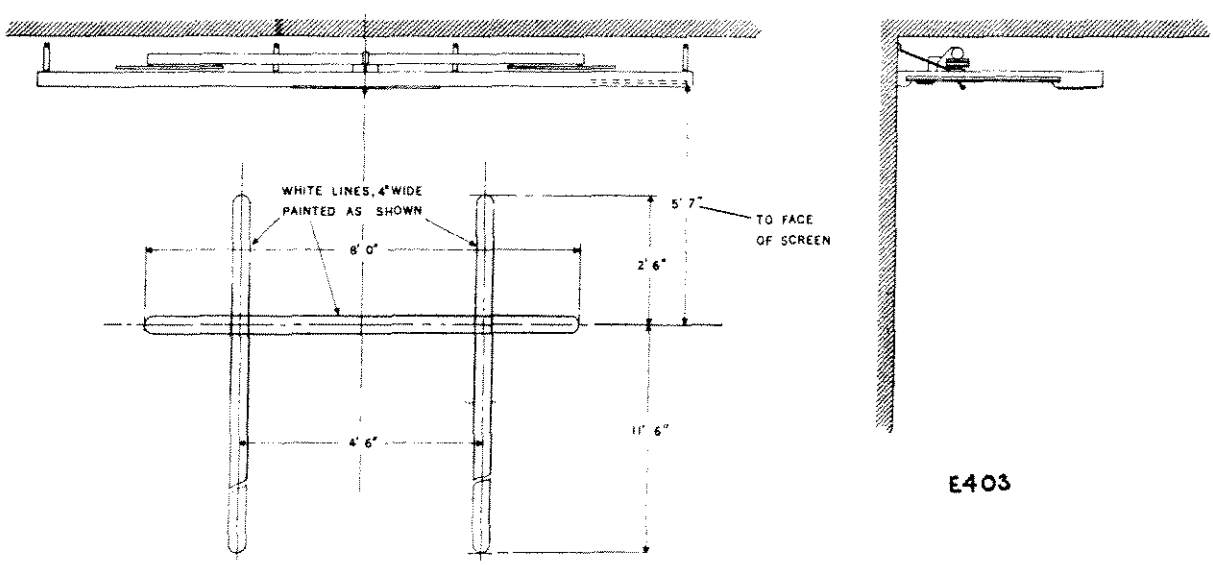


Fig. 27. Suggested floor markings relative to the optical screen face

Attaching the Projectors

Attach the wheel clamps by resting the lower support (6) on the edge of the wheel rim and pushing the upper support (4) until the cut-screws touch the inside of the upper wheel rim. Whilst pressing the upper support against the wheel rim edge, turn the cam lock (3) to secure the clamp.

Jack up the front wheels and ensure that the wheel clamp is clear of obstructions when rotating the wheel. Loosen the projector cam lock (5) centre the projector pivot (7) on the rods and retighten the cam lock (5). Slide the projector on to its pivot and tighten the clamping bolt (9). Repeat the procedure on the opposite front wheel.

Compensating for Wheel Run-out

The projector pivot mountings are provided with three large diameter milled edged compensating screws (2) for adjusting the projector beams to the true axis of the road wheels. Compensation for wheel run-out is effected as follows:

Connect the projectors to the control panel and, by sliding the telescopic projector lens (8) backwards or forwards, focus the light beam on the vertical line trueing scale immediately above the mirror hole in the screen.

Slacken the projector clamp screw (9) and, holding the projector (10) to keep the light image within the trueing scale, slowly rotate the road wheel. Note the extent of movement made by the light image across the scale and stop turning the wheel when the image reaches one extreme position.

Adjust the rearmost compensating screw (2) to bring the image to the centre of its movement. If two screws point to the rear, adjust both evenly. Repeat as necessary until the light image remains laterally stationary during wheel rotation.

Lower the wheels on to the centre of the turntables and apply the brake pedal depressor. Take hold of the bumper and jolt the car up and down a few more times. Unlock the turntables and jolt the car a few more times.

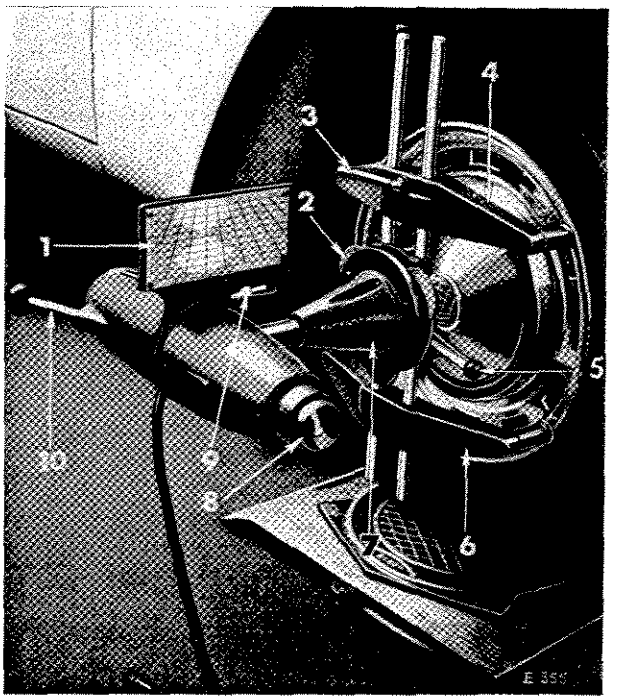


Fig. 28. Projector attachment

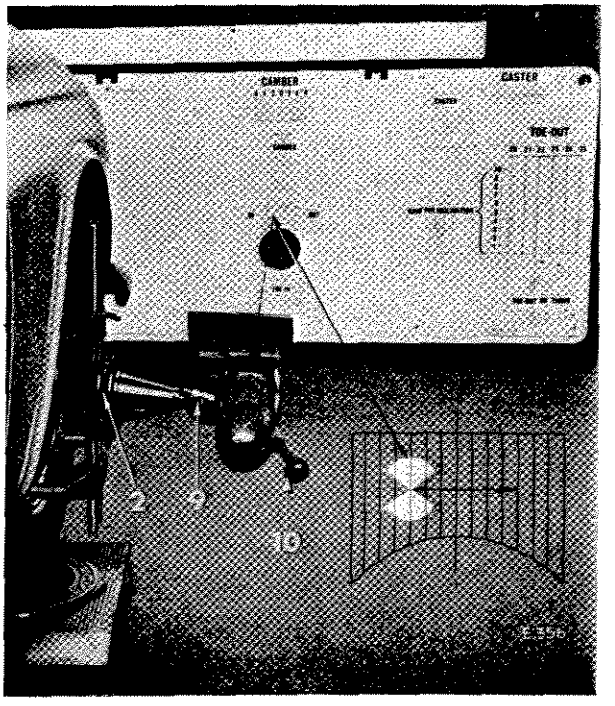


Fig. 29. Checking wheel run-out

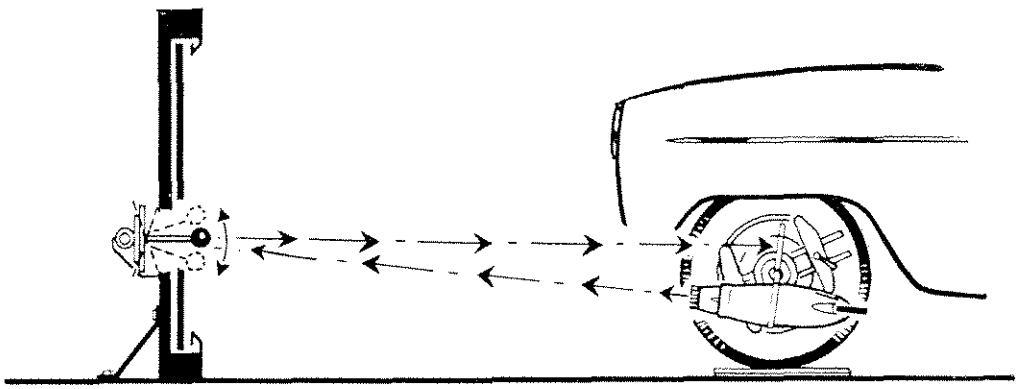


Fig. 30. Aligning mirrors to re-direct light image to the toe-in scale

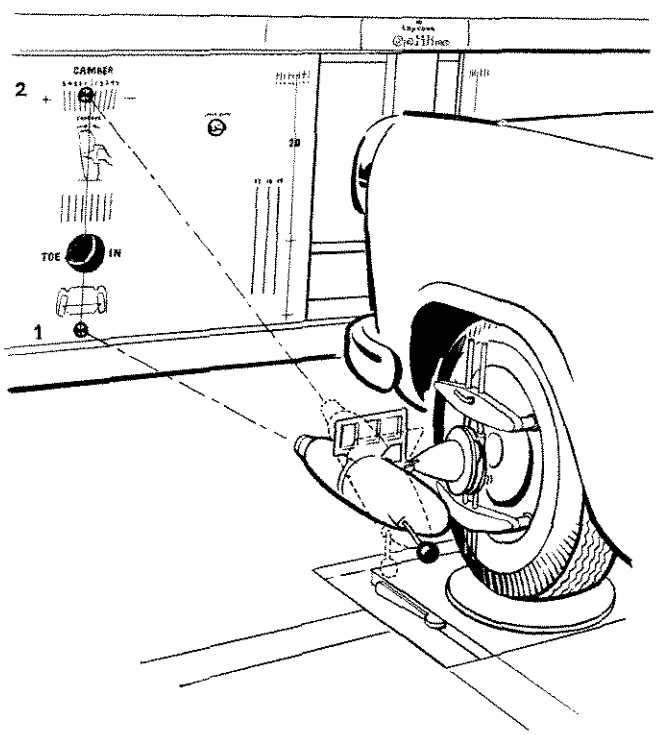


Fig. 31. Checking front wheel camber angle

TAKE CARE TO ENSURE THAT THE SCREENS REMAIN IN THIS POSITION FOR ALL FURTHER OPERATIONS.

Toe-in

To check toe-in condition, aim the light image at the centre of the mirror and, by tilting the mirror up or down, re-direct and focus the image on to the toe-in scale (1), Fig. 28, attached to the top of the projector. Turn the steering to align the light image with the zero line on the scale. In this position the road wheel is at right angles to the mirror.

Aim the opposite projector at the centre of its mirror and focus the reflected image on the toe-in scale. A direct reading of the toe-in condition can now be read from this scale.

Centre Steering

When the toe-in checks have been completed, turn the steering to equalize the readings on both projector toe-in scales and check the position of the steering wheel spokes. These should be perfectly horizontal.

Camber—Straight-ahead position

IMPORTANT: Before taking a camber reading it is essential that the wheel is in the straight-ahead position (this applies for both L.H. and R.H. front wheels).

To check the camber of either front wheel, aim the light image at the centre of the mirror and, by tilting the mirror up or down, re-direct and focus the image on to the toe-in scale attached to the top of the projector. Turn the steering to align the light image with the zero line on the scale. In this position the road wheel is at right angles to the mirror.

By traversing the screen horizontally and tilting the projector, aim and refocus the light image on the measuring cross below the mirror. Tilt the projector to bring the image into the camber scale and note the reading.

Repeat the procedure on the opposite wheel.

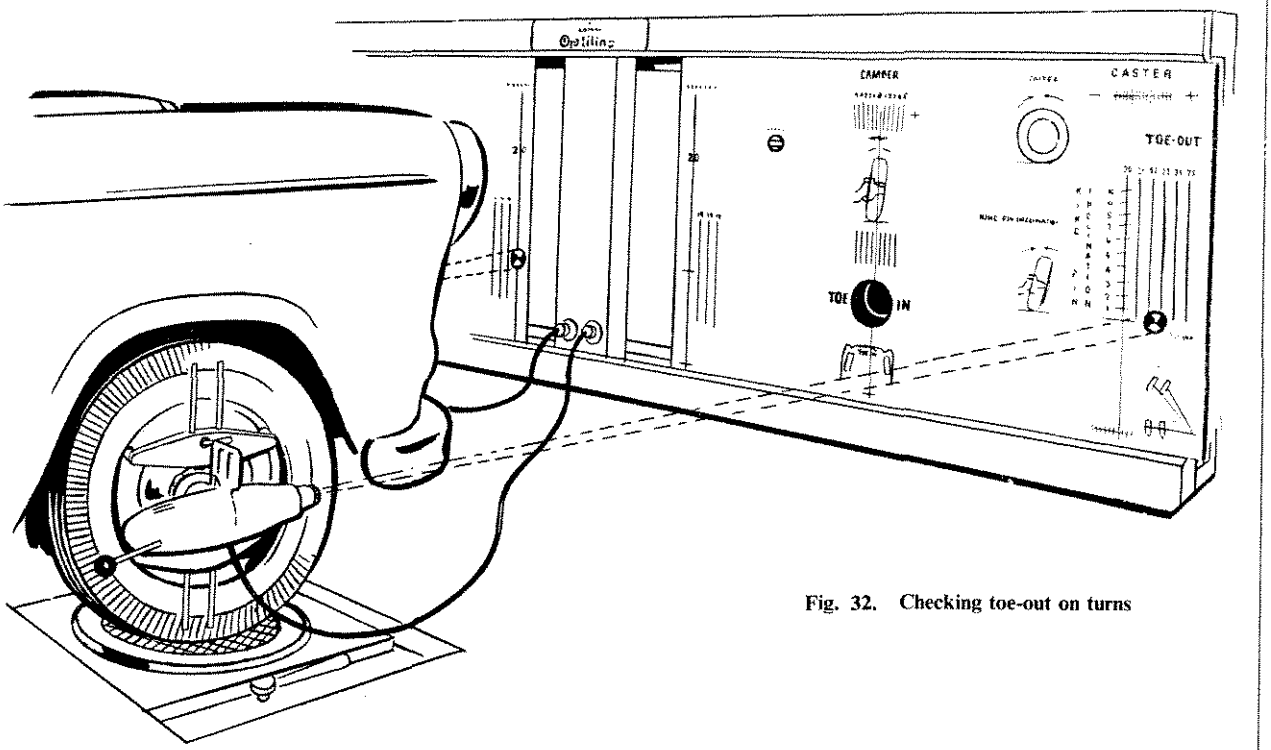


Fig. 32. Checking toe-out on turns

King Pin Inclination and Castor (Fig. 33)

Turn the wheel inwards and tilt the projector to focus the light image on the lower measuring cross (Position 1). Tilt the projector to bring the image into Position 2 **and note the reading on the Castor index scale.**

Tilt the projector to focus the image on the measuring cross (Position 3) and tighten the projector clamping screw. Turn the wheel 20° outwards and **note the reading on the K.P.I. scale (Position 4).**

Slacken the projector clamping screw and, by turning the road wheels and tilting the projector as necessary, focus the light image on the lower Castor index scale (Position 5) to the same value noted in Position 2.

Tilt the projector to bring the image into Position 4 **and note the reading on the Castor scale.**

Toe-out on Turns (Fig. 32)

Turn the L.H. wheel inwards and focus the light image on the mean measuring cross on the 20° line nearest the inner edge of the L.H. screen. Tilt the projector on the opposite wheel and focus the light image on the base line of the Toe-out scale, nearest to the outer edge of the R.H. screen.

This will indicate R.H. wheel toe-out on turns.

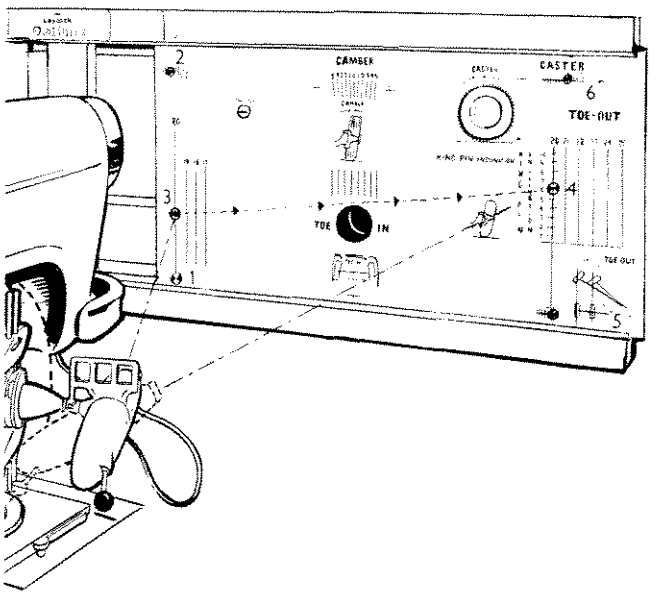


Fig. 33. Measuring castor and king pin inclination

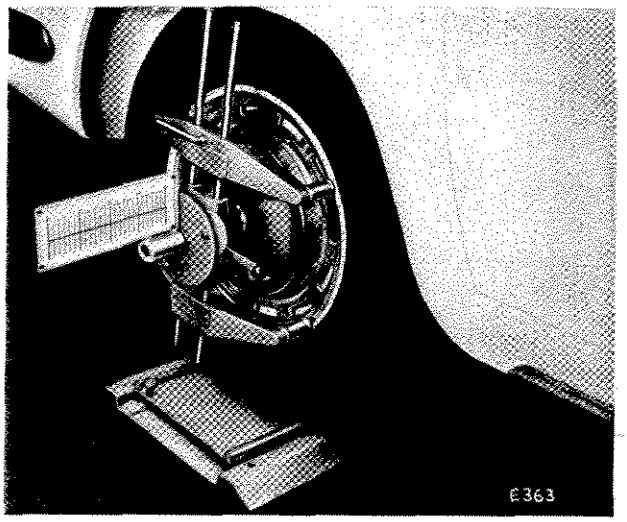


Fig. 34. Scales fitted to the rear wheels

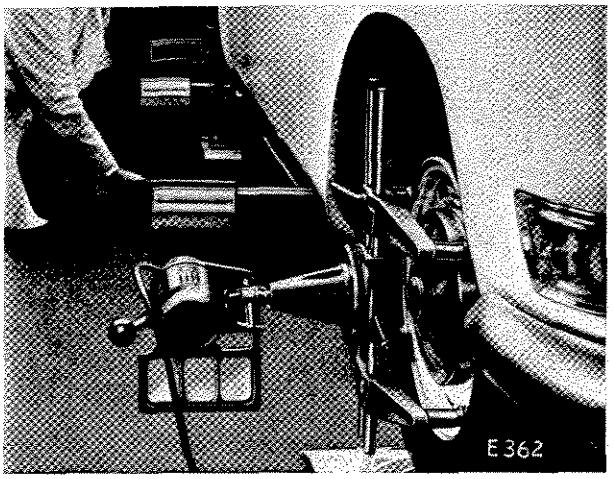


Fig. 35. Centralising the front measuring rod

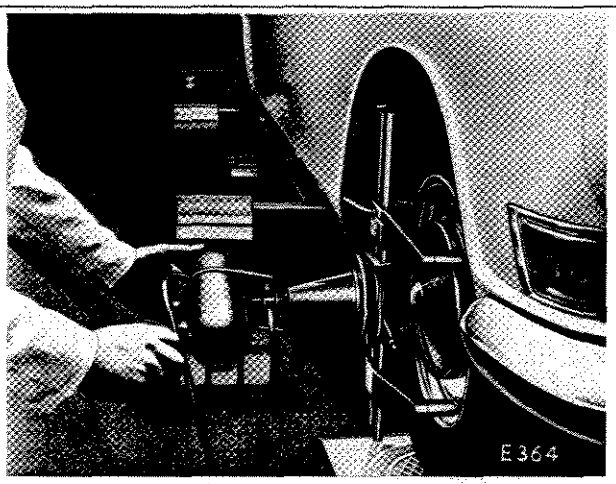


Fig. 36. Centralising the rear measuring rod

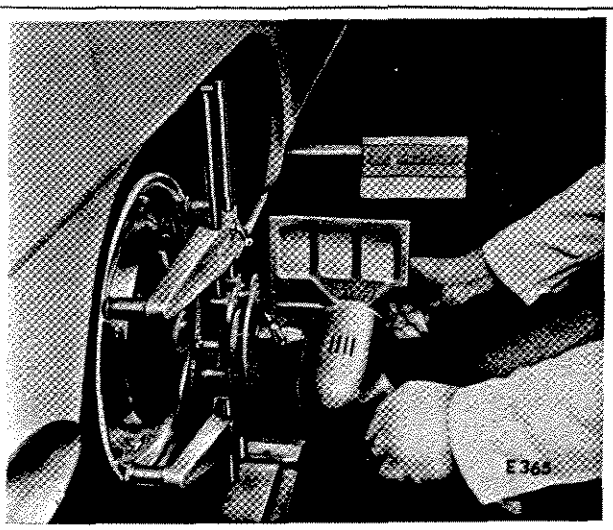


Fig. 37. Checking rear wheel toe-in

Rear Wheel Toe-in

Attach wheel clamps and scales to the rear wheels by following the procedure on page 4·213, for "attaching the projectors", but substituting scales for projectors.

Turn the projectors on the front holders through 180° until the beams of light appear on the scales mounted on the rear holders. Turn the steering wheel until the same reading is obtained on both right and left rear wheel scales.

Mount the distance rods onto the measuring rods; place the assemblies on the floor in front and behind the rear axle with the distance rod plates resting against the wheels.

Focus both beams of light onto the front measuring rod scales, move measuring rods sideways until the same reading is obtained on the right- and left-hand scales; repeat this operation for setting the rear measuring rod.

Remove the projectors from the front holders and fit them in place of the rear wheel scales on the rear holders. Focus the beam of light on both front and rear measuring rods in turn, taking note of the readings obtained; by subtracting one from the other a toe-in value is obtained from each rear wheel.

Rear Wheel Camber (Fig. 38)

1. With the projectors mounted on the rear holders, focus the beam of light onto the main screens and, by traversing the screens horizontally, focus the light image on the measuring cross (Position 1).

2. Tilt the projector to bring the image into the camber scale (Position 2) and note the reading. Repeat the procedure on the opposite side.

Chassis Alignment

When the rear end check is completed, check chassis alignment by placing the wheel indicator scales on the front holders (without disturbing the wheels, as they are set in the straight-ahead position). Readings taken direct from the wheel indicator scales will give an indication of the chassis and axle condition.

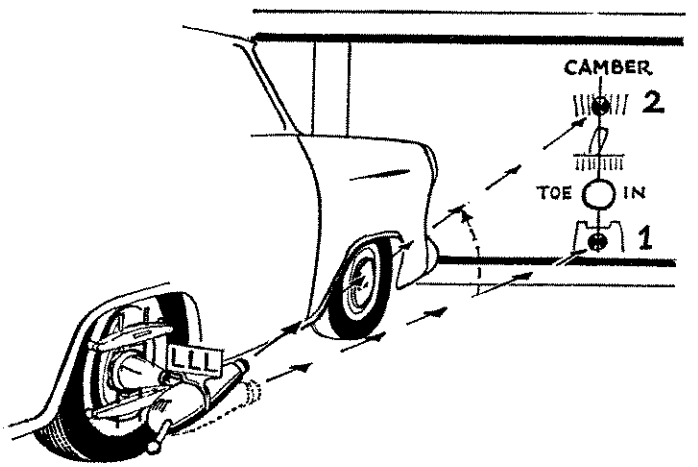


Fig. 38. Checking rear wheel camber

TRIUMPH TR4

WORKSHOP MANUAL

GROUP 3

Comprising:

TR4 WORKSHOP MANUAL

GROUP 3

CONTENTS

REAR AXLE DIMENSIONS

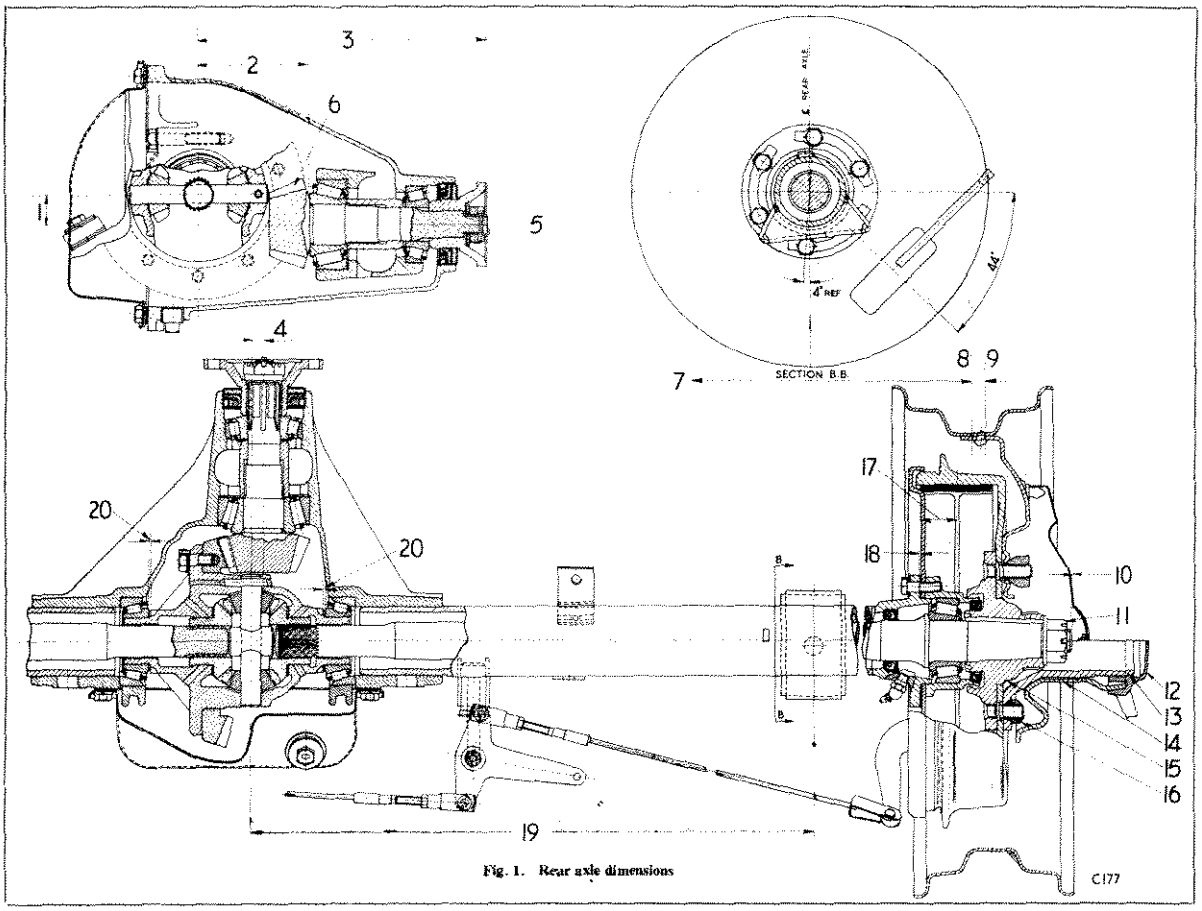


Fig. 1. Rear axle dimensions

Key to Fig. 1

REAR AXLE DIMENSIONS

1 Pinion height below crown wheel centre line — 1" (25·4 mm.)

2 Pinion front face to crown wheel centre line — 3·44" (87·38 mm.) ; 3·437" (87·3 mm.)

3 Driving flange to crown wheel centre line — 8·94" (227·07 mm.)

4 Pinion off set from axle centre line — 0·38" (9·65 mm.)

5 Pinion pre-load 15 - 18 lb. in. (0·1728 - 0·207 m.k.g.) without oil seal

6 Pinion and crown wheel backlash 0·004" - 0·006" (0·1016 - 0·1524 mm.)

7 24·04" (61·07 cm.) to centre line of axle

8 Centre line to disc wheel

9 Centre line of wire spoke wheel

10 0·004" - 0·006" (0·1016 - 0·1524 mm.) hub end float

11 Axle shaft nut — tighten to 125 - 145 lb. ft. (17·28 - 20·05 k.g.m.) torque

12 Centre lock wheel nut (wire spoked wheels)

13 Hub extension (wire spoked wheels)

14 Wire spoked wheel centre

15 Hub

16 Hub extension nut (wire spoked wheels)

17 1·13" (28·7 mm)

18 Total thickness of shims in both sides of axle 0·016" (0·406 mm.) min. to 0·108" (2·74 mm.) max.

19 Axle centre line to spring mounting 17·5" (444·5 mm.)

20 Differential bearing pre-load to be shimmed 0·002" - 0·004" (0·0508 mm. - 0·1016 mm.) measured over both bearings

REAR AXLE

Parts and Description	Dimensions when new	Clearances when new	Remarks
Axle Ratio	3·7 or 4·1 : 1		
Track	4′ 0″		4′ 1″ with wire wheels.
Width between Spring Centres	2′ 11″		
Crown Wheel			
Number of Teeth	37 (41)		4·1 crown wheel is identified by two grooves on its periphery.
Locating Diameter	4·3750″/4·3760″	0·0010″/0·0030″	Diameter of location on carrier—4·373″/4·374″.
Maximum permissible Run-out	0·003″		When bolted to differential carrier.
Pinion			
Number of Teeth	10		4·1 pinion identified by two annular grooves on the splines.
Diameter of Journal—			
for Pinion Head Bearing	1·2506″/1·2511″		Bearing press-fit. Interference of —0·000″/0·0011″.
for Pinion Tail Bearing	1·0004″/1·0009″		Bearing light drive fit. Limits allow clearance of 0·0002″ to an interference of 0·0009″.
Spline Diameters—Maximum	0·9900″/0·9940″		
—Minimum	0·8460″/0·8475″		Driving flange locating diameter.
Thread Dimensions	$\frac{5}{8}$″—18 U.N.F.		
Axle Casing			
Internal Diameter for :			
Pinion Head Bearing Outer Ring	2·8578″/2·8588″		Ring is press fit in bore. Interference of 0·0005″/0·0021″.
Pinion Nose Bearing Outer Ring	2·4395″/2·4405″		Ring is press fit in bore. Interference of 0·0005″/0·0019″.
Differential Bearing Outer Rings	2·8445″/2·8455″		With bearing caps tightened, limits allow clearance of 0·0015″ to an interference of 0·0001″.
Width between Differential Bearing Outer Ring Abutments	7·2550″/7·2630″		
Maximum Spreading Load for entry of Assembled Differential Unit	3250 lbs.		Load applied between reaction points 30″ apart.
Axle Shafts			
Overall Length	26·31″		
Hub Bearing Journal Diameter	1·3135″/1·3140″		Bearing press fit on shaft. Interference of 0·0004″/0·0015″.
External Diameter of Serrations	1·0377″/1·0417″		
Number of Serrations	24		
Thread Dimensions	$\frac{3}{4}$″ × 16 T.P.I. U.N.F.	Class 2A	
Keyway Width	0·2500″/0·2510″		
Driving Key Dimensions	1 $\frac{7}{16}$″ × $\frac{1}{2}$″ × $\frac{1}{4}$″		
Axle Shaft End Float	0·0040″/0·0060″		End float controlled by shim thickness between end of axle casing and brake backing plate. See remarks concerning "Thrust Button".
Hub Bearing Housing			
Internal Diameter for Bearing Outer Ring	2·7485″/2·7495″		Ring is press fit in housing. Interference of 0·0005″/0·0019″.

REAR AXLE — continued

Parts and Description	Dimensions when new	Clearances when new	Remarks
Pinion Setting Dimensions			
Distance from Head Bearing Abutment Face on Pinion to Centre of Crown Wheel Bearings	3·4375″		
Pinion Centre Line 'Offset' below Crown Wheel Centre Line	0·9990″/1·0010″		
Pinion Bearing Pre-load (without Oil Seal)	15/18 lb. ins.		Controlled by shim thickness between bearing spacer and nose bearing inner cone.
Backlash between Pinion and Crown Wheel	0·0040″/0·0060″		Controlled by shim thickness behind differential bearings.
Differential Unit			
Differential Sun Gear :			
Number of Teeth	16		
Journal Diameter	1·4985″/1·4993″	0·002″/0·004″	Clearance of Gear in gear carrier.
Number of Internal Serrations	24		
Internal Diameter	0·9750″/0·9790″		
Thrust Washer Thickness	0·0470″/0·0490″		
Planet Gear :			
Number of Teeth	10		
Internal Diameter	0·6250″/0·6265″	0·0008″/0·0028″	Clearance between gear and cross-pin.
Thrust Washer Thickness	0·0470″/0·0490″		
Cross-pin :			
Diameter	0·6237″/0·6242″	0·0003″/0·0020″	Clearance of pin in differential housing.
Length	4·19″		
Thrust Button :			
Length between Thrust Faces	1·3700″/1·3800″		Arrange hub bearing adjusting shims to permit the thrust button to assume a central position in relation to cross-pin.
Differential Casing :			
Diameter of Journal for Differential Bearings	1·5012″/1·5018″		Bearing press fit. Interference of 0·0006″/0·0018″.
Width of Case between Differential Bearing Abutments	5·3120″/5·3170″		
Dimension between Bearing Abutment and Crown Wheel Locating Face	1·5620″/1·5680″		
Internal Diameter for Differential Sun Gear Journals	1·5013″/1·5025″	0·002″/0·004″	Clearance of gear in gear carrier.
Width between Differential Side Gear Thrust Faces	2·3620″/2·3660″		
Diameter of Cross-pin Bore	0·6245″/0·6257″	0·0003″/0·0020″	Clearance of cross-pin in housing.
Differential Bearing Pre-Load (measured over both bearings)	0·0020″/0·0040″		Controlled by thickness of shims.
Hubs (Rear)			
Thread Dimensions for Withdrawal Purposes	1⅞″ × 8 T.P.I. S.A.E.		

REAR AXLE

To Remove

1. Jack up the rear of the vehicle and lower onto stands positioned beneath the chassis frame adjacent to the forward spring eyes. Remove road wheels and drain axle oil.
2. Disconnect propeller shaft at the rear end.
3. Disconnect the handbrake primary cable from the compensator lever (2) and release the cable from its abutment (3) on the axle tube.
4. Drain the brake system and disconnect the flexible brake hose (4).

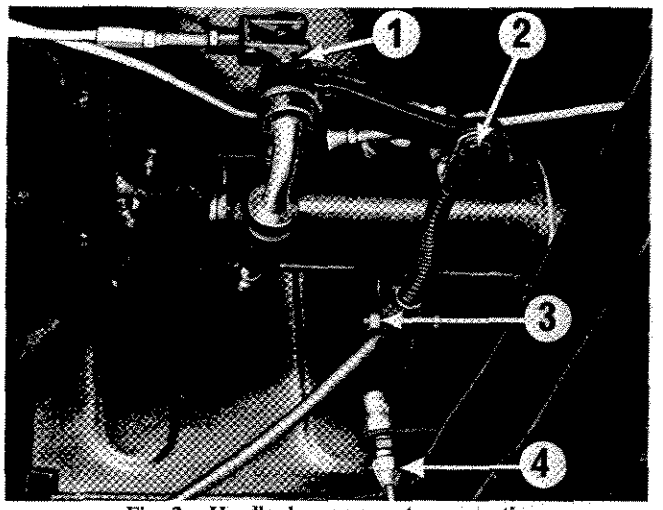


Fig. 2. Handbrake compensator connections

5. Release the brake pipe assembly (7) from the axle and the handbrake cables from the wheel cylinder levers (4).
6. Release the lock tabs, remove six bolts (5) and detach the hubs, axle shafts, brake drums and backplates as a unit. Keep the two shim packs separate.
7. Remove the axle bump straps (9).
8. Jack up each spring until the axle rebound rubbers are clear of the chassis frame. Remove the U-bolts (6) allowing the plates to hang on the damper links (8). Remove the jacks from the springs.

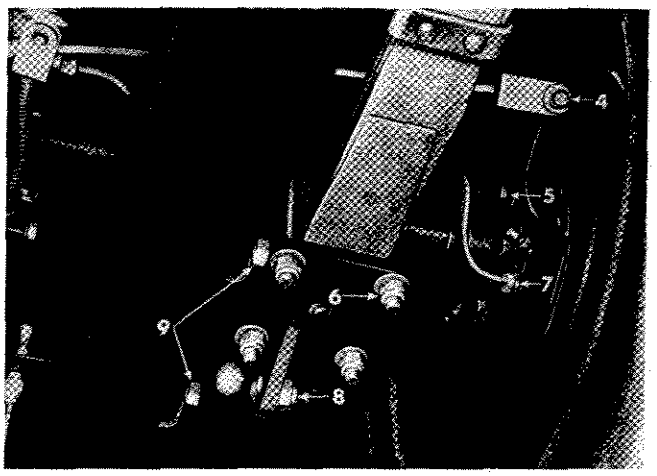


Fig. 3. Axle attachments

9. Release the exhaust tail pipe mounting from the chassis.
10. Feed the axle over the L.H. side of the chassis frame. Lower the R.H. side of the axle and move rearwards to allow the axle tube to pass beneath the chassis frame.
11. Manoeuvre the axle clear of the chassis.

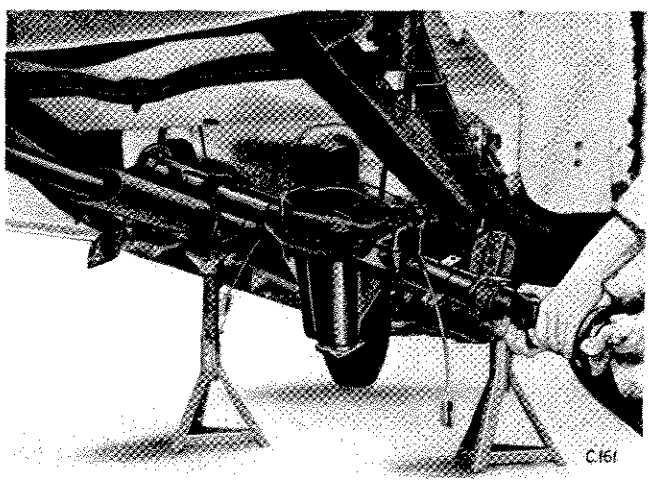


Fig. 4. Removing the axle

To Refit

To refit, reverse the removal procedure, noting that on L.H. steering cars, a $\frac{1}{16}$" thick packing piece must be fitted between the spring and the axle tube mounting platform on the passenger side of the car.

Fill the axle with oil and bleed the brake hydraulic system.

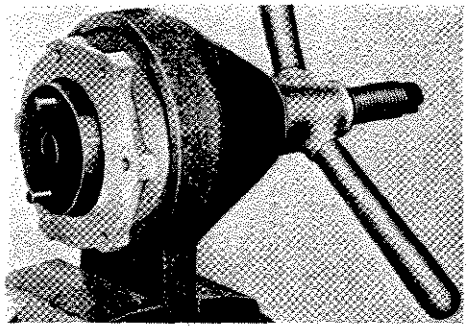


Fig. 5. Using Tool No. 20S.93 to remove hub bearing outer rings

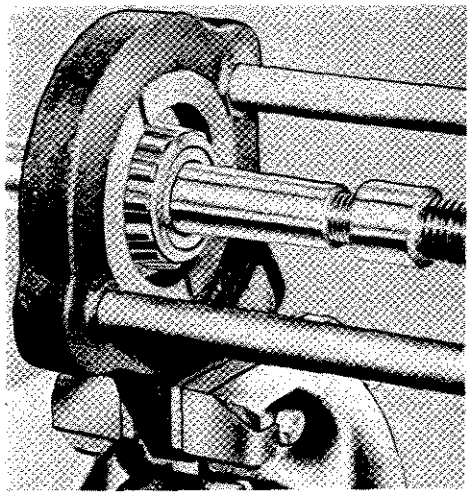


Fig. 6. Using Tool No. S.4221-2 to withdraw hub bearing from axle shaft

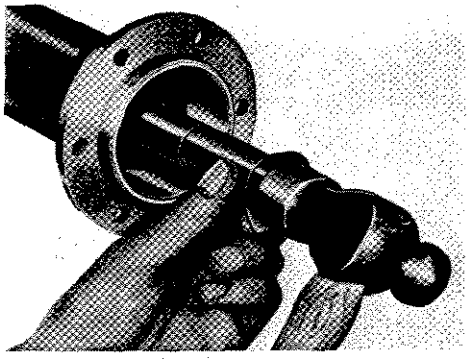


Fig. 7. Using Tool No. 20S.92 to fit oil seal in axle tube

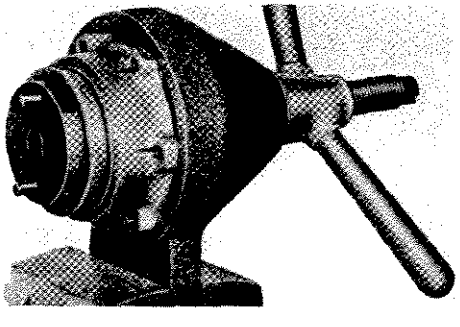


Fig. 8. Using Tool No. 20S.93 to fit hub bearing outer rings

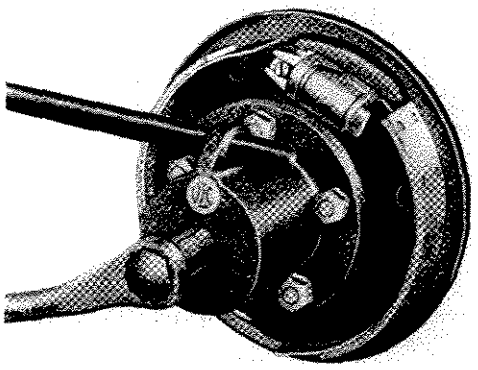


Fig. 9. Using Tool No. M.86A to remove rear hub

Axle Shaft, Hub Bearing and Oil Seals

To Remove and Dismantle (Fig. 13)

Jack up the rear of vehicle and place on stands : remove road wheel, hub extension (if fitted) and brake drum. Drain the brake hydraulic system and uncouple the brake pipe and handbrake cable from the backplate.

Withdraw split pin (48) and remove the slotted nut (46) and plain washer (47). Extract rear hub using Tool No. M86.A.

Release lock plates (41), remove six setscrews (42) and detach the bearing housing (38), shims (40) and brake assembly.

Tap out the oil seal (39) and extract the bearing outer ring (37) from the housing, using Tool No. 20S.93.

Withdraw the axle shaft, remove the key (45) and extract the bearing (37) using Tool No. S.4221-2.

Extract the oil seal (51) from the axle casing.

To Re-Assemble

Placing the sealing lip inwards, install a new seal (51) into the axle casing.

Using Tool No. 20S.92, drive the hub bearing (37) onto the axle shaft and refit key (45).

Draw the bearing outer ring into the housing (Tool No. 20S.93) and install a new oil seal (39), its lip facing inwards. Pack the hub bearing with grease.

Thread the bearing housing (38) onto the shaft (36) and refit hub (43), plain washer (47) and slotted nut (46), which must be tightened to a torque of 125 to 145 lbs. ft. (17·28 to 20·05 kilogrammetres) and secured with a split pin (48).

Insert the assembled axle shaft into the axle casing. Locate the shaft serrations in the sun wheel and secure the bearing housing with six setscrews (42) and lockplates (41).

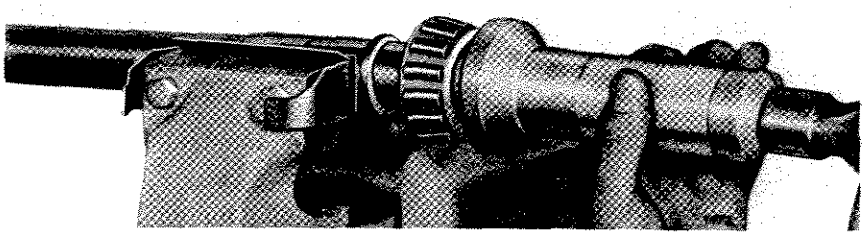


Fig. 10. Using Tool No. 20S.92 to drive bearing onto half shaft

Axle Shaft End Float

Check the axle shaft end float as shown on Fig. 11. This should be 0·004″ to 0·006″ (0·1 to 0·15 mm.). Adjust by altering the thickness of the shim pack interposed between axle sleeve and backing plate.

IMPORTANT: To ensure centralisation of the thrust block with the cross pin (see Fig. 12) equalize the thickness of the shim packs behind both backing plates.

Replace the brake drum and road wheel, then remove the axle stands and lifting jack.

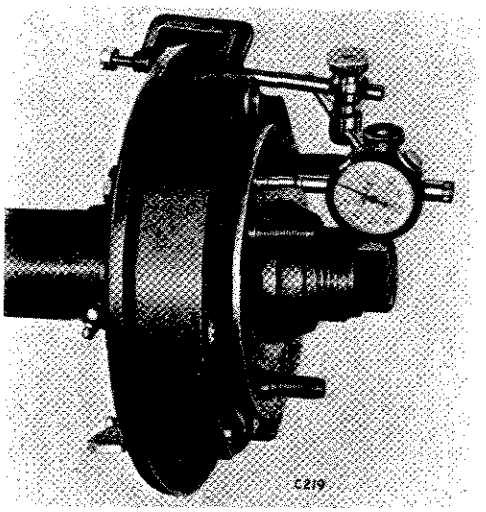


Fig. 11. Measuring axle shaft end float

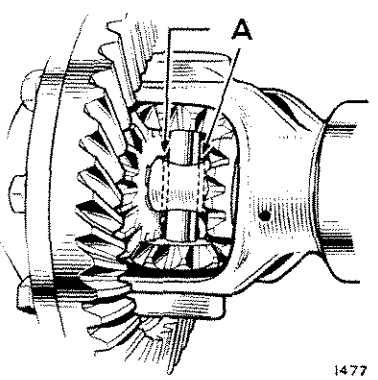


Fig. 12. Showing position of differential cross-pin in relation to the thrust block Clearances A should be equal

REAR AXLE DETAILS

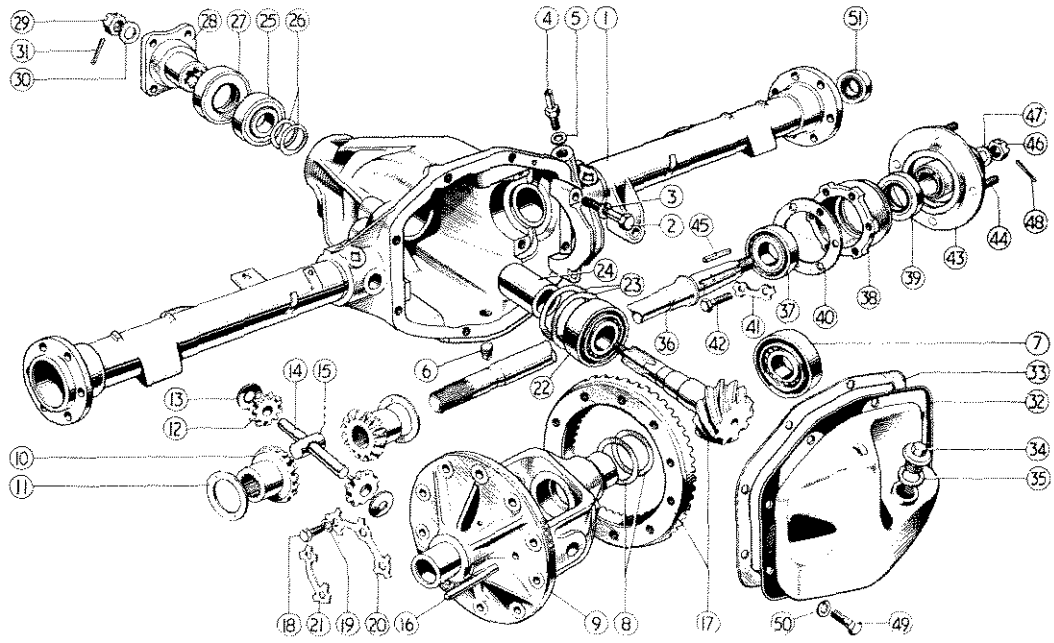


Fig. 13. Rear axle details

Key to Fig. 13

1	Axle casing assembly	18	Crown wheel securing bolt	*35	Fibre washer
2	Bearing cap setscrew	19	Spring washer for (18)	36	Axle shaft
3	Spring washer	*20	Three hole lockplate	37	Hub bearing
4	Axle case breather	*21	Two hole lockplate	38	Hub bearing housing
5	Fibre washer	22	Pinion head bearing	39	Oil seal for hub bearing housing
6	Drain plug	23	Adjusting shims for (22)	40	Adjusting shims for hub bearing
7	Differential bearing	24	Bearing spacer	41	Lockplate
8	Adjusting shims for (7)	25	Pinion tail bearing	42	Setscrew for securing housing
9	Differential carrier	26	Adjusting shims for (25)	43	Hub
10	Differential sun gear	27	Pinion shaft oil seal	44	Road wheel attachment stud
11	Thrust washer for (10)	28	Pinion driving flange	45	Hub driving key
12	Differential planet gear	29	Driving flange securing nut	46	Hub securing nut
13	Thrust washer for (12)	30	Plain washer for (29)	47	Plain washer for (46)
14	Cross pin	31	Split pin for (29)	48	Split pin for (46)
15	Thrust block	32	Rear cover	49	Cover plate securing setscrew
16	Lock pin for securing (14)	33	Joint washer for (32)	50	Spring washer for (49)
17	Crown wheel and pinion	34	Oil filler plug	51	Axle tube oil seal

*Now Deleted

Differential Unit—To Remove (Fig. 13)

Remove the axle shafts as described on page 3·106.

Remove setscrews (49), lockwashers (50), cover plate (32) and joint (33). Unscrew the four securing bolts (2) and remove the bearing caps.

Assemble the axle spreading tool as shown on Fig. 14. Turn the double ended tensioner screw until it is hand tight, then a further half turn with a spanner.

IMPORTANT: OVER-SPREAD WILL DAMAGE THE AXLE CASING.

Lift the differential unit from the casing.

If the bearings are likely to be re-used, tie the bearing outer rings to their respective inner races.

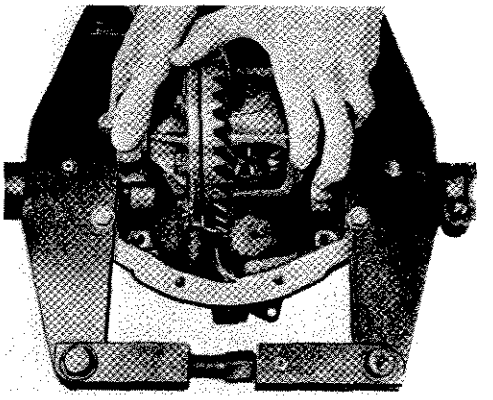


Fig. 14. Using axle spreading tool, No. S.101, to remove differential unit

Differential Unit—To Dismantle

Remove the fixing bolts (18) and detach the crown wheel (17) from the carrier (9).

Drive out the lock pin (16), withdraw the pinion cross shaft (14) and remove the thrust block (15).

Rotate the sun wheels and remove the gears (12), (10) and the thrust washers (13), (11).

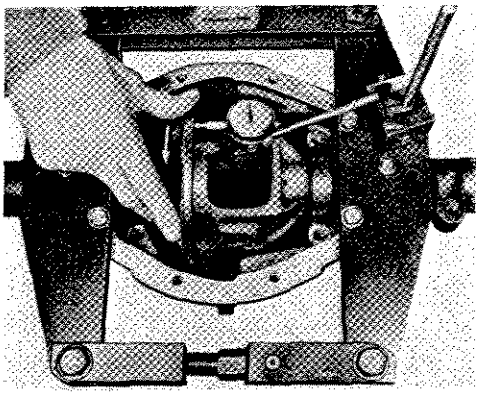


Fig. 15. Checking the differential carrier for run-out

Preliminary Check for Run-out of the Differential Carrier

Before removing the bearings (7) from the carrier (9) check the crown wheel mounting face of the carrier for run-out as follows :—

Re-install the carrier into the centre casing.

Mount a dial indicator gauge on the casing as shown in Fig. 15 and rotate the carrier.

Maximum amount of run-out should not exceed 0·003″ (0·08 mm.).

Readings in excess of this figure indicate defective bearings, or carrier.

Remove the differential carrier from the casing and extract the bearings (7) and shims (8).

Remove the spreading tool from the rear axle case.

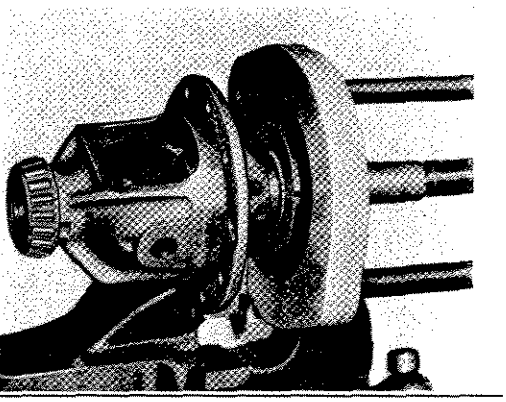


Fig. 16. Using Tool No. S.103 and Press No. S.4221A to remove differential bearings

Removing Pinion and Bearings

Remove split pin (31), slotted nut (29), washer (30) and withdraw the flange (28).

Using a soft drift, drive the pinion (17) from the casing.

Remove the shims (26), spacer (24) and extract the pinion head bearing (22) as shown in Fig. 17.

Drive out the tail bearings (25) and seal (27) ; the pinion head bearing outer ring and shims (23).

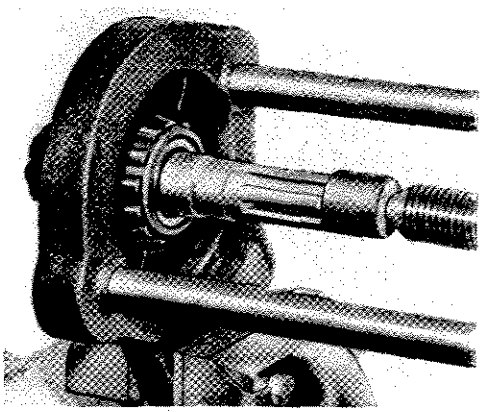


Fig. 17. Using Tool No. TS.1 and Press No. S.4221A to remove pinion head bearing

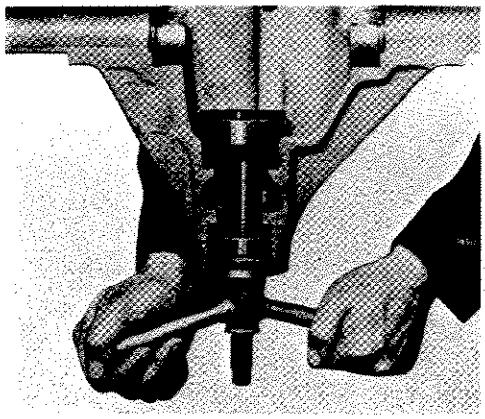


Fig. 18. Using Tool No. M.70 to install the pinion head and tail bearing outer rings

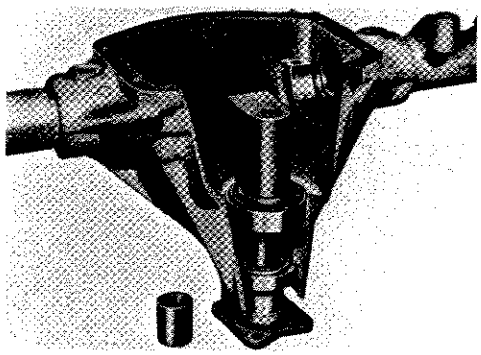


Fig. 19. Showing the dummy pinion installed

Setting gauge, Tool No. M.84

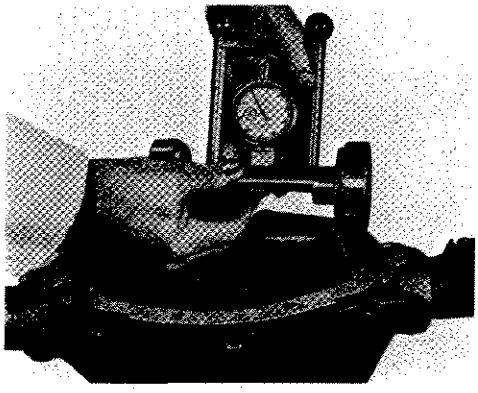


Fig. 20. Using a special ground button to zero the gauge

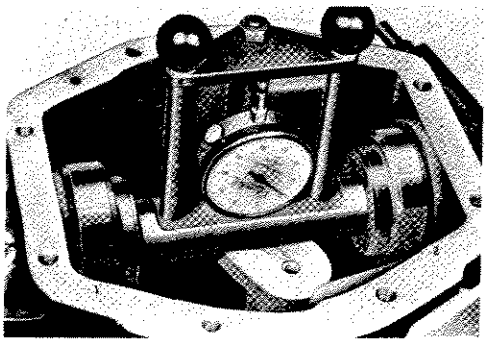


Fig. 21. Using setting gauge to calculate thickness of shims required under pinion head bearing outer ring

AXLE RE-ASSEMBLY

Before re-assembling the axle components, check the bearing housing for burrs or other damage caused by driving the bearing rings from the casing. Incorrectly seated bearings will prevent accurate measurement of shim requirements and may result in premature loss of pre-load, rapid wear and pinion failure.

Carefully examine all components for serviceability. If the crown wheel or pinion is worn or damaged, discard both items and fit a new matched pair. These gears are machined together and etched with identical markings to identify them as a pair ; therefore, before fitting, ensure that each is identically marked.

Keep the component parts of each bearing together, and when renewal becomes necessary replace the complete bearing assembly.

Pinion Assembly

Using Tool No. M.70, pull the outer rings of bearings (25) and (22) into position as shown in Fig. 18. Shims are not fitted at this stage.

Fit the pinion head bearing (22) on the dummy pinion (Tool No. M.84) and assemble to casing. Fit the tail bearing (25), driving flange (28), washer (30) and nut (29), Fig. 19. Tighten the flange nut to give a pre-load of 15 to 18 lb. ins. (Fig. 25).

The bearing spacer and oil seal are not fitted at this stage.

Zero the pinion setting gauge and determine the required shim thickness as follows:

Using the ground button, depress the dial gauge plunger to its maximum and zero the gauge as shown in Fig. 20.

Place the gauge in the axle casing with the plunger contacting the dummy pinion (Fig. 21).

Exerting downward pressure on the gauge, centralize it by slightly rocking to show maximum reading. This indicates the thickness of shims required under the pinion head bearing outer ring.

Remove the gauge, dummy pinion and the bearing outer rings.

Place a shim pack of the required thickness on the pinion head bearing abutment face (Fig. 23) and fit both bearing outer rings, as shown on Fig. 18.

Assemble the bearing (22), spacer (24) and shims (26) to the pinion shaft.

NOTE : The thickness of shim pack (26) may require re-adjustment to give correct pre-loading.

Drive the bearing (25) onto the pinion shaft. Fit the driving flange (28), washer (30) and nut (29) which should be securely tightened.

Pinion Pre-load

Attach a pre-load gauge on the driving flange as shown on Fig. 25. Slowly move the weight along the graduated scale and note the point at which it falls. This should be 15 to 18 lbs. ins.

Higher readings indicate the need for a thicker shim pack between the tail bearing and spacer, lower readings require a thinner shim pack.

When the pre-load is correct, remove the driving flange and fit the oil seal. Replace the flange, plain washer and nut, tighten the nut to the specified torque and secure with a split pin.

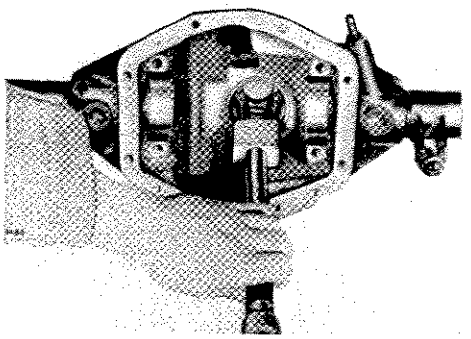


Fig. 22. Using Tool No. S.123A to remove pinion bearing outer rings

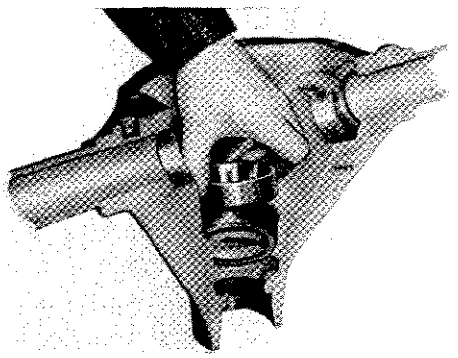


Fig. 23. Placing a shim pack under the pinion head bearing outer ring

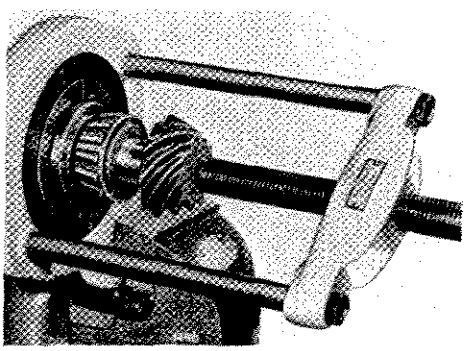


Fig. 24. Using Tool No. S.103 and Press S.4221A to fit pinion head bearing

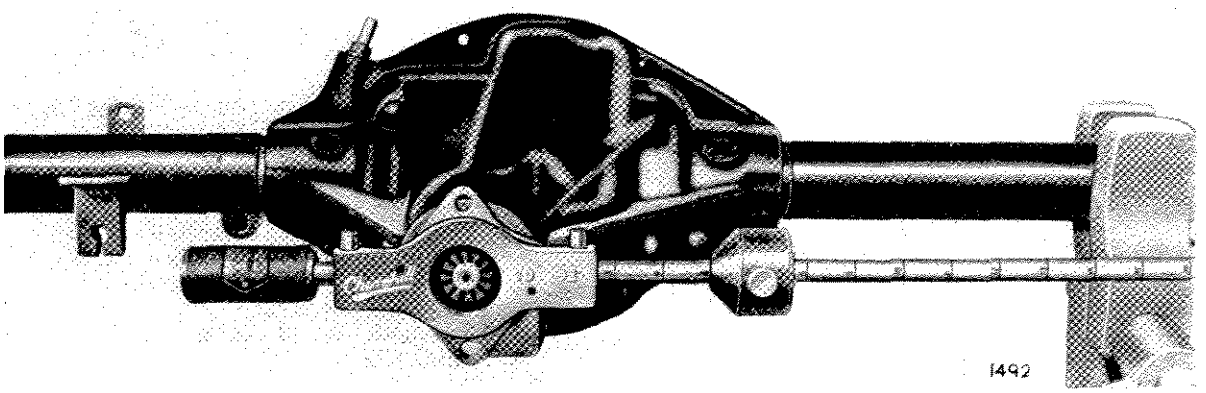


Fig. 25. Pre-load gauge 20.SM.98

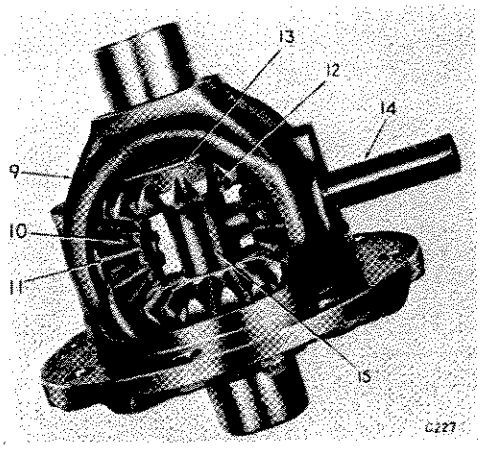


Fig. 26. Fitting differential gears and thrust washers

Differential Gears (Fig. 26)

Assemble the thrust washer (13) to the sun gears (12) and insert them into the differential carrier (9).

Using grease to retain them, attach the planet thrust washers (11) on the thrust faces of the gears (10) and insert them through the side aperture in the differential carrier to mesh with the sun gears already positioned.

Align the gears with the holes in the casing ; insert the cross pin (14) and simultaneously feed the axle shaft thrust block (15) into position.

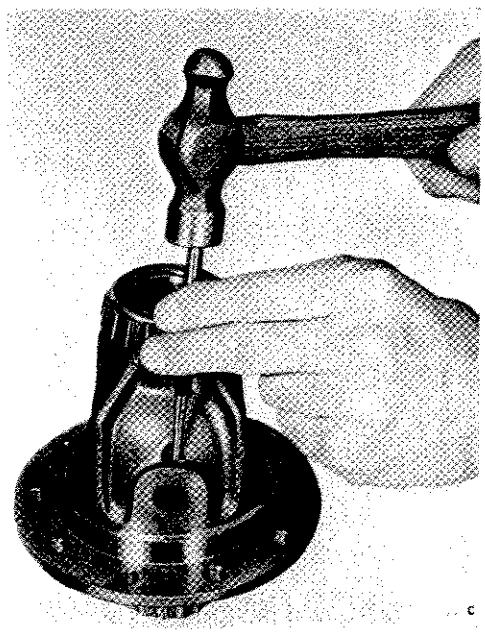


Fig. 27. Fitting locking pin to differential cross-shaft

Align the locating hole in the cross pin and insert the lock pin (16). (Fig. 13).

Using a punch, peen the metal of the differential carrier over the end of the lock pin to prevent its working loose. (Fig. 27).

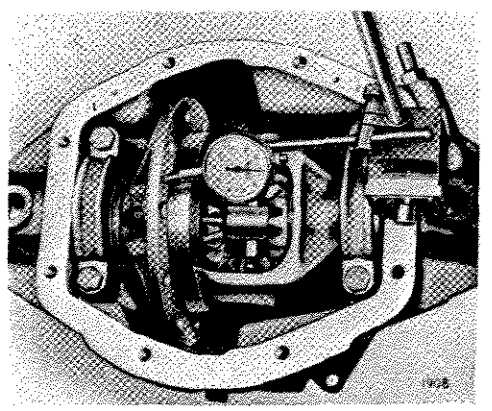


Fig. 28. Using a dial gauge to measure total float

Differential—Measuring Total Float

Fit the differential bearings (7) without shims at this stage.

Pressing both outer rings towards the bearing, place the carrier into the casing.

Mount a dial gauge on the casing as shown in Fig. 28. Move the carrier AWAY from the gauge and zero the dial.

Move the carrier TOWARDS the gauge and note the dial reading. This indicates total side float and is referred to as dimension "A" (see Fig. 31) at a later stage.

Remove the differential carrier from the centre casing.

Crown Wheel—Measuring "In and Out" of Mesh

Clean, examine and remove any burrs from the gear mounting face of the carrier and the crown wheel.

Fit the crown wheel (17) to the carrier (9), and insert the bolts (18) with new spring washers (19). Tighten the bolts uniformly to the specified torque.

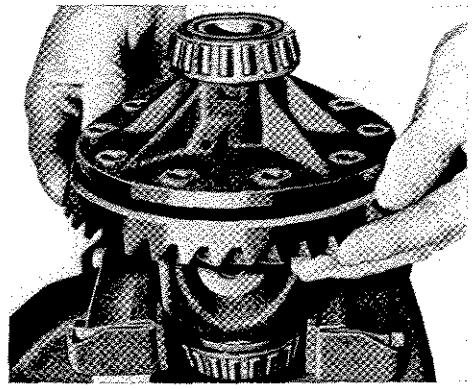


Fig. 29. Fitting the crown wheel to the differential carrier

Refit the differential unit in the axle casing and position the dial gauge as shown in Fig. 30.

Move the differential unit away from the gauge, to the "Full Mesh" position, and zero the dial.

Note the dial reading when the differential unit is moved towards the indicator gauge. This is the "in and out" of mesh dimension used in the following calculations and referred to as dimension "B" (see Fig. 31).

Lift the differential unit from the axle casing and remove the bearings (7), Fig. 16, taking care not to mix them.

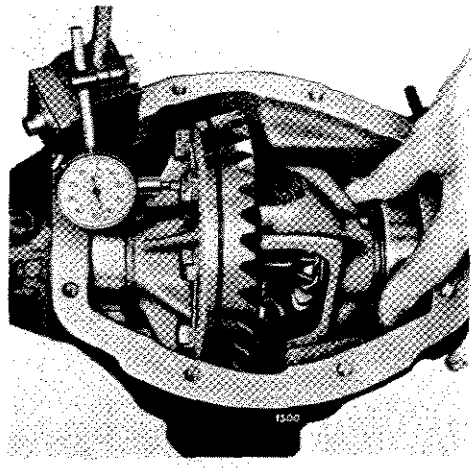


Fig. 30. Using a dial gauge to measure "in and out" of mesh

Differential Bearing Pre-load

To ensure that the differential bearings are correctly pre-loaded, the shim packs interposed between the carrier and each bearing must be of a precise thickness.

By substituting correct measurements in place of those used in the examples, the thickness of both shim packs may be calculated as follows :

Example

Total float "A" - - -	0·060″
Plus 0·003″ pre-load - - -	0·003″
Total thickness of shims required -	0·063″
Shim thickness at "Y"	
In/Out of mesh clearance "B" -	0·025″
Subtract specified backlash 0·004″/ 0·006″ - - - - -	0·005″
Shim pack thickness required at "Y"	0·020″
Shim thickness at "X"	
Total shim thickness - - -	0·063″
Minus shim pack thickness at "Y" -	0·020″
Shim pack thickness required at "X"	0·043″

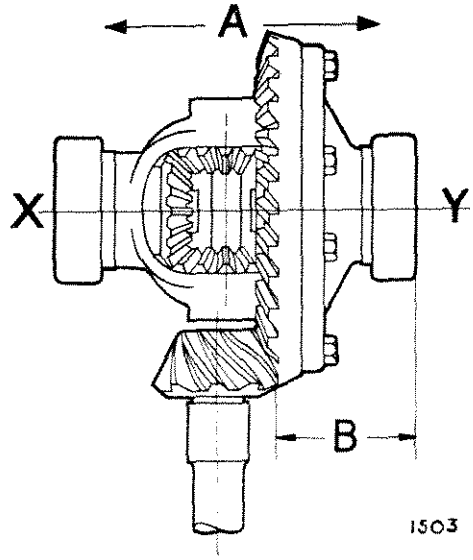


Fig. 31. Diagram for calculating shim thickness.

A. Total float

B. In and out of mesh

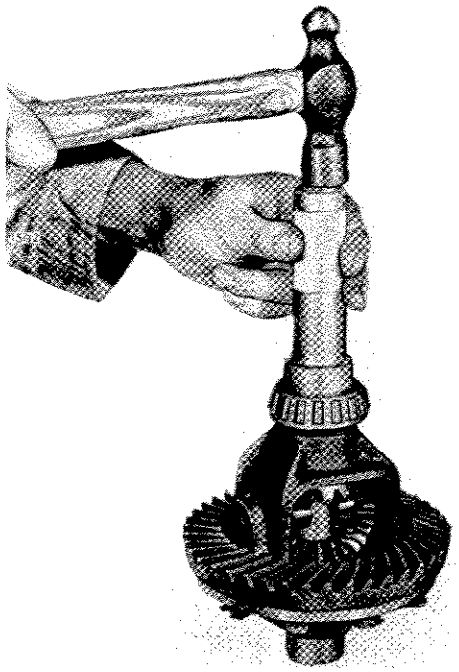


Fig. 32. Using adaptor No. S.100 with Handle No. 550 to refit differential bearings

Crown Wheel Backlash

Using the axle spreading tool and observing the same precautions in respect of overspreading, re-insert the differential unit into the casing. Remove the axle spreader, assemble the caps and tighten the securing bolts (2) to the specified torque.

Check the crown wheel backlash by mounting the dial gauge and moving the crown wheel in alternative directions as shown on Fig. 33. Measure the backlash at several positions each of which should be within the limits of 0·004″ - 0·006″ (0·1 - 0·15 mm.).

Should the backlash be excessive, reduce the thickness of the shim pack at "X", Fig. 31, and add an equal amount to "Y". If the backlash is insufficient, reverse the procedure.

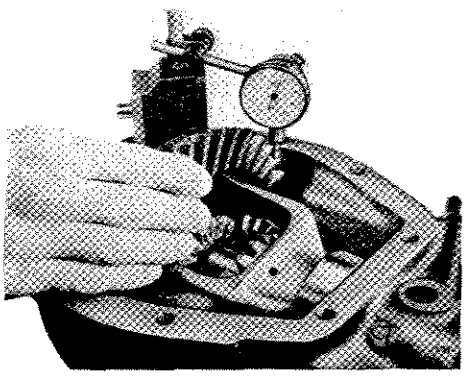


Fig. 33. Measuring crown-wheel backlash

Tooth Markings

After setting the backlash to the required figure, use a small brush to lightly smear eight or ten of the crown wheel teeth with engineer's blue. Move the painted gear in mesh with the pinion to obtain a good tooth impression.

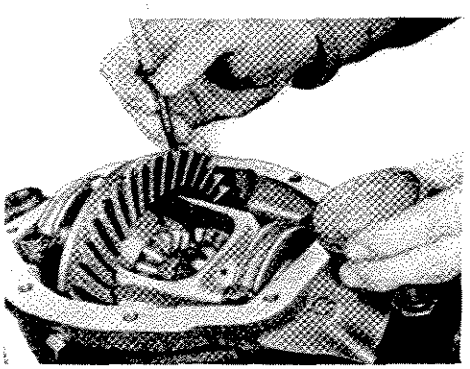


Fig. 34. Painting crown-wheel teeth to check pinion marking

(a) **Correct Markings** (Fig. 35)

When the gear meshing is correctly adjusted, the markings obtained should closely approximate those shown in Fig. 35a, this being the ideal contact.

The area of contact is evenly distributed over the working depth of the tooth profile and is located slightly nearer to the TOE than the heel.

(b) **High Contact**
The markings shown at (35b) are those produced by high contact, i.e., when the tooth contact is heavy on the crown wheel face or addendum and caused by the pinion being too far out of mesh. To rectify, move the pinion deeper into mesh by adding shims under the pinion head bearing outer ring. To maintain the existing pinion bearing preload, an equal amount of shims must also be added between the tail bearing inner cone and the bearing distance piece.

(c) **Low Contact**
Fig. 35 (c) shows heavy markings on the crown wheel flank or dedendum, this being the opposite to that shown in (b). Rectification of this condition necessitates moving the pinion out of mesh by removing an equal amount of shims from the positions described in (b).

NOTE :-When correcting for (b), the new position will tend to move the tooth contact towards the toe on drive and the heel on coast, whilst correcting for (c) will tend to move the tooth contact towards the heel on drive and the toe on coast. In either case it may be necessary, after correcting the pinion mesh, to re-adjust the crown wheel as described in (d) and (e).

(d) **Toe Contact**
The markings shown in Fig. 35 (d) result when the tooth contact is concentrated at the small end of the tooth. To rectify this condition, move the crown wheel out of mesh, i.e., increase backlash by transferring shims from the crown wheel side of the differential to the opposite side.

(e) **Heel Contact**
Fig. 35 (e) shows the markings obtained when the tooth contact is concentrated at the large end of the tooth. This condition is rectified by reducing backlash, i.e., by transferring shims in the opposite direction as for (d).

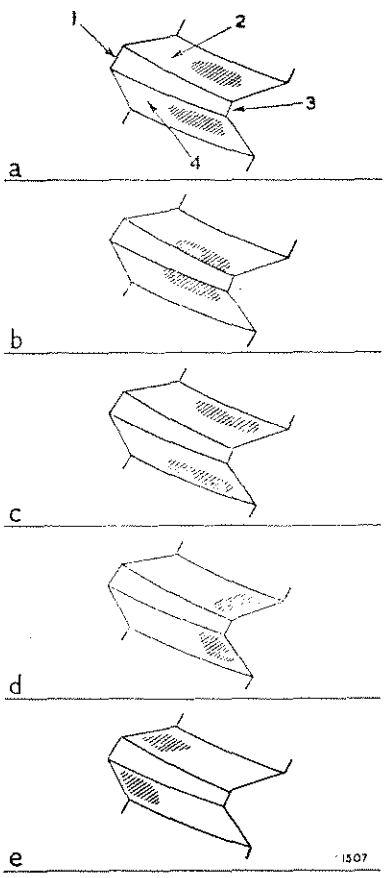
IMPORTANT :-Whatever corrections are necessary, it is most important that the backlash at all times is within the specified limits.

(i) **Backlash** When adjusting for backlash, always move the crown wheel as this member has more direct influence on backlash.

(ii) **Crown Wheel Movement** Moving the gear out of mesh has the effect of moving the tooth contact towards the heel and raising it slightly towards the top of the tooth.

(iii) **Pinion Movement** Moving the pinion out of mesh raises the tooth contact on the face of the tooth and slightly towards the heel on drive, and towards the toe on coast.

ADDENDUM - upper part of tooth profile
DEDENDUM - lower part of tooth profile



1 Heel (outer end)
2 Coast side (concave)
3 Toe (inner end)
4 Drive side (convex)

Fig 35. Typical gear tooth markings

REAR AXLE DIMENSIONS

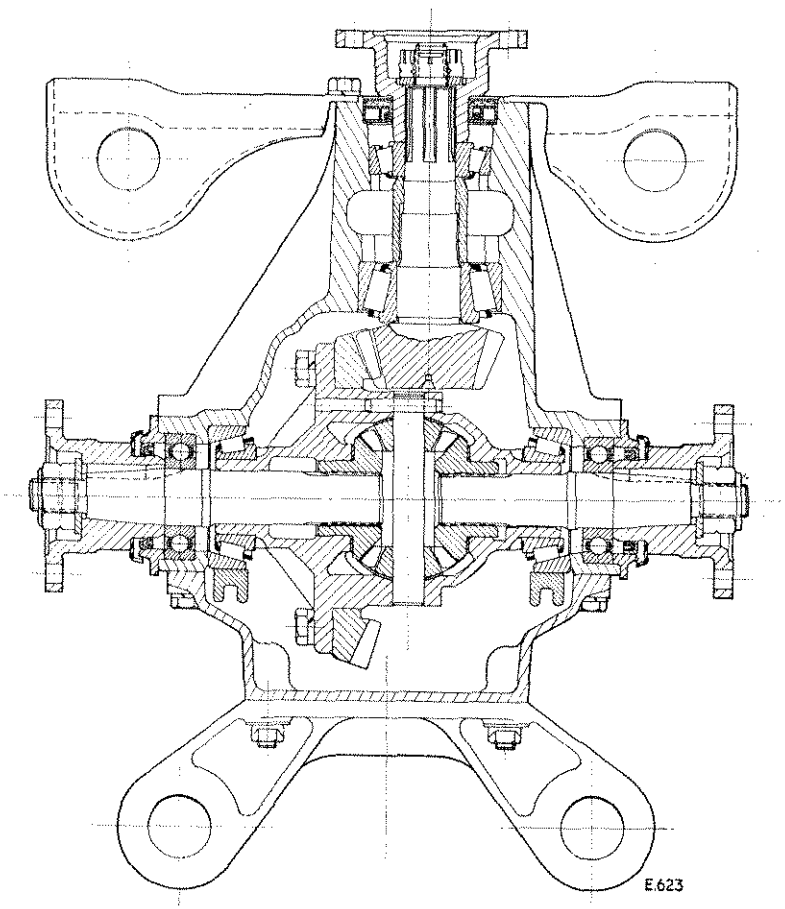


Fig. 36. Rear axle arrangement.

REAR AXLE (TR.4A)

REAR AXLE — DIMENSIONS AND TOLERANCES

PARTS AND DESCRIPTION	DIMENSIONS WHEN NEW		REMARKS
	ins.	mm.	
Axle ratio	4·1 : 1 or 3·7 : 1		
Crown Wheel			
Number of teeth	41		37 for 3·7 : 1 ratio
Location diameter	4·376/4·375	111·15/111·13	Clearance 0·001″—0·003″ (0·025—0·076 mm.)
Maximum permissible run-out	·003	·07	When mounted on differential cage
Fixing bolts	10		
Thread dimensions	⅜ U.N.F. 2A ·41 deep		
Pinion			
Number of teeth	10		
Journal diameter for:			
Pinion head bearing	1·2511/1·2506	31·78/31·77	Bearings press fit. Interference
Pinion tail bearing	1·0009/1·0004	25·42/25·41	0·0001″—0·0011″ (·002—·03 mm.)
Spline diameter — major	0·9916/0·9912	25·19/25·18	Clearance in driving sleeve
— root	0·8475/0·8460	21·53/21·49	Slide fit in driving sleeve
Key width	0·2485/0·2475	6·31/6·29	Slide fit in driving sleeve
Number of keys	6		
Thread dimensions	⅜ UNF. 2A		
Axle Casing			
Internal diameter for:			
Pinion head bearing outer race	2·8588/2·8578	72·61/72·59	Bearings press fit. Interference 0·0005″—0·0021″(0·013—0·053 mm.)
Pinion tail bearing outer race	2·4405/2·4395	61·99/61·96	Bearings press fit. Interference 0·0005″—0·0019″(0·013—0·048 mm.)
Pinion oil seal	2·687/2·686	68·25/68·22	
Differential trunnion bearing outer race	2·8455/2·8445	72·28/72·25	With bearing caps tightened bearings transition fit. 0·0015″ clearance to 0·0001″ interference
Inner axle shaft journal bearing	2·5003/2·4993	63·51/63·48	Bearing transition fit 0·0002″ clearance to 0·0013″ interference.
External diameter of spigot for mounting bracket	2·938/2·936	74·62/74·57	
Width between differential bearing abutments	7·263/7·255	184·48/184·28	
Diameter of rear cover dowel holes	0·3135/0·3131	7·96/7·95	
Level plug thread dimensions	⅜″ × 18 t.p.i. N.P.T.		
Pinion Setting Dimensions			
Offset of pinion below crown wheel centre line	1·001/0·999	25·43/25·37	Determined by axle casing
Centre line of pinion to crown wheel mounting face of differential cage	1·878/1·872	47·70/47·55	These dimensions are theoretical and may vary in practice when meshing is adjusted to correct backlash and tooth marking
Pinion head bearing abutment face to crown wheel centre line	3·4375	87·31	
Backlash	0·006/0·004	0·15/0·10	

REAR AXLE — DIMENSIONS AND TOLERANCES — continued

PARTS AND DESCRIPTION	DIMENSIONS WHEN NEW		REMARKS
	ins.	mm.	
Differential Unit			
Differential Sun Gears			Gears and shafts to be selected to give a push fit on the splines
Number of teeth	16		
Journal diameter	1·4993/1·4985	38·08/38·06	Clearance in cage 0·002″—0·004″ (0·05—0·10 mm.)
Number of splines	24		
Internal diameter	0·979/0·975	24·87/24·77	
Thrust washer thickness	0·0495/0·0465	1·26/1·18	
Planet Gears			
Number of gears	2		
Number of teeth	10		
Internal diameter	0·6265/0·6250	15·91/15·88	Clearance on cross shaft 0·0028″—0·0008″ (0·07—0·02 mm.)
Thrust washer thickness	0·0495/0·0465	1·26/1·18	Varying thicknesses available to reduce backlash
Cross Shaft			
Diameter	0·6242/0·6237	15·85/15·84	See Differential Cage
Length	4·20/4·18	106·68/106·17	
Differential Cage			
Location diameter for crown wheel	4·374/4·373	111·10/111·07	
Diameter of trunnions	1·5018/1·5012	38·15/38·13	Bearings press fit. Interference 0·0006″/0·0018″ (0·015—0·046 mm.)
Internal diameter for sun gears	1·5025/1·5013	38·16/38·13	Clearance on gears 0·002″—0·004″ (0·05—0·10 mm.)
Width between trunnion bearing abutments	5·317/5·312	135·05/134·92	
Bearing abutment to crown wheel mounting face	1·568/1·562	39·83/39·67	
Width between sun wheel thrust faces	2·366/2·362	60·10/60·00	
Diameter of cross shaft bores	0·6257/0·6245	15·89/15·86	Clearance on shaft 0·0003″—0·002″ (0·007—0·05 mm.)
Differential bearing pre-load	0·004/0·002	0·10/0·05	Measured over both bearings
Inner Axle Shafts			
Overall length, left-hand	7·06	179·32	
Overall length, right-hand	6·19	157·23	
Top diameter of splines	1·0417/1·0377	26·46/26·36	Involute form keys Flank fitting; push fit
Number of splines	24		
Keyway width	0·250/0·249	6·35/6·32	
Shaft diameter for journal bearing	1·1258/1·1254	28·60/28·59	Shaft press fit in bearing Interference 0·0002″ to 0·0011″ (0·005 to 0·028 mm.)
Thread dimensions	$\frac{5}{8}$ UNF. 2A		

REAR AXLE COMPONENTS

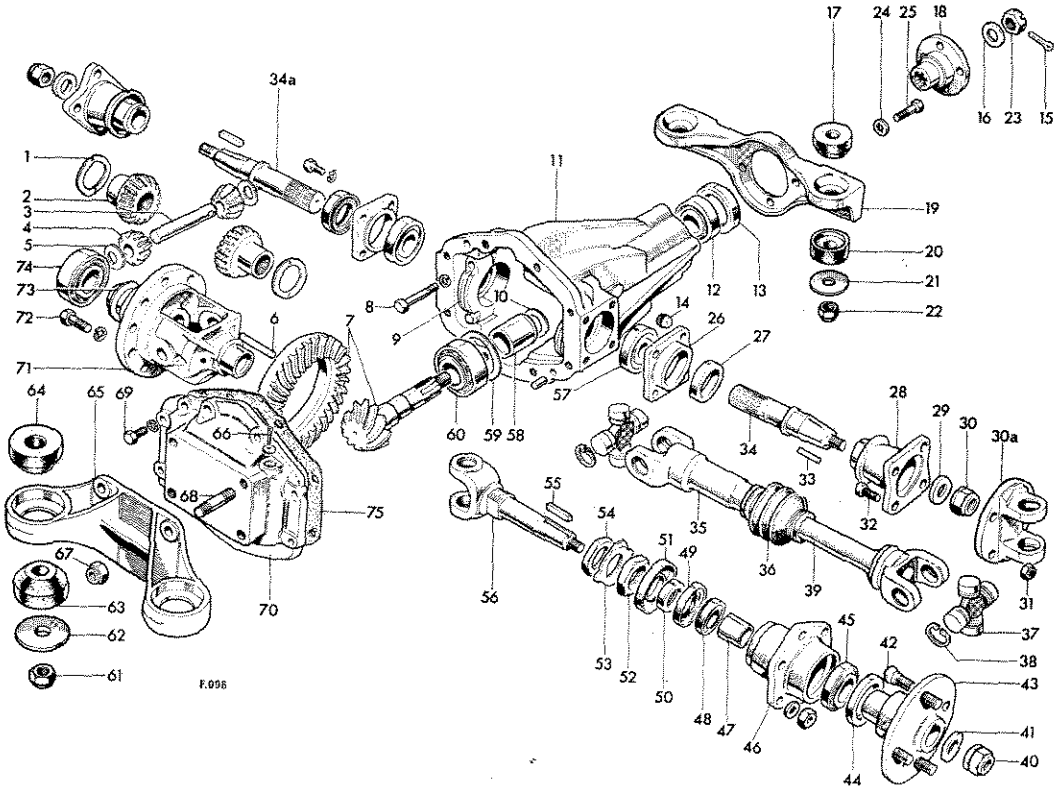


Fig. 37. Rear Axle — exploded arrangement.

Key to Fig. 37

REAR AXLE COMPONENTS

1. Thrust washer — sun wheel
2. Sun wheel
3. Cross shaft
4. Planet wheel
5. Thrust washer — planet wheel
6. Locking pin — cross shaft
7. Crown wheel and pinion
8. Bolt, bearing cap
9. Bearing cap
10. Shim, pinion pre-loading
11. Axle casing
12. Tail bearing, pinion
13. Oil seal, pinion
14. Filler plug — oil level
15. Split pin
16. Washer
17. Rubber buffer, upper
18. Companion flange
19. Mounting, front
20. Rubber buffer, lower
21. Backing plate
22. Nyloc nut
23. Castellated nut
24. Lockwasher
25. Bolt
26. Bearing retainer
27. Oil seal
28. Flange
29. Washer
30. Nut
30a. Yoke
31. Nut, nyloc
32. Bolt
33. Key
34. Axle shaft, inner, short
34a. Axle shaft, inner, long
35. Axle shaft, fixed, outer
36. Gaiter
37. Universal spider
38. Circlip
39. Axle shaft, sliding, outer
40. Nut
41. Washer
42. Wheel stud
43. Hub
44. Oil seal
45. Hub bearing, outer
46. Bearing housing
47. Bearing spacer, collapsible
48. Hub bearing, inner
49. Oil seal
50. Bearing spacer
51. Stone guard
52. Adjusting nut
53. Tab washer
54. Locknut
55. Key
56. Stub shaft
57. Bearing, inner axle shaft
58. Spacer, pinion bearing
59. Shim, pinion locating
60. Head bearing, pinion
61. Nut, nyloc
62. Backing plate
63. Buffer, lower
64. Buffer, upper
65. Mounting, rear
66. Split pin — breather
67. Nut, nyloc
68. Stud
69. Bolt
70. Rear cover
71. Differential cage
72. Bolt
73. Shim, crown wheel pre-load
74. Bearing, differential cage
75. Gasket, rear cover

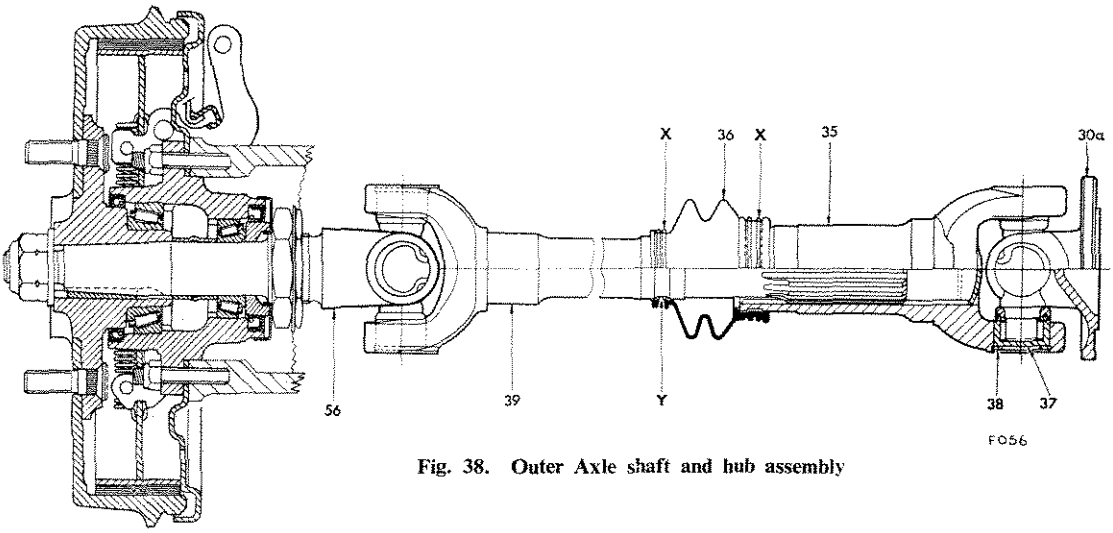


Fig. 38. Outer Axle shaft and hub assembly

TELESCOPIC SHAFTS, WHEEL BEARINGS, SEALS AND DRIVING FLANGES

(Fig. 38)

Removal

These items are removed as a complete assembly. Proceed as follows:-

Chock the front wheels, slacken the rear wheel nuts and release the handbrake. With a trolley jack placed under the differential casing, raise the rear of the car onto stands positioned beneath the chassis frame. Remove the road wheels, the countersunk screws and the brake drums.

With a socket spanner passed through the holes in the driving flange, remove the six nuts securing the hub assembly to the suspension arm (Fig. 39).

Remove the four nuts and bolts from the inboard universal coupling on the axle shaft, wire the sliding portions of the axle shaft together as shown in Fig. 40, and withdraw the axle shaft through the boss in the trailing arm.

The rear brake assembly need not be disturbed, but if it is necessary to remove it for other reasons, it may be withdrawn at this stage after draining the hydraulic system and disconnecting the brake pipe and handbrake cable from the brake backplate.

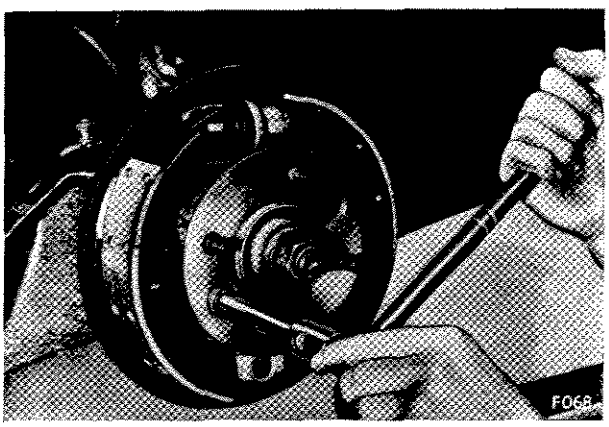


Fig. 39. Removing bearing housing retaining nuts

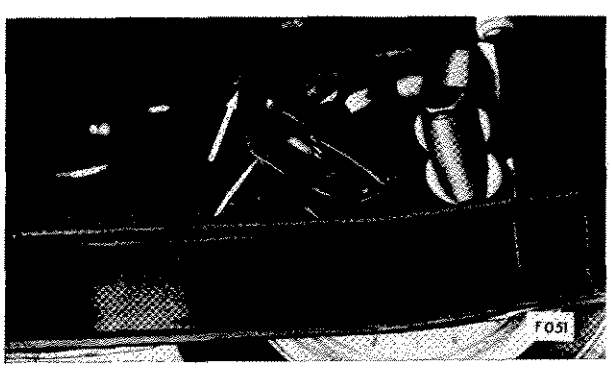


Fig. 40. Axle shaft companion flange bolt

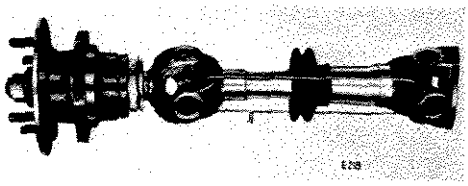


Fig. 41. Axle shaft and hub assembly

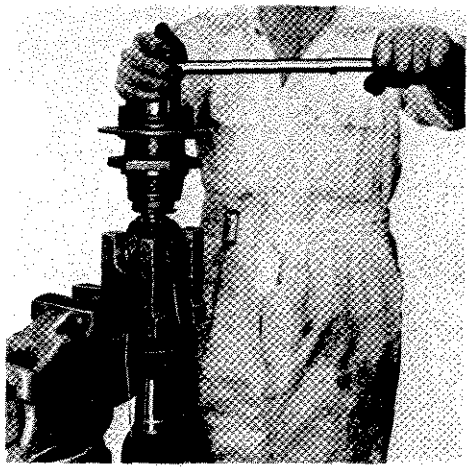


Fig. 42. Removing the hub retaining nut

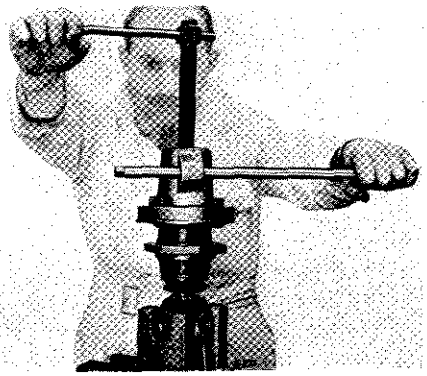


Fig. 43. Extracting a rear hub

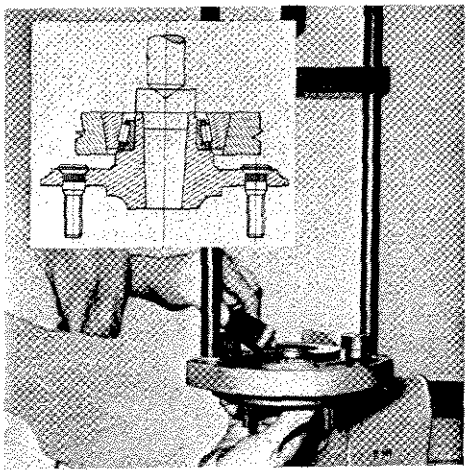


Fig. 44. Extracting an outer hub bearing cone

To Dismantle (Fig. 37)

Mount the axle shaft in the holding fixture as shown on Fig. 42 and remove the nut (40), the washer (41) and extract the hub (43), see Fig. 43. The rear hub bearing housing assembly will be removed with the hub. Remove the key (55) and discard the collapsible spacer (47); remove the inner hub bearing cone (48), the bearing spacer (50) and the stone guard (51).

Release the tabs on the tabwasher (53) and wind the adjusting nut (52) and the locknut (54) one complete turn towards the universal joint.

With the bearing housing (46) supported under its mounting face, drive out the inner hub bearing outer race. The inner oil seal (49) will simultaneously be removed.

Lever out the outer oil seal (44) and drive out the outer hub bearing, outer race (45). Using Tool No. S4221A-16, extract the outer hub bearing cone (45) from the hub.

Inspection

Wash all dismantled components in clean paraffin and dry with an air jet. Examine the rollers and roller tracks of the bearings for wear, pitting or fractures.

Examine the key, keyways, and tapers in the stubshaft (56) and hub (43) for wear or damage. Examine the stubshaft for cracks and scores at the inner hub bearing seat and the surface of the bearing spacer (50) outer diameter (oil seal track).

To Re-assemble

Press the outer hub bearing cone (45) up to the shoulder on the hub (43). Press the outer and inner hub bearing outer races up to the shoulders in the bearing housing (46), followed by the inner and outer oil seals (49) and (44).

Feed the stoneguard (51), bearing spacer (50), the inner cone of the inner hub bearing and a new collapsible spacer (47) onto the stubshaft and fit the key (56) into the keyway in the stubshaft, with its inner end in line with the two indentations on the shoulders of the key way.

Pack the spaces between the bearing rollers and the recess in the bearing housing with grease.

Pass the bearing housing assembly over the stubshaft so that the inner hub bearing outer race engages with its mating cone. Avoid damage to the lip of the inner oil seal.

Feed the hub onto the stubshaft, folloewd by the washer (41) and the nut (40). Tighten the nut to the correct torque.

Bearing End Float — to Adjust

Wind the nut (52) up against the stoneguard (51) until it is finger tight.

Mount a dial indicator on the hub flange with the indicator stylus contacting the bearing housing flange (Fig. 46).

Pull the bearing housing as far as possible AWAY from the indicator, using a rocking motion to ensure proper contact between the bearing components. Zero the indicator dial.

Push the bearing housing as far as possible TOWARDS the indicator, again rocking the housing. Note the reading on the indicator. Tighten the nut (52) one flat at a time whilst an assistant checks the end float as described previously. When the total float is between 0·004″ and 0·002″ (0·10 and 0·05 mm.) secure the assembly with the locknut (54) and tabwasher (53).

NOTE: If the end float has been reduced below 0·002″ (0·05 mm.), the collapsible spacer must be replaced. Merely slackening back the nut (52) is NOT satisfactory.

To Refit

Reverse the removal instructions. If grease has leaked into the rear brake assembly, remove the brake shoes, wash off the backplate assembly and brake drum in clean petrol and dry with an air jet. If the brake linings have become contaminated with grease, the shoes must be replaced.

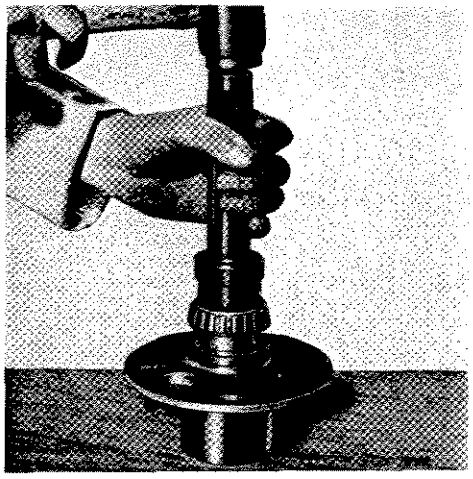


Fig. 45. Fitting the outer hub bearing cone

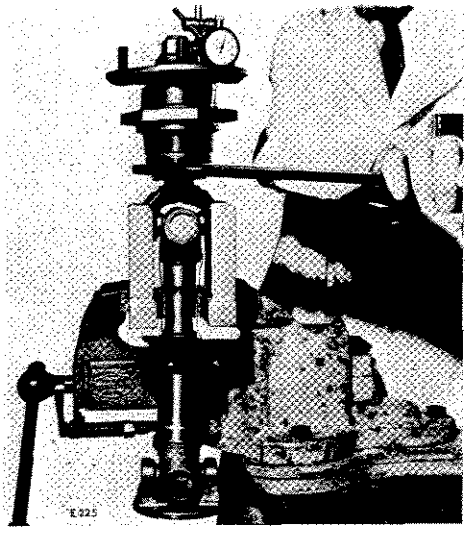


Fig. 46. Adjusting the bearing end float

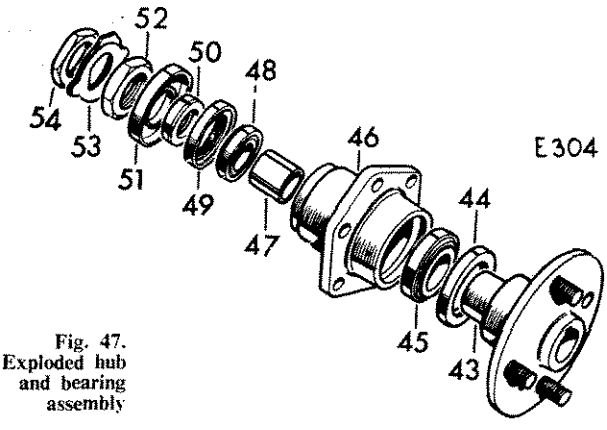


Fig. 47. Exploded hub and bearing assembly

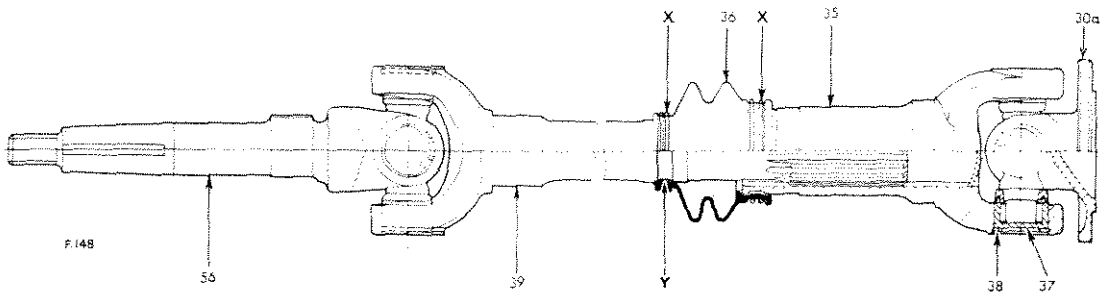


Fig. 48. Outer Axle shaft assembly

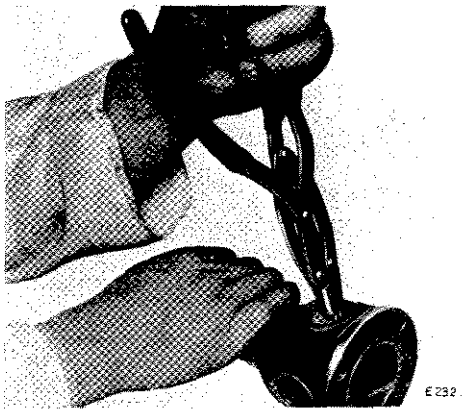


Fig. 49. Removing a circlip

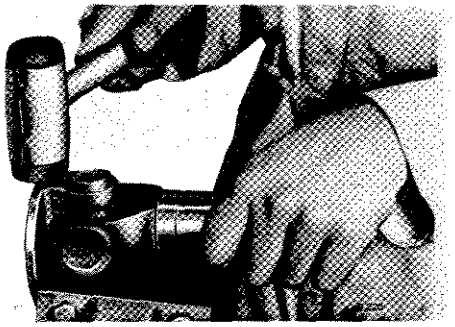


Fig. 50. Removing a bearing cup from the flange

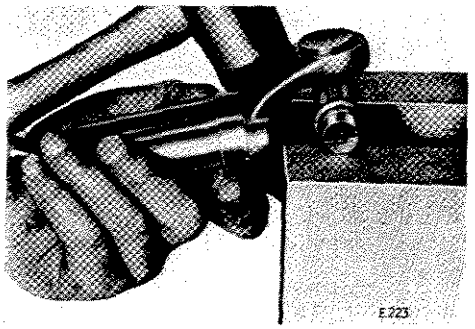


Fig. 51. Removing a bearing cup from the shaft

Outer Axle Shafts (Fig. 48)

To Dismantle

Remove the axle shaft from the vehicle (see page 3·119) and remove the hub and bearing housing. Release the gaiter clip X from the fixed shaft (35) and disengage the gaiter (36). Discard the sealer strip (Y). Withdraw the sliding shaft (39) from the fixed shaft and remove the clip, gaiter and sealer strip from the sliding shaft.

Remove the circlips (38), support the forked end of the shaft (35) as shown, and by striking the flange (30a) with a mallet, drive out the needle bearing cap until it is sufficiently exposed to be removed with a pair of grips. Reverse the shaft and extract the opposite cup in a similar manner. Remove the seals (Fig. 52).

Support the two exposed trunnions of the spider (37) on wooden blocks (Fig. 51) and, by striking the radiused portion of the forked end of the shaft, drive out the needle bearing cup until it is sufficiently exposed to be removed. Repeat the operations to remove the remaining cup. Remove the spider from the forked end of the shaft.

Employ the same method for removing the stubshaft (56) from the sliding shaft (39).

Inspection

Examine the trunnions of the universal joint spiders and the needles and needle tracks in the cups. Examine the grease seals and the circlips and grooves.

Wash the sliding splines of the shafts (35) and (39) in paraffin and dry them with an air jet. Check the splines for wear or damage.

To Re-assemble (Fig. 48)

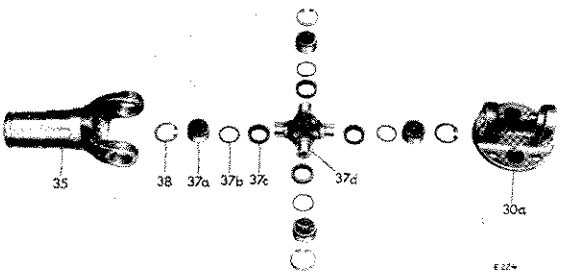
Pass two trunnions of the spider through the bearing bores in the forked end of the shaft (35); With the exposed trunnions supported as shown in Fig. 51, fit the grease seals and needle bearing assembly into the uppermost bearing bore; fit the circlip (38). Reverse the shaft and fit the opposite grease seal, needle bearing assembly and circlip.

Pass the remaining two trunnions into the bores in the flange (30a) and fit the grease seals, needle bearing assemblies and circlips.

Employing the same procedure, fit the universal joint to the stubshaft (56) and the sliding shaft (39). Wrap a length of Expandite Sealer Strip (Y) $\frac{1}{2}''$ × $\frac{1}{16}''$ section round the groove in the shaft (39) so as to completely cover the groove. Fit the smaller end of the gaiter (36) over the sealer strip and double wrap the gaiter clip (X) round the gaiter; secure the clip.

Liberally coat the splined end of the sliding shaft with ROCOL MOLYTONE 320 or Duckham's Q5648 Grease and assembly the sliding shaft (39) into the fixed shaft (35). Ensure that the splines slide freely.

Fit a length of Expandite Sealer Strip round the groove in the fixed shaft, pull the larger end of the gaiter (36) over the sealer strip and secure by double wrapping the gaiter clip (X) round the gaiter.



35 Outer shaft — fixed
38 Circlip
37a Needle bearing assembly
37b Seal spreader
37c Grease seal
37d Spider
30a Companion flange

Fig. 52. Exploded universal coupling

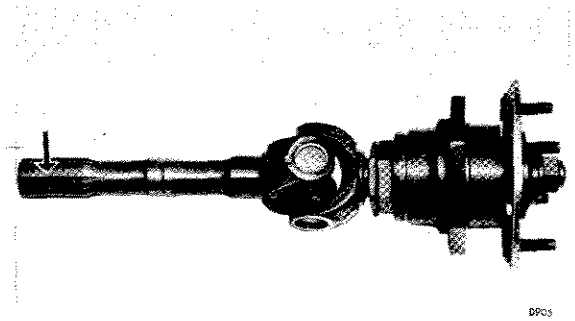


Fig. 53. Stubshaft, sliding outer shaft and hub bearing assembly

(The arrow indicates the master spline)

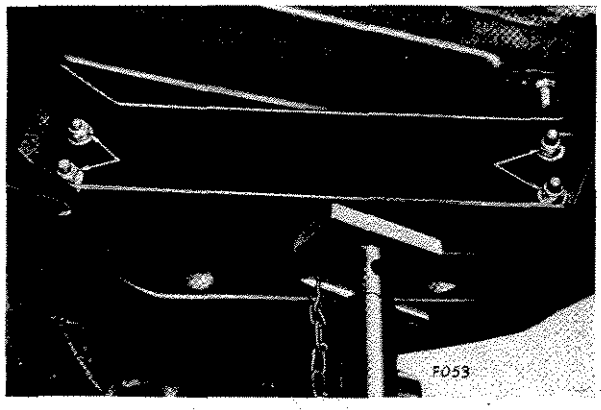


Fig. 54. Location of chassis stands

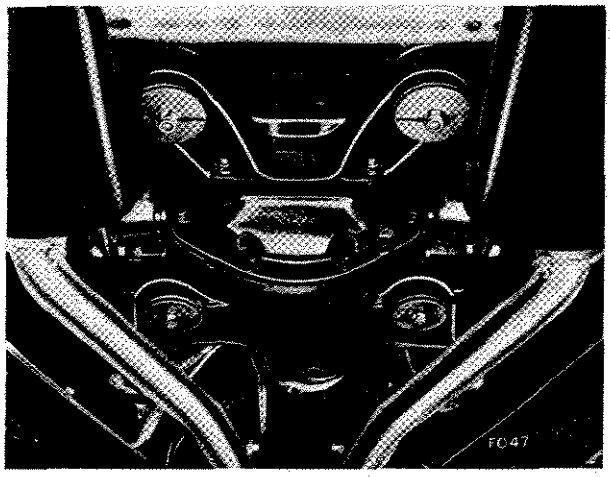


Fig. 55. Axle unit attachment to chassis

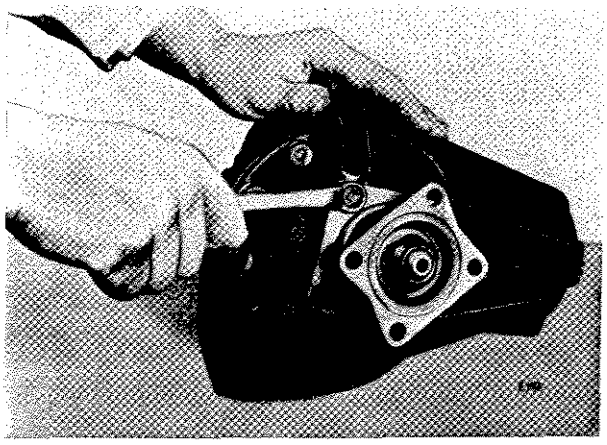


Fig. 56. Removing the bearing retainer bolts

Rear Axle Casing and Differential Unit

Rear Axle Removal

Chock the front wheels, release the handbrake, and with a trolley jack placed under the differential casing, raise the rear of the car onto stands positioned beneath the chassis frame, as shown on Fig. 54.

Working underneath the car, remove the obstructing section of the exhaust system; disconnect the wheel shafts and the propeller shaft from the axle unit. Support the axle with the trolley jack, unscrew the four nuts, shown arrowed on Fig. 55, which suspend the axle in the chassis and lower the unit to the ground.

Rear Axle Installation

Reverse the removal procedure.

Differential Unit — To Remove (refer to Fig. 37 for component designations)

Remove the eight bolts (69) and spring washers and remove the rear cover (70) together with the mounting (65) and the joint (75).

Remove the inner axle shafts (34), by removing four bolts (Fig. 56) and spring washers from the bearing retainers (26) and withdrawing the shaft assemblies (Fig. 57). Remove the nut (30) and washer (29) and extract the flange (28); see Fig. 58.

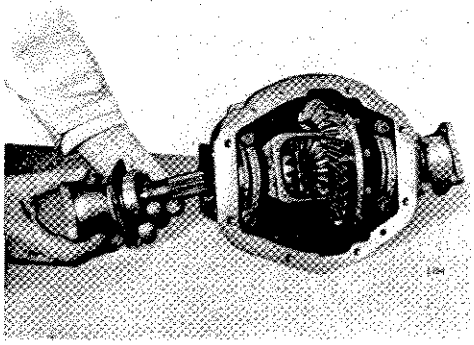


Fig. 57. Removing the inner axle shaft assembly

Remove the key (33), the bearing retainer (26) with the oil seal (27). Extract the bearing (57), see Fig. 59. Remove the oil seal (27) from the bearing retainer, see Fig. 60.

Remove the bolts (8) and spring washers, and lift out the bearing caps (9), see Fig. 62.

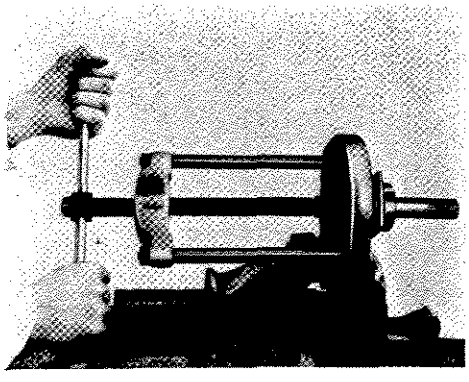


Fig. 58. Extracting the inner axle shaft flange

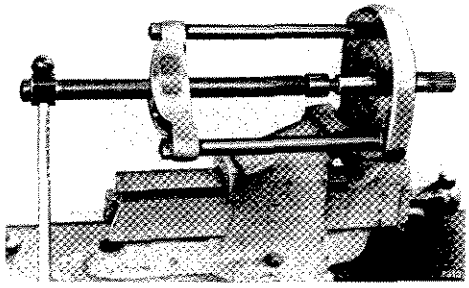


Fig. 59. Extracting the inner axle shaft bearing

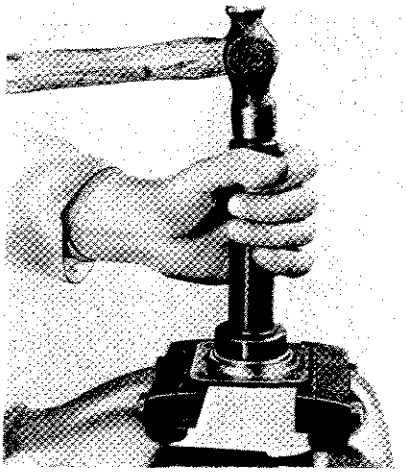


Fig. 60. Removing the inner axle shaft seal

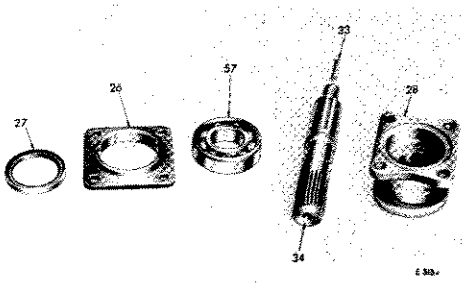


Fig. 61. Exploded inner axle asembly

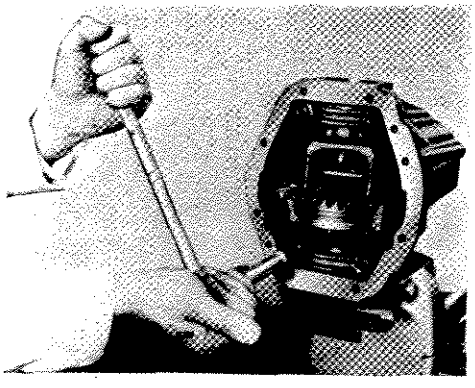


Fig. 62. Removing the differential bearing caps

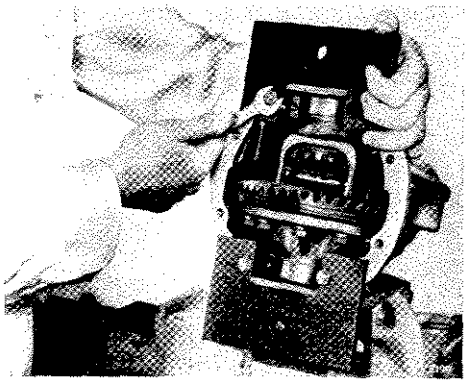


Fig. 63. Fitting the spreader adaptor plates

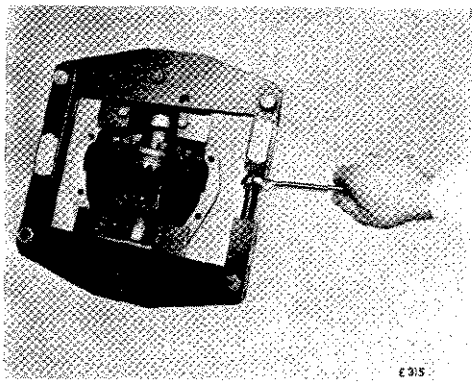


Fig. 64. Spreading the axle casing

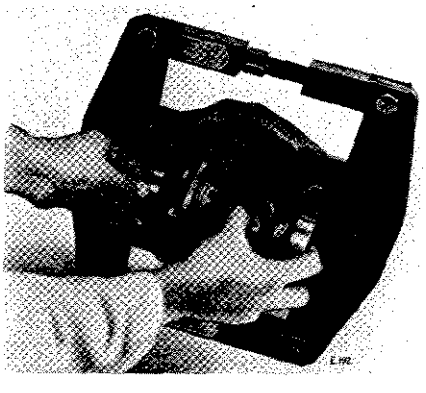


Fig. 65. Lifting out the differential unit

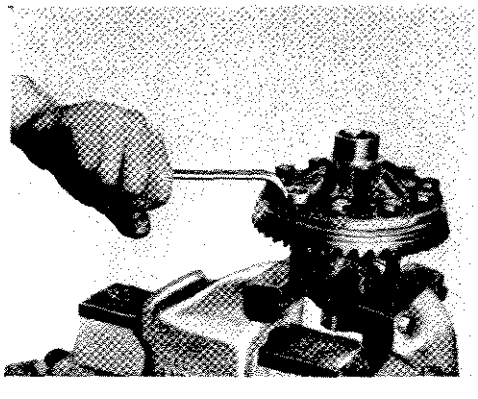


Fig. 66. Removing the crown wheel

Fit the spreader tool adaptor plates to the axle casing and lightly nip them down with four $\frac{3}{8}$" U.N.F. bolts $2\frac{1}{4}$" long (Fig. 63). Mount the spreader tool on the adaptor plates so that the pegs in the arms of the spreader fit into the large holes in the adaptor plates; turn the jacking screw until it is hand tight. A further HALF TURN with a spanner will spread the casing sufficiently to release the differential unit (Fig. 64).

IMPORTANT: OVERSPREADING WILL CAUSE IRREPARABLE DAMAGE TO THE AXLE CASING.

Lift the differential unit from the axle casing (Fig. 65) and ensure that the trunnion bearing cups and cones are kept in respective pairs.

Differential Unit — To Dismantle

With the differential cage (71) mounted in a vice, remove the bolts (72) and spring washers, and remove the crown wheel (7) from its location spigot on the cage (Fig. 66).

Preliminary Check for Run-out of the Differential Cage

Before removing the inner cones of the trunnion bearings from the differential cage, check the crown wheel mounting face of the differential cage for run-out as follows:—

Wash the oil from the trunnion bearings, assembly the cups onto their respective cones and install the differential assembly into the axle casing. Release all tension on the spreading tool and mount a dial gauge as shown in Fig. 67. Zero the dial of the gauge and rotate the differential cage.

Run-out must not exceed 0·003" (0·08mm.). Greater run-out indicates defective bearings or a distorted differential cage.

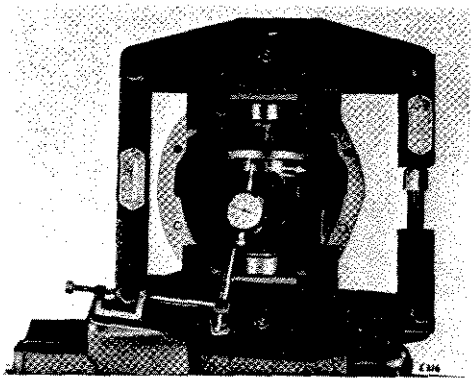


Fig. 67. Checking the differential cage for run-out

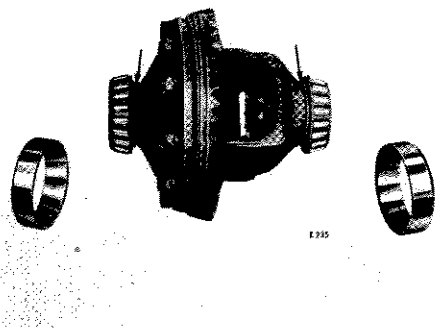


Fig. 68. Differential unit and bearings

Remove the cage from the casing and extract the bearings (74), see Fig. 69. Remove the shims (73) and note the thickness and location of each shim pack. The shims are shown on Fig. 68.

Remove the spreading tool.

Drive out the cross shaft locking pin (6), Fig. 70, and drift out the cross shaft (3), Fig. 71. Rotate both sun wheels (2) through 90°, thus bringing the planet wheels (4) in line with the apertures in the differential cage.

Remove the planet wheels (4) and thrust washers (5) and the sun wheels (2) and thrust washers (1).

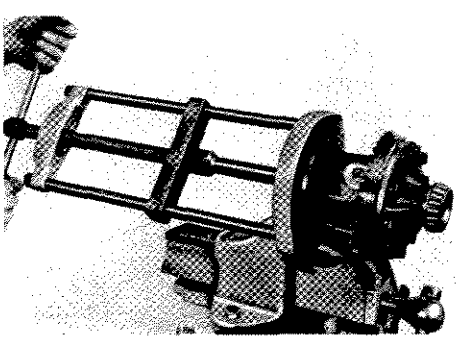


Fig. 69. Extracting the differential bearing cones

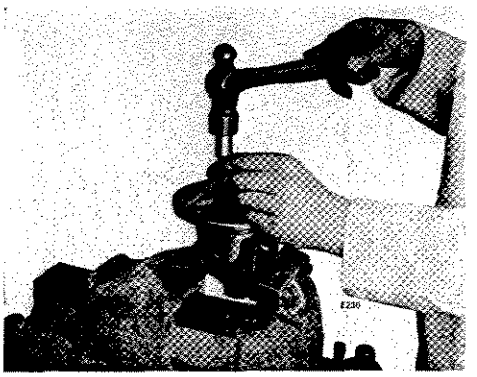


Fig. 70. Driving out the cross shaft pin

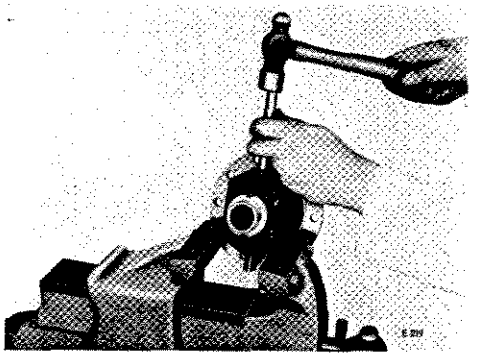


Fig. 71. Drifting out the cross shaft

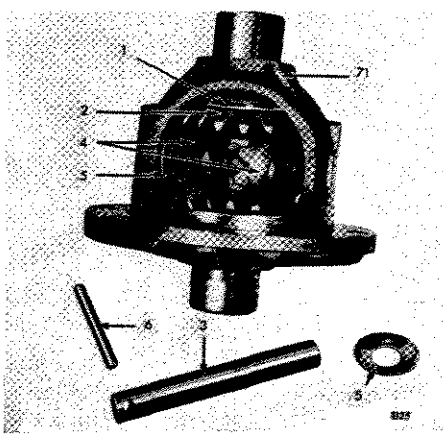


Fig. 72. Removing the differential gears

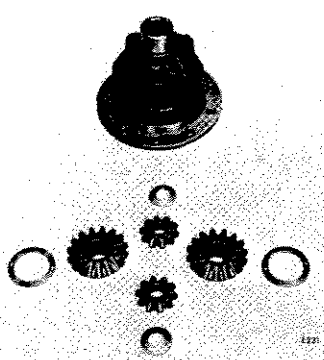


Fig. 73. Exploded differential unit

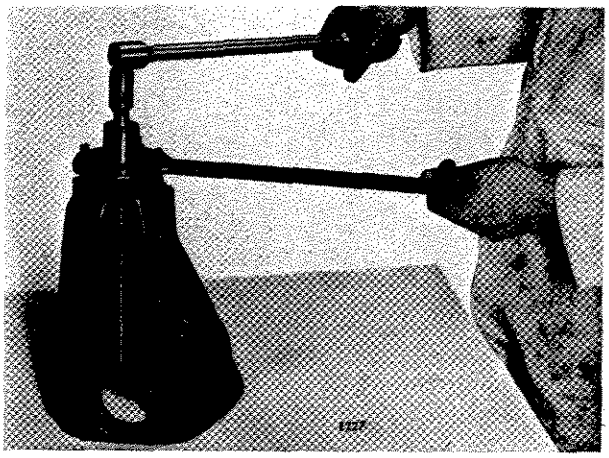


Fig. 74. Removing the pinion shaft nut

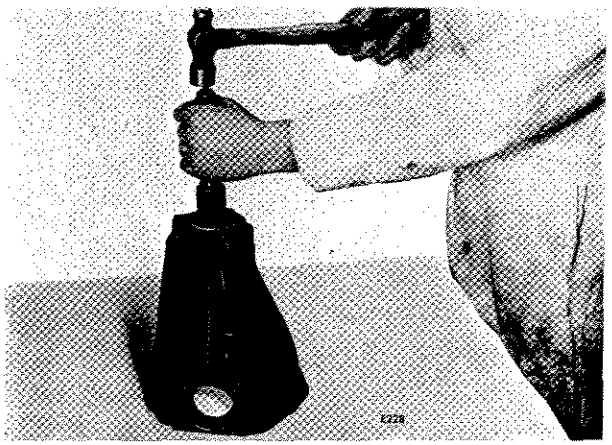


Fig. 75. Driving out the pinion

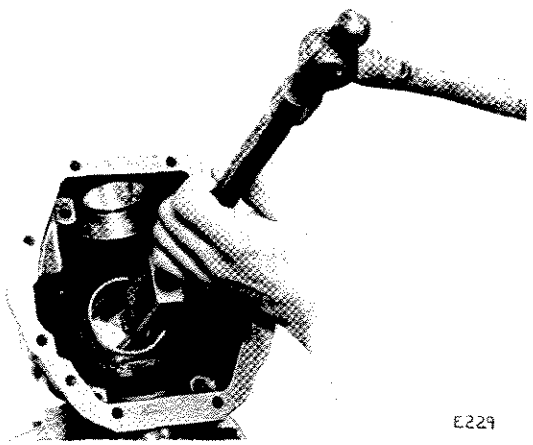


Fig. 76. Driving out the pinion bearing outer races

Removing the Pinion and Bearings

Withdraw the split pin, fit the peg spanner (Fig. 74) over the companion flange (18) and remove the castellated nut (23) and the washer (16). Drive out the pinion (Fig. 75) taking care to avoid damaging the threaded end diameter.

Remove the spacer (58) and the shim pack (10). Extract the pinion head bearing cone.

Drive out the seal (13) with the pinion tail bearing outer race (12) as shown in Fig. 76. In a similar manner, drive out the pinion head bearing outer race (60) and remove the shim pack (59).

Inspection

Wash all dismantled components in clean paraffin and dry with a compressed air jet. Examine all bearings for wear, chips, or cracks; pay particular attention to the balls and rollers and replace the complete bearings where pitting of these components is evident.

ENSURE BEARING COMPONENTS REMAIN IN SETS.

Lubricate the bearings and wrap in clean paper until required.

Check all gear teeth for wear, chips and cracks, and ensure that all bearing seats are undamaged and free from burrs.

Check the threads on all bolts, nuts and studs and replace all doubtful components.

IMPORTANT: **Crown wheels and pinions are produced as matched pairs and etched with identical identification marks. These components must, if necessary, be replaced as a pair.**

Axle Re-assembly

Using tool No. M.70, pull the pinion bearing outer races (cups) into the axle casing without the shims (59) fitted (Fig. 77).

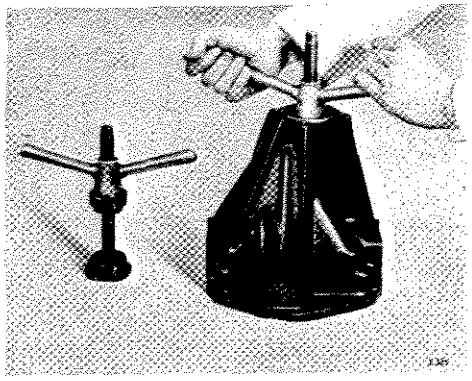


Fig. 77. Pulling in pinion bearing outer races

Fit the pinion head bearing cone (60) on the dummy pinion (Fig. 78) and install the assembly into the axle casing. Fit the tail bearing cone (12), the companion flange (18) and the washer and nut (16) and (23) onto the pinion shaft. Do NOT at this stage fit the spacer (58) or the shims (10). Tighten the nut (16) to pre-load the bearings until a torque of 15-18 lb.ins. will just turn the pinion (Fig.82).

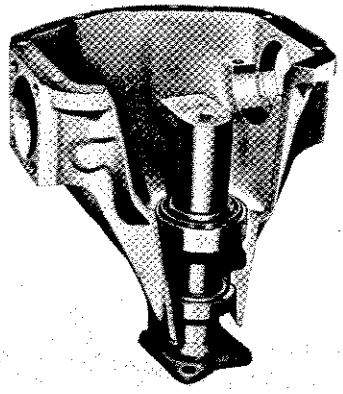


Fig. 78. Dummy pinion installed

Zero the pinion setting gauge by fully depressing the stylus with the setting button (Fig. 79) and setting the zero mark on the dial in line with the indicator needle.

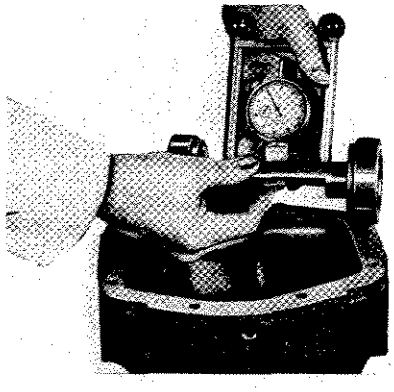


Fig. 79. Zeroing pinion setting gauge

To determine the thickness of the shim pack (59) to be inserted under the pinion head bearing outer race (60), place the zeroed gauge in the axle casing with the stylus contacting the ground face of the dummy pinion (Fig. 80). Exerting downwards pressure on the gauge body, rock it in the differential trunnion bearing bores and observe the swing of the needle. The minimum reading is obtained when the gauge stylus is parallel to the pinion centre line and this value indicates the thickness of the shims required under the head bearing outer race.

Remove the gauge, dummy pinion and the head bearing outer race from the axle casing.

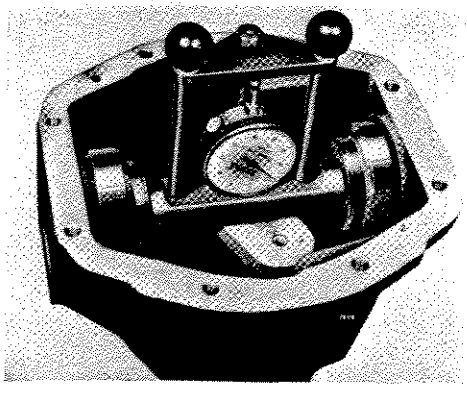


Fig. 80. Measuring pinion height

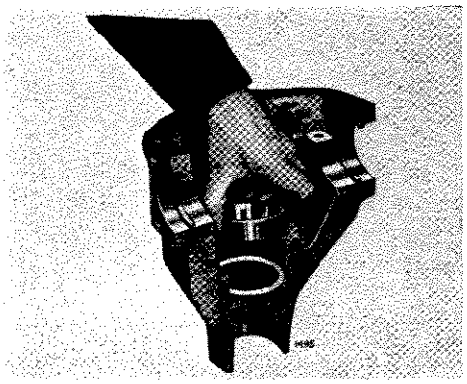


Fig. 81. Pinion positioning shims in casing

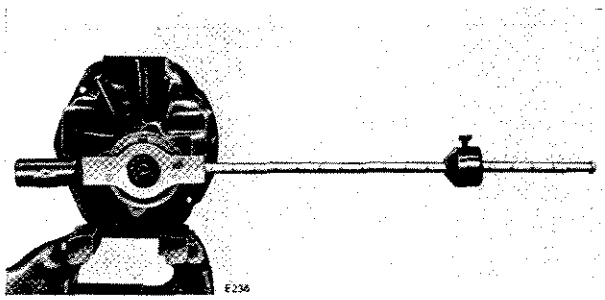


Fig. 82. Pre-load gauge

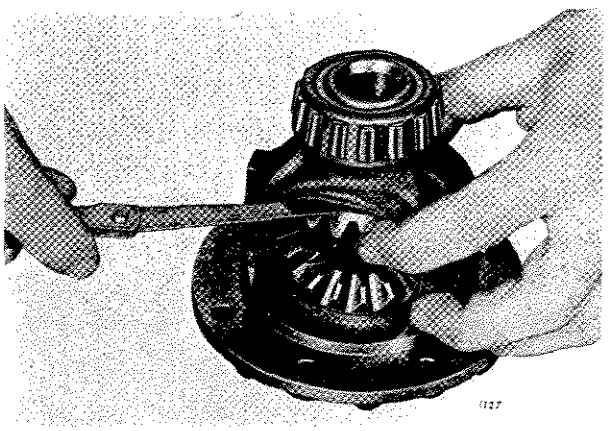


Fig. 83. Planet gear float measurement

Place the required shims (59) on the pinion head bearing abutment face in the casing and install the outer race (Fig. 81).

Assemble the inner cone of the head bearing (60), the spacer (58), and the shims (10) to the pinion shaft and install the assembly into the axle casing.

NOTE: Ensure that the chamfered end of the spacer is towards the tail bearing.

The thickness of the shim pack (10) may require adjustment to give the correct pre-loading of the pinion bearings.

Drive the tail bearing inner cone (12) onto the pinion shaft. Fit the companion flange (18), the washer (16) and the nut (23). Securely tighten the nut, whilst turning the companion flange to ensure that the pre-load does not become excessive.

Pinion Pre-load

Attach a pre-load gauge to the companion flange (Fig. 82).

Move the weight along the graduated rod until the pinion just begins to rotate. Read off the torque value at which this occurs. The value should be between 15 and 18. To increase pre-loading, subtract shims from the pack between the tail bearing inner cone (12) and the spacer (58); to decrease pre-loading, add shims.

When correct pre-loading has been achieved, remove the gauge and the companion flange. Fit the oil seal (13), refit the companion flange, securely tighten the slotted nut and lock with a new split pin.

Differential Gears (Fig. 72)

Assemble the thrust washers (1) to the sun gears (2) and insert them into the differential cage (71). Retain the thrust washers (5) with grease on the planet wheels (4) and insert the planet gears through the apertures in the cage to mesh with the sun gears.

Rotate both sun gears together to carry the planet gears into the cage. When the gear and cage bores are aligned, insert the cross shaft (3) through the cage bores, thrust washers and planet gears.

Check the planet gear backlash by measuring the sun gear end float with feeler gauges (Fig. 83). By selection from the range of thrust washers of differing thicknesses, adjust the backlash between the sun and planet gears to the minimum value consistent with freedom of rotation.

Differential Gears (Continued)

Align the locating hole in the cross shaft (3) with the drilling in the cage and fit the locking pin (6). Peen over the side of the locking pin hole to prevent dislodgement of the pin (Fig. 84).

Differential — Measuring Total End Float

Press the inner cones of the differential trunnion bearing (74) onto the journals of the differential cage. Do NOT fit the shims (73) at this stage. Fit the bearing outer races over the cones and place the assembly into the axle casing.

Mount a dial indicator as shown in Fig. 85, and zero the indicator when the differential assembly has been moved as far as possible AWAY from the indicator.

NOTE: Ensure that the trailing bearing outer race is not left behind, thus allowing the differential assembly to tilt and give a false indicator reading.

Move the differential assembly as far as possible TOWARDS the indicator and read off the total travel. This value gives DIMENSION "A" for later use (Fig. 87).

Crown Wheel—Measuring "In and Out of Mesh"

Remove all burrs and clean the gear mounting face of the differential cage. Check that the mounting face of the crown wheel is clean and free from burrs and fit the crown wheel to the differential cage. Fit the ten bolts (72) and new spring washers and tighten down uniformly to the specified torque.

Install the differential unit into the axle casing but do NOT fit the bearing caps (9). Mount a dial indicator as shown in Fig. 86 and move the differential unit away from the indicator until the crown wheel is hard in mesh with the pinion. Observe the precautions set out under "Measuring Total End Float". Zero the indicator. Move the differential unit towards the indicator until the bearing outer race is hard against the face of the bearing bore in the axle case and read off the total travel. This is the "In and out mesh" dimension ('B' in Fig. 87).

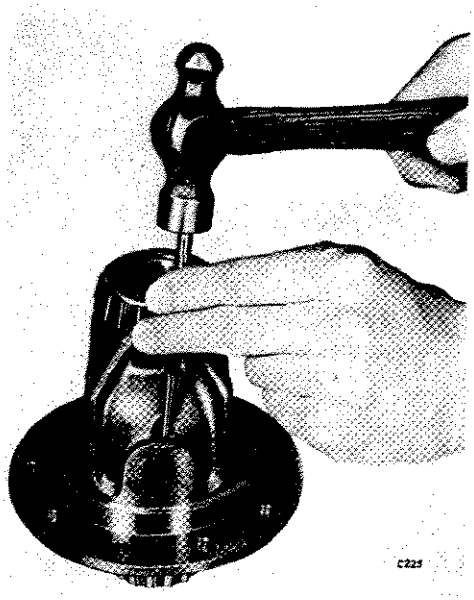


Fig. 84. Securing the cross shaft locking pin

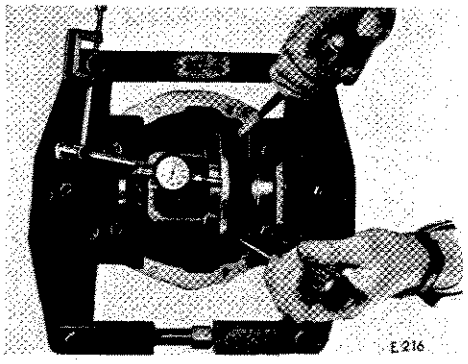


Fig. 85. Measuring the total differential end float

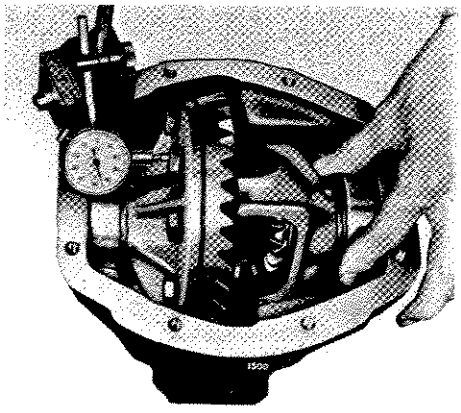
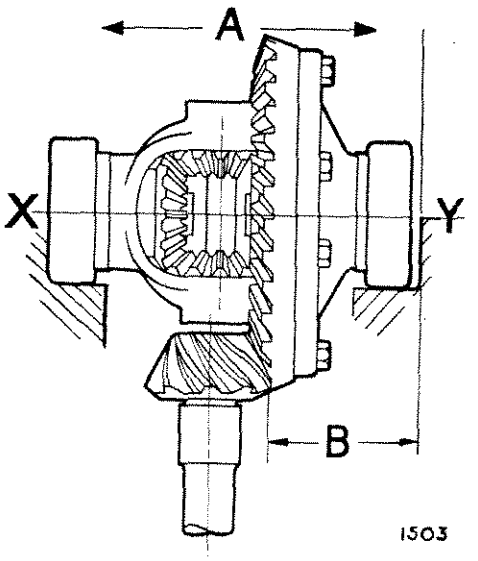


Fig. 86. Measuring the crown wheel "in and out" of mesh



A Total float B In and out of mesh

Fig. 87. Diagram for calculation of shim thickness

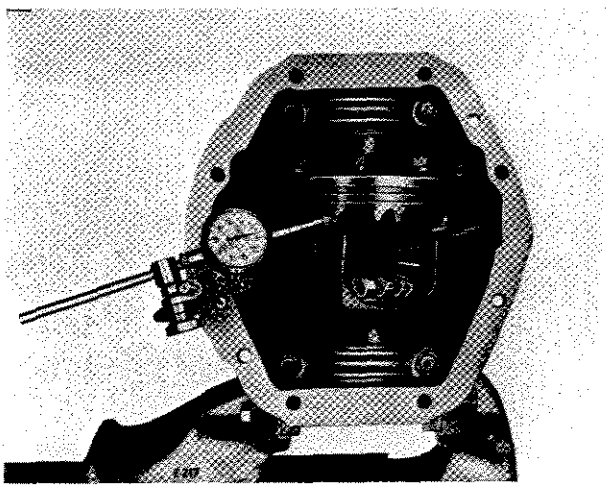


Fig. 88. Measuring crownwheel pinion backlash

Remove the differential unit from the axle casing and extract the bearings (74). Ensure that the bearings cups (outer races) and cones (roller assemblies) are not mixed and that they are fitted to the same sides of the cage when the axle is re-assembled.

Differential Bearing Pre-Load (Fig. 87)

Correct pre-load is achieved only by precise shimming.

Example

(i)	Total float 'A'	·060″
(ii)	Plus pre-load	·003″
(iii)	Total shims required ((i) plus (ii))	·063″
	Shim thickness at 'Y':—	
(iv)	In/out mesh 'B'	·025″
(v)	Specified backlash (·004″ to ·006″)	·005″
(vi)	Shims required at 'Y' ((iv) minus (v))	·020″
	Shim thickness at 'X':—	
	(iii) minus (vi)	·063″
		·020″
(vii)	Shims required at 'X'	·043″

Fit the appropriate shims to the differential cage trunnions and refit the bearings (74).

Crown Wheel/Pinion Backlash

Using the spreading tool, refit the differential unit to the axle casing. Remove the spreading tool; fit the caps (9). Use new spring washers and tighten the bolts (8) to the specified torque.

Check the backlash with a dial indicator mounted as shown in Fig. 88. With the pinion rigidly held, rock the crown wheel to the full possible extent and note the total indicator reading.

Measure the backlash at several positions and check that it is within the specified ·004/·006″ (·10/·15 mm.).

If the backlash is excessive, transfer shims to the equivalent value by which backlash is to be reduced from 'X' to 'Y'. To increase backlash, reverse the procedure.

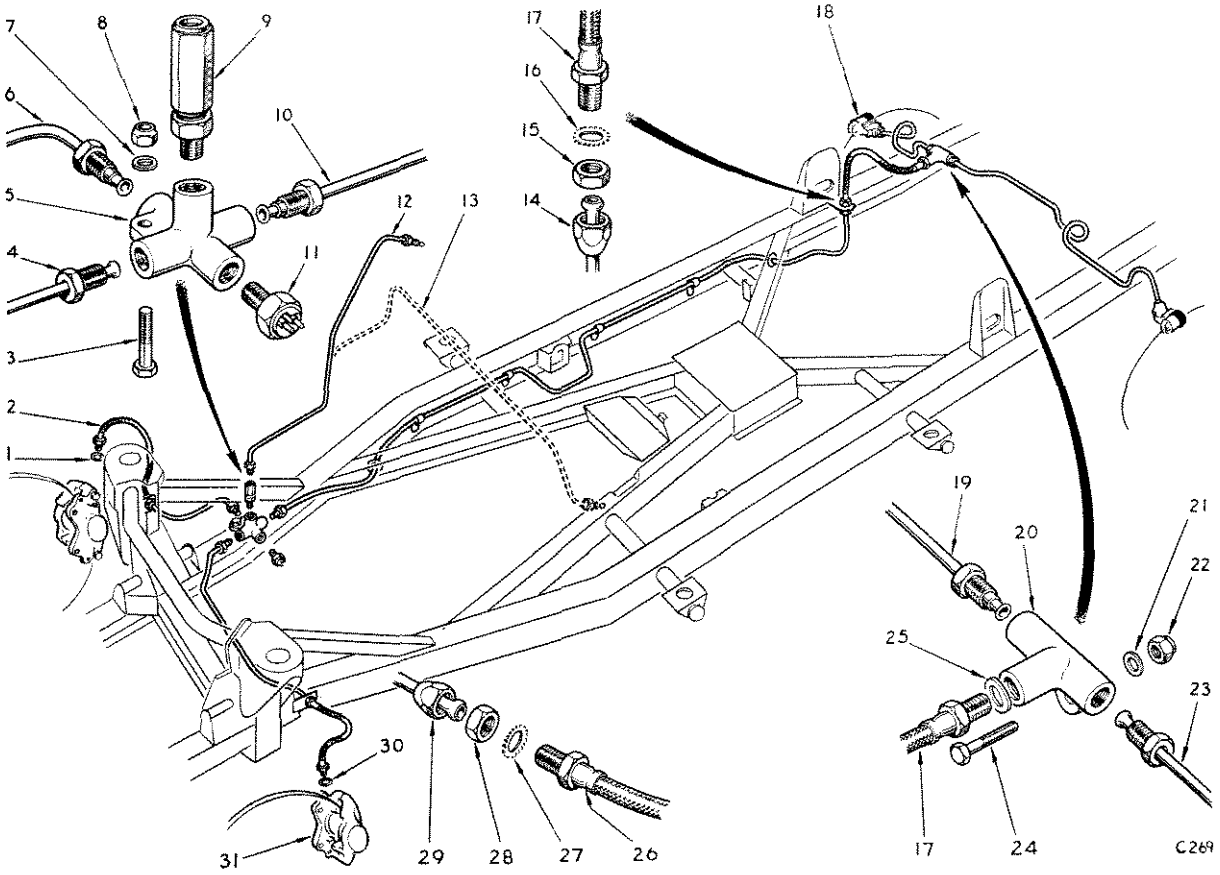
Tooth Markings Refer to Page 3·114.

Differential Unit—To Install

Refit the rear cover (70) and joint (75) to the correctly adjusted axle casing and bolt on the mounting (65).

Rear Axle Casing and Differential Unit

To refit, reverse the removal instructions given on page 3·124, fill the casing with one of the approved lubricants and road test the car.



1 Copper washer
2 Flexible pipe R.H. front
3 Bolt
4 Pipe—L.H. front brake
5 Five way union
6 Pipe—R.H. front brake
7 Washer
8 Nyloc nut
9 Restrictor valve
10 Pipe—rear brakes
11 Stop light switch
12 Pipe—five way union to master cylinder—R.H. drive
13 Pipe—five way union to master cylinder—L.H. drive
14 Pipe—five way union to rear flexible pipe
15 Nut
16 Shakeproof washer
17 Flexible pipe
18 R.H. rear hydraulic cylinder
19 Pipe—three way union to R.H. rear brake
20 Three way union
21 Washer
22 Nyloc nut
23 Pipe—three way union to L.H. rear brakes
24 Bolt
25 Copper washer
26 Flexible pipe—L.H. front brake
27 Shakeproof washer
28 Nut
29 Pipe—L.H. front brake
30 Copper washer
31 L.H. front caliper unit

Fig. 1. Hydraulic pipes and couplings

MASTER CYLINDER OPERATION (Fig. 2)

A. Brakes Released Condition

When the brake pedal is released, the push rod (9) is returned to its stop (12) by the pedal return spring. This permits the plunger (7) to move rearwards under pressure of the spring (5). The flange on the end of the valve shank (4) contacts the spring retainer (6) and as the plunger continues to move rearwards, the valve shank (4) lifts the seal (1) from its seat on the end of the cylinder bore and compresses the spring (2). Hydraulic fluid can then flow past the three legged distance piece (3) and seal (1) either to or from the reservoir.

B. Brakes Applied Condition

Initial movement of the push rod (9) and plunger (7) releases the valve shank (4) and permits the spring (2) to press the valve shank (4) and seal (1) against its seat. This cuts off communication between the cylinder and reservoir. Continued movement of the plunger displaces fluid through the hydraulic pipelines and applies the brakes.

Maximum stroke available—
1·38″ (35·05 mm.).

Stroke position at maximum cut off—
0·099″ (2·5 mm.).

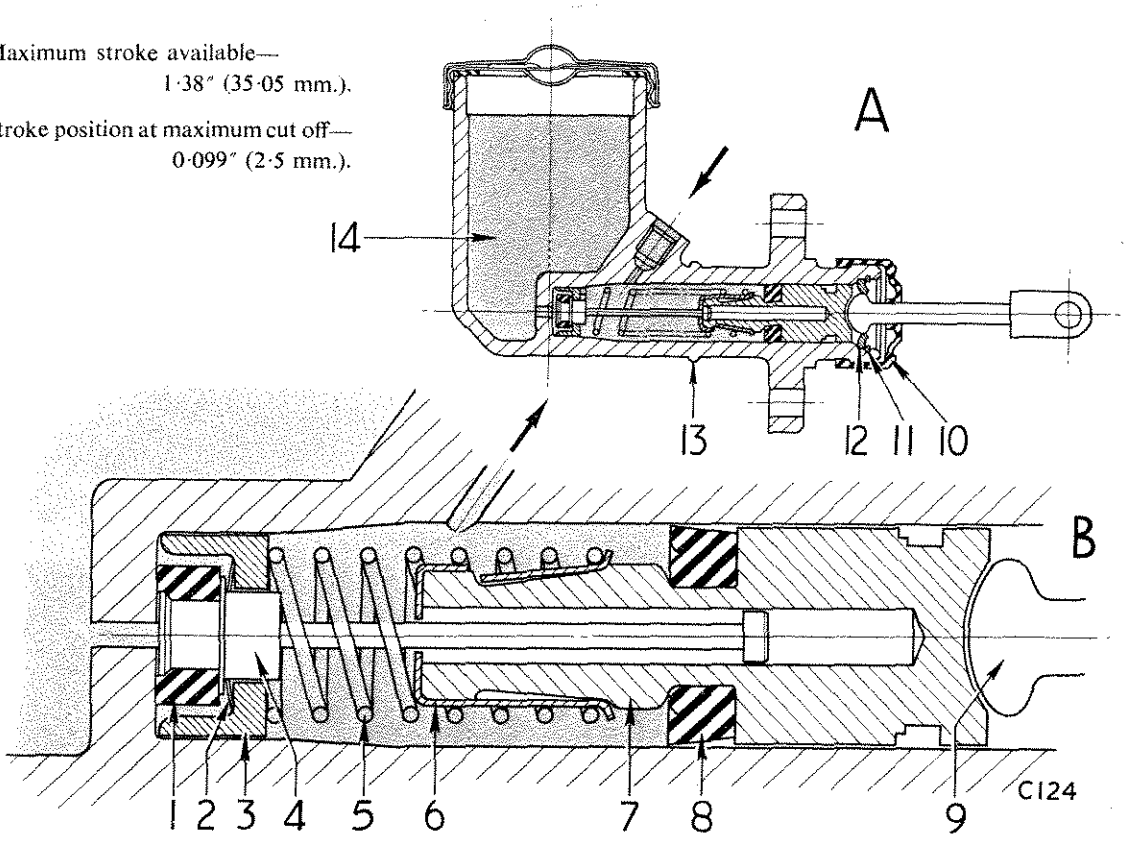


Fig. 2. Section through brake master cylinder

1 Valve seal
2 Spring (valve seal)
3 Distance piece
4 Valve shank
5 Plunger return spring
6 Spring retainer
7 Plunger
8 Plunger seal
9 Push rod
10 Dust cover
11 Circlip
12 Push rod stop
13 Identification ring (s)
14 Fluid reservoir

Note.—A single ring (13) cast on the body indicates a bore of 0·75″ (19·05 mm.). Two rings indicate a bore of 0·7″ (17·78 mm.)

The smaller bore supersedes the larger from Commission Number CT.5783

Brake Master Cylinder

Removal (Fig. 3)

Clutch and brake master cylinders cannot be removed individually, but only as an assembly, therefore :—

1. Empty the clutch and brake hydraulic systems.
2. Detach the fluid pipes from the master cylinders.
3. Remove the brake and clutch pedal clevis pins (1).
4. Remove setscrews (4) and nuts (3) from the cylinder support bracket (11), and lift the bracket, complete with cylinders, from the scuttle.
5. Remove the master cylinders from the support bracket.

Dismantling (Fig. 2)

1. Remove the dust cover (10). Depress the push rod (9), remove the circlip (11) and withdraw the push rod (9) together with items (10), (11) and (12).
2. Shake out the plunger, spring and valve assembly. If necessary, apply low pressure compressed air to the outlet union to eject the plunger assembly.
3. Lift the locating clip on the spring retainer (6) and remove the retainer from the plunger (7) with the valve and spring assembly.
4. Detach the valve shank (4) by passing it through the offset hole in the retainer (6). Remove the spring (5), distance piece (3) and spring (2) from the valve shank (4). Using fingers, detach the seal (1) from item (4) and the seal (8) from item (7).

Inspection

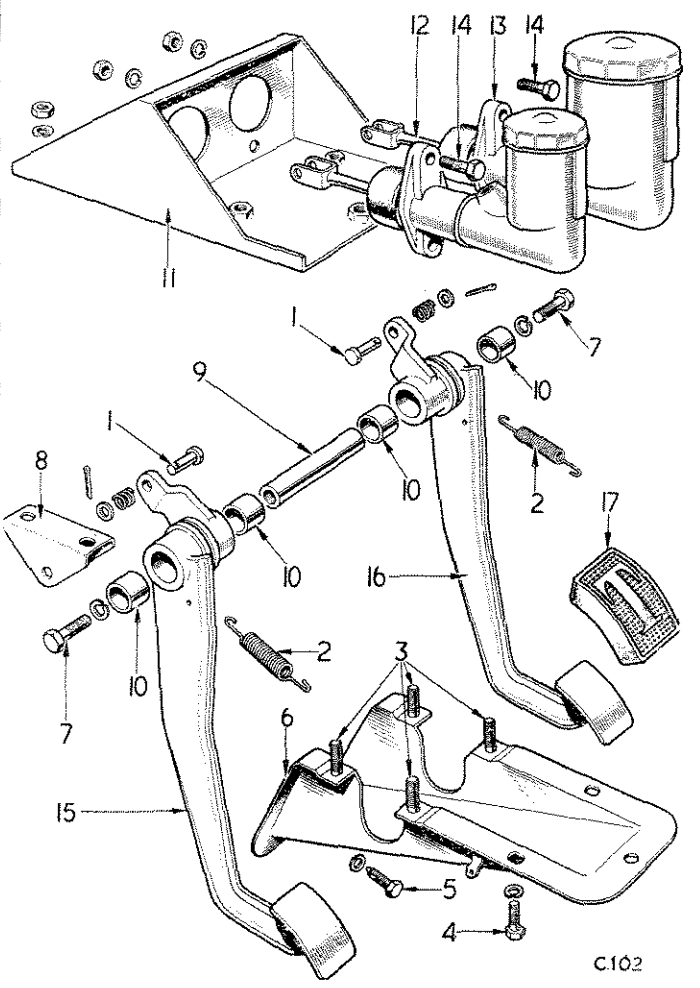
Clean and examine all components for deterioration, renewing items as necessary.

Re-Assembly (Fig. 2)

1. Refit the seals (1) and (8) to items (4) and (7).
2. Fit the spring (2), distance piece (3) and spring (5) to the valve shank (4), attach the spring retainer (6) and fit the assembly to the plunger (7). Lubricate the components with clean hydraulic fluid and fit them to the master cylinder bore. Fit the push rod (9) with stop plate (12), circlip (11) and dust cover (10).

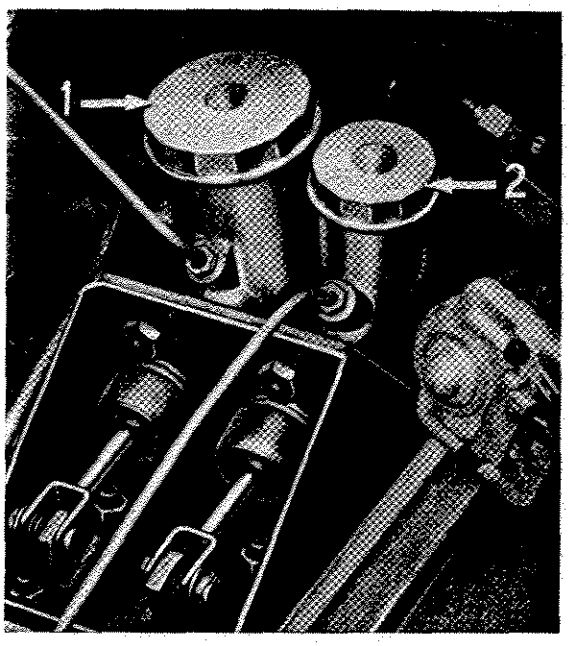
To Refit (Fig. 3)

Re-assemble the master cylinder to the bracket and secure this to the bulkhead. Reconnect the clutch and brake pedals to the push rods, using new split pins to secure the clevis pins (1). Refill and bleed the clutch and brake hydraulic systems as describe on page 3·204.



1 Clevis pin
2 Pedal return spring
3 Bolts } Pedal shaft cover assembly to
4 Bolts } master cylinder support bracket
5 Setscrew (pedal shaft cover assembly to bulkhead)
6 Pedal shaft cover assembly
7 Setscrew (pedal stay to pedal shaft support bracket)
8 Pedal shaft support bracket
9 Pedal shaft
10 Pedal pivot bush
11 Master cylinder support bracket
12 Push rod
13 Bracket master cylinder
14 Setscrew (master cylinder to support bracket)
15 Clutch pedal
16 Bracket pedal
17 Pedal pad

Fig. 3. Master cylinder support and pedal details



1 Brake master cylinder 2 Clutch master cylinder

Fig. 4. Position of master cylinders

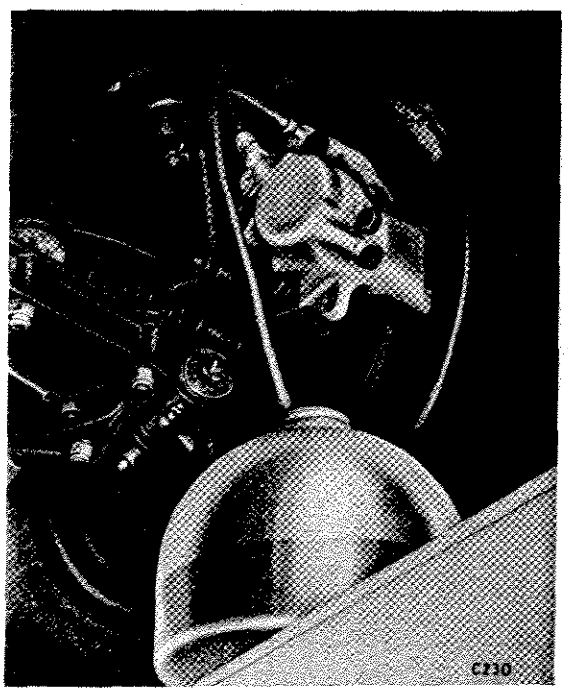


Fig. 5. Bleeding the brakes

Draining the Hydraulic System

Before a brake pipe is disconnected, drain the brake hydraulic system as follows :—

1. Attach a length of rubber tube to the bleed nipple nearest the pipe being disconnected.
2. Insert the opposite end of the tube in a clean jar. Unscrew the bleed nipple one turn and pump the brake pedal to drain the system.
3. Tighten the bleed nipple and remove the draining tube.

Bleeding Procedure

1. Fill the reservoir with fluid, check regularly and maintain the level during bleeding operations.
2. Remove the rubber dust cap from the bleed nipple on the wheel cylinder furthest from the master cylinder (N/S rear). Fit a flexible bleed tube over the nipple, with the free end immersed in a jar containing a little brake fluid.
3. Unscrew the nipple approximately $\frac{3}{4}$ of a turn and, giving fairly fast full strokes, pump the brake pedal until fluid entering the jar is free from air bubbles.
4. Hold the pedal fully depressed, tighten the bleed nipple, remove the bleed tube and refit the dust cap.
5. Repeat the procedure for the remaining three brakes, finishing with the wheel cylinder nearest the master cylinder (O/S front).
6. Adjust all the brakes in the normal manner and whilst applying pressure to the brake pedal, check for leaks at all pipe joints and unions, flexible hose connections, wheel cylinders and master cylinder.

NOTE : Should the fluid reservoir empty during bleeding operations, the whole process must be repeated from the beginning. When replenishing the system, use only new fluid that has been stored in a container sealed from atmosphere. Immediately bleeding is completed, re-seal residual fluid in the container, before it is again stored.

BRAKES

Front Brakes

Self-adjusting front brakes consist of Girling 11″ discs with cast aluminium double acting caliper units, each containing two quickly detachable friction pads.

Friction Pad Replacement

1. Jack up the car and remove the front road wheels.
2. Release two spring retainers (9) and remove the pad retainer pins (10).
3. Lift the friction pads (4) and the anti-squeal plates (5) from the caliper and renew them if worn. **Do not attempt to re-line worn pad assemblies.**
4. Before fitting new pads, push the pistons (6) back to the full extent of their travel. Refit the pads and anti-squeal plates, positioning the arrow in the direction of wheel rotation. Insert the retainer pins (10) and secure them with the spring retainer clips (9).

Caliper Cylinder Maintenance

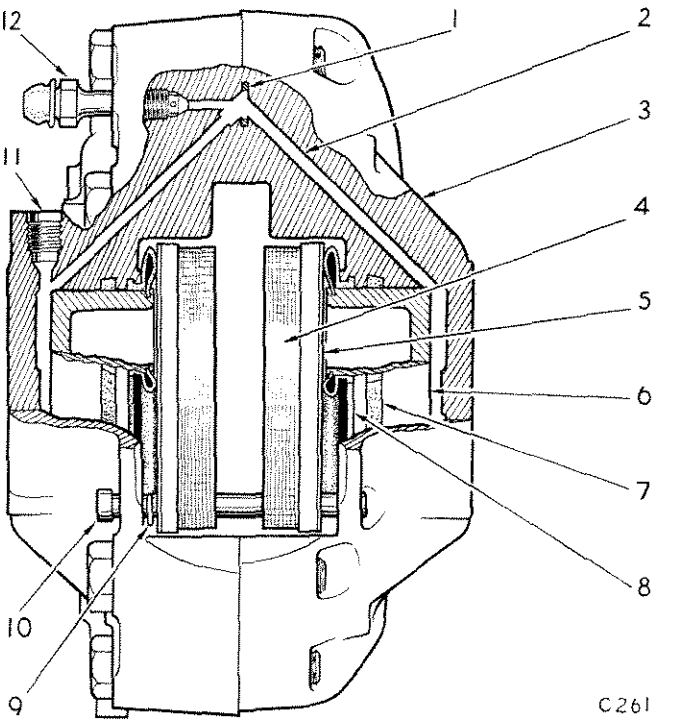
To replace piston sealing rings or dust excluders, dismantle as follows :—

1. Release the rigid pipe and locknut at the support bracket. Unscrew the flexible hose from the caliper.
2. Remove two bolts securing the caliper to its support bracket.
3. Remove the caliper and withdraw the pistons from the body.
4. Carefully remove the rubber sealing ring from its recess.
5. Clean the piston, cylinder and rubbers with clean brake fluid ONLY.
6. Examine all components for serviceability and renew where necessary.

Re-Assembly

Lubricate the surfaces of the bore and piston with clean brake fluid.

1. Fit a new piston seal into the recess in the cylinder.
2. Locate the projecting lip of the rubber dust excluder in its recess in the cylinder.
3. Insert the piston, closed end leading, into the cylinder, taking care not to damage the polished surface. Push piston fully home and engage the outer lip of the dust excluder with the recess in the piston.
   Replace the friction pads.
4. Assemble the caliper over the disc, and refit shims between caliper and mounting bracket.
5. Refit the flexible brake hose and bleed the system.



1 Rubber 'O' ring
2 Fluid transfer channels
3 Caliper body
4 Brake pad
5 Anti-squeal plate
6 Piston
7 Piston sealing ring
8 Dust cover
9 Retaining clip
10 Retaining pin
11 Flexible hose connection
12 Bleed nipple

Fig. 6. Details of caliper assembly

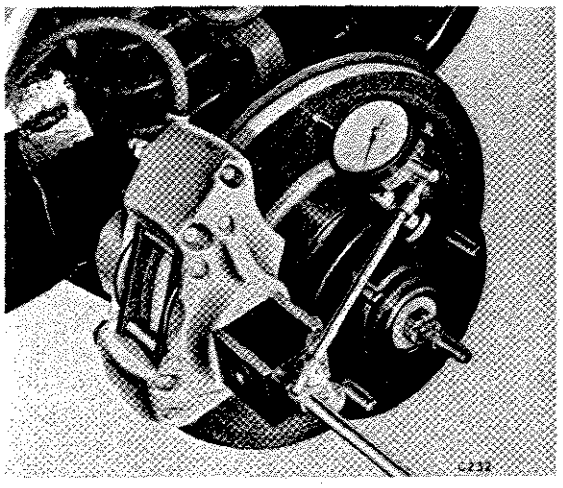


Fig. 7. Using a dial indicator to check disc run-out

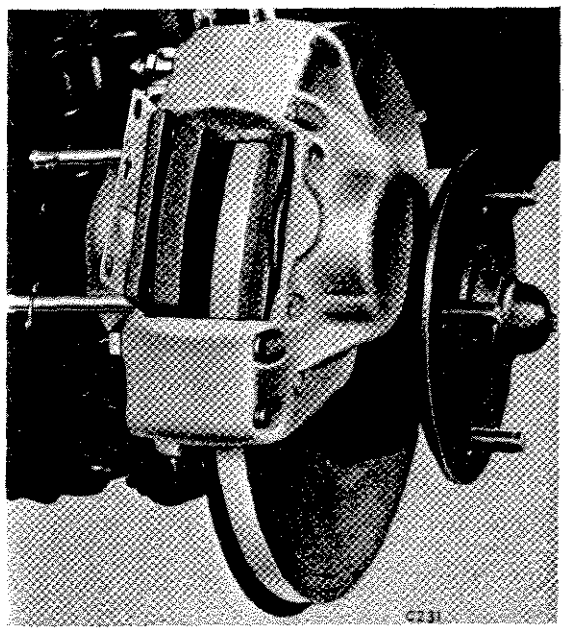


Fig. 8. Removing the brake pads

Note.—The arrow on the anti-squeal plate pointing in the direction of forward wheel rotation.

Discs

Maximum permissible run-out on the friction faces of the disc is ·002″ (0·0508 mm.).

The discs may be machined to a thickness of ·440″ (11·18 mm.) to rectify excessive run-out or scored faces. Minimum permissible finish of the disc machining:
15-30 micro inches measured circumferentially.
50 micro inches measured radially.

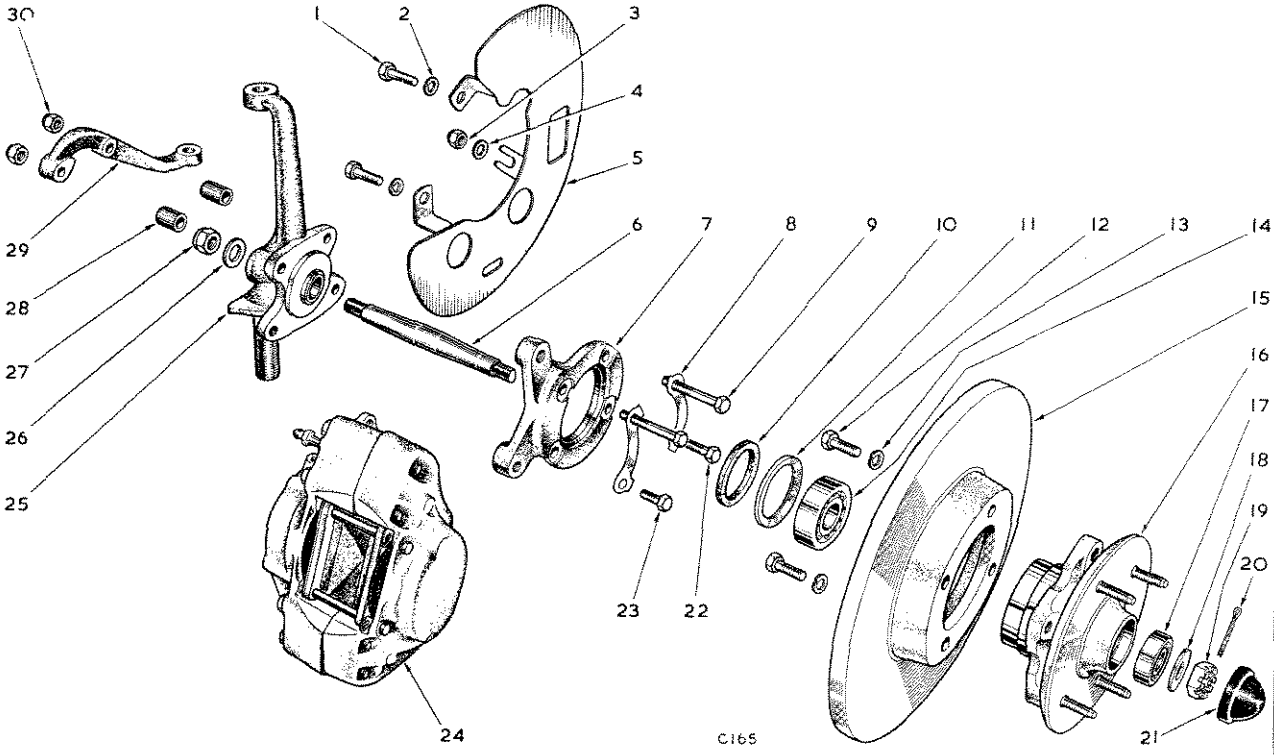
Disc and Hub Removal (Fig. 9)

1. Remove caliper assembly (24).
2. Remove the grease retaining cap (21) from the hub by screwing through it a No. 10 U.N.F. setscrew (supplied in tool kit).
3. Remove the split pin, slotted nut (19) and plain washer (18) from the stub axle (6).
4. Withdraw the hub (16) complete with the outer race (17) and the outer part of the inner race (14).
5. Detach the brake disc (15) from the hub (16) and degrease the hub components.

If new bearings are required, drift the old bearing outer rings and the oil seal (10) with retainer (11) from the hub. New bearings should only be fitted as complete sets.

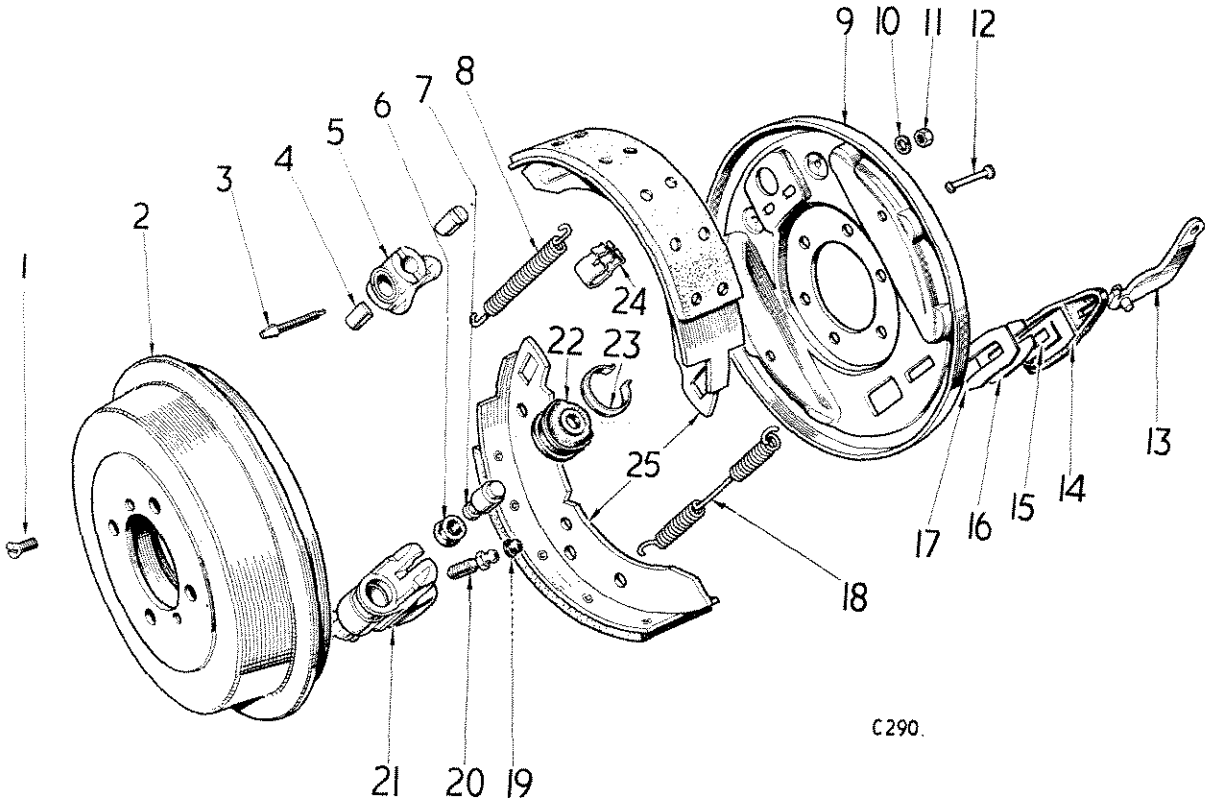
Re-Assembly

1. Fit the bearing outer rings (14) and (17) with their tapers facing outwards. Refit the disc (15), securing with bolts (12) and washers (13).
2. Assemble the inner races (14) and (17) and fit the hub and disc to the stub axle. Fit the washer (18) and slotted nut (19) and, whilst rotating the hub, tighten the nut (19) with finger pressure only. Slacken the nut back to the nearest split pin hole and mark its position by centre punching the end of nut and stub axle. The hub should have 0·003″ - 0·005″ (·076 mm. - 0·127 mm.) end float. If slacking back the nut produces excessive end float, remove the nut and file the rear face so that when refitted the correct end float is provided.
3. Remove the nut (19), washer (18), hub (16) and races (14) and (17). Pack the races and hub with an approved grease.
4. Secure a new hub sealing felt (10) to the seal retainer (11) with jointing compound. Allow the compound to dry, then soak the seal in engine oil and squeeze out surplus oil.
5. Fit the races (14) and (17) and seal retainer (11) to the hub, with the felt seal facing inwards.
6. Fit the hub assembly to the stub axle, securing it with the washer (18) and nut (19). Tighten the nut until the centre punch marks made in (2) correspond, and secure the nut with a new split pin (20).
7. Fit the cap (21). Secure the caliper assembly with bolts (1) and spring washers (2), re-fitting any shims originally fitted between the caliper and bracket.



1	Bolt	16	Hub
2	Spring washer	17	Outer taper race
3	Nyloc nut	18	Washer
4	Plain washer	19	Slotted nut
5	Dust shield	20	Split pin
6	Stub axle	21	Hub cap
7	Caliper bracket	22	Bolt
8	Tab plate	23	Bolt
9	Bolt	24	Caliper unit
10	Felt seal	25	Vertical link
11	Seal retainer	26	Plain washer
12	Bolt	27	Nyloc nut
13	Spring washer	28	Distance pieces
14	Inner taper race	29	Steering arm
15	Disc	30	Nyloc nut

Fig. 9. Exploded view of disc brake and hub assembly



1 Screw
2 Brake drum
3 Tappet
4 Expander-adjuster
5 Adjuster housing
6 Piston seal
7 Piston
8 Spring
9 Backplate
10 Spring washer
11 Nut
12 Steady pin
13 Handbrake lever
14 Dust excluder
15 Abutment plate
16 Spring plate—retaining
17 Spring plate
18 Spring
19 Dust cap
20 Bleed nipple
21 Hydraulic cylinder
22 Dust excluders
23 Clip
24 Spring clip—steady pin
25 Brake shoes

Fig. 10. Rear brake details

Brake Shoes

Removal

Should the brake linings be contaminated with grease or hydraulic fluid, trace the source of leakage and rectify. Saturated shoes cannot be satisfactorily cleaned and must, therefore, be renewed as follows :—

1. Chock the front wheels, jack up the rear and release the handbrake.
2. Remove the road wheel and brake drum.
3. Turn the adjuster back to the fully "OFF" position.
4. Press the spring plate (4), turn the anchor pin (21) 90 degrees and withdraw it from the rear of the backing plate.
5. Pull one of the brake shoes against spring load and lift it over the adjuster anchorage. Release the springs and remove the brake shoes.

Clean the backplate and inspect the operating cylinder for leaks and freedom of piston movement. Ensure that the cylinder slides laterally in the backplate slot and check the adjuster tappets and wedge for freedom of movement. Inspect the brake drums for scoring and grease contamination which, if present, must be removed with petrol or methylated spirits.

Assembly

The brake shoe linings are shorter in length than the platforms to which they are attached. The end of the shoe having the greater length of platform exposed is the "toe", whilst the other end is the "heel". When installed, the toe of the leading shoe is adjacent to the wheel cylinder piston, and its heel is located in a slot in the abutment. The heel of the opposite shoe locates in a slot at the closed end of the wheel cylinder body.

Lightly smear a thin film of white (Zinc base) grease over the six shoe contact pads and over the area on which the wheel cylinder and spring plate slide. Do not contaminate the shoe linings with grease or oil.

Assemble the brake shoes, pull-off springs and shoe anchor pins to the L.H. brake assembly as shown on Fig. 11. The R.H. side assembly is symmetrically opposite.

Refit the brake drum ; turn the adjuster fully "IN" and turn it back one notch to free the drum.

Refit the road wheel and lower the jack.

Wheel Cylinders

To Renew Piston Seal

Remove the brake shoes, drain the hydraulic system, uncouple the brake pipe, and disconnect the cable from the wheel cylinder lever.

Remove the dust cover (34), distance piece (33), locking plate (35) and securing spring (36).

Withdraw the wheel cylinder and handbrake lever from the backplate.

Extract the piston (28) from the wheel cylinder body (26) and renew the piston seal (27). Examine the cylinder bore and renew if scored or damaged.

Re-assemble the brake components by reversing the removal procedure.

Brake Adjustment

Front

The front brakes are self-adjusting.

Rear

Each rear brake is provided with an adjuster protruding from the backplate (see Fig. 12).

The procedure for adjusting is as follows :—

1. Jack up the rear of the vehicle.
2. Screw in each adjuster until solid resistance is felt, then slacken back one notch, which should allow the drum to rotate freely.
   If excessive binding is felt, slacken the adjuster a further notch.

NOTE : Do not confuse binding with the normal drag caused by hub grease and the oil in the differential unit, particularly when cold.

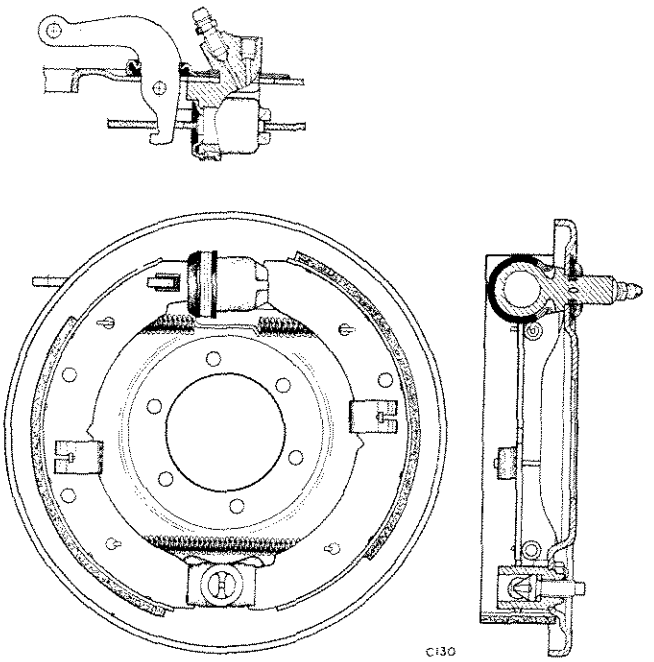


Fig. 11. Arrangement of brake shoes and wheel cylinder

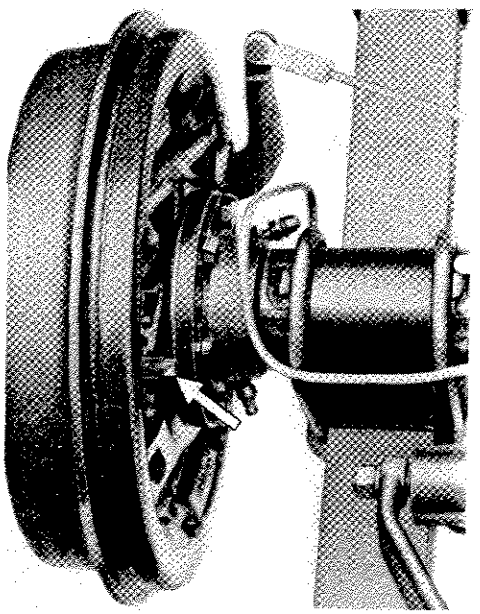
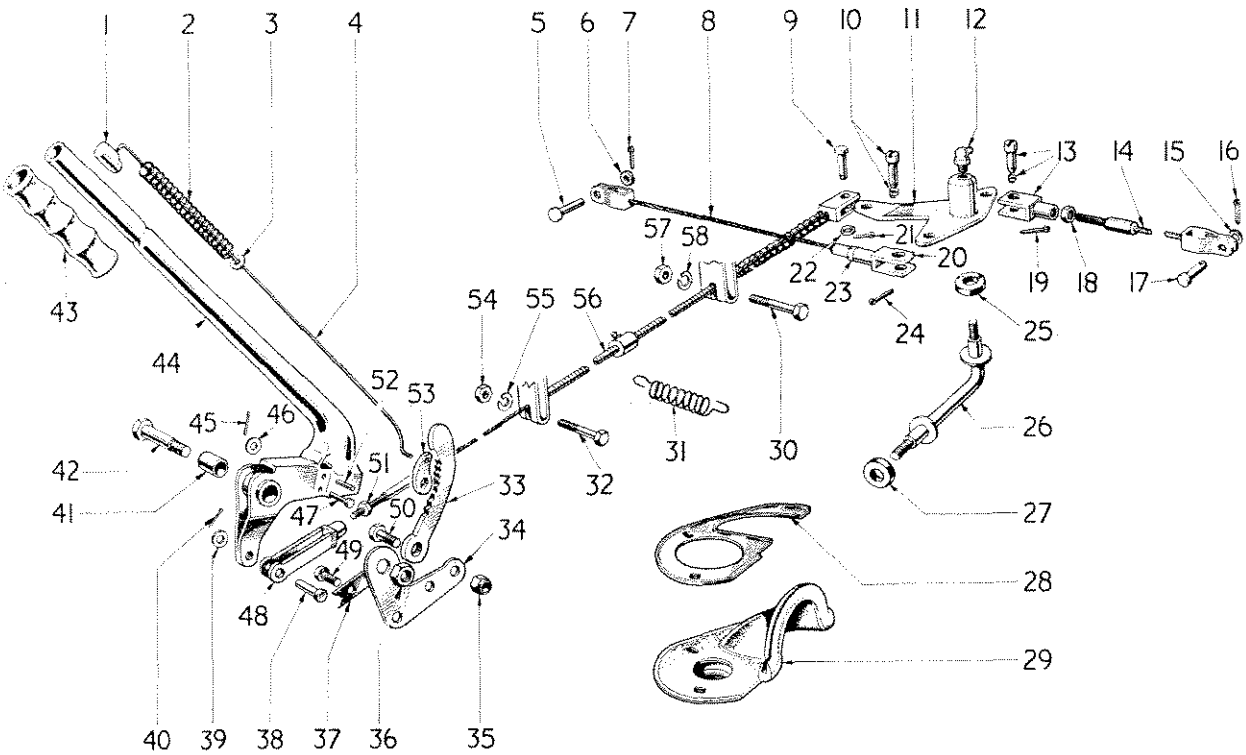


Fig. 12. Rear brake adjuster shown arrowed



1 Push rod button
2 Pawl release spring
3 Plain washer (between spring and lever
4 Push rod
5 Clevis pin
6 Plain washer
7 Split pin
8 Cable assembly (compensator to R.H. brake unit)
9 Clevis pin
10 Clevis joint assembly
11 Compensator lever
12 Grease nipple
13 Clevis joint assembly
14 Cable assembly (compensator to L.H. brake unit)
15 Plain washer
16 Split pin
17 Clevis pin
18 Jam nut
19 Split pin
20 Clevis joint assembly
21 Split pin
22 Plain washer
23 Jam nut
24 Split pin
25 Felt seal
26 Compensator bar assembly
27 Felt seal
28 Cover plate
29 Handbrake grommet
30 Bolt
31 Spring
32 Bolt
33 Ratchet
34 Attachment plate
35 Nyloc nut
36 Nyloc nut
37 Tab washer
38 Clevis pin
39 Plain washer
40 Split pin
41 Lever pivot bush
42 Pivot bolt
43 Handbrake grip
44 Lever assembly
45 Split pin
46 Plain washer
47 Joint pin (pawl to lever)
48 Fork end
49 Setscrew (attachment plate to frame bracket)
50 Setscrew (ratchet to attachment plate)
51 Jam nut
52 Mills pin
53 Pawl
54 Nut
55 Spring washer
56 Cable assembly (handbrake to compensator lever)
57 Nut
58 Spring washer

Fig. 13. Details of handbrake and linkage

HANDBRAKE

Removal

1. Chock the wheels, jack up the rear of the car and release the handbrake.
2. Remove the moulded hand grip (43).
3. Withdraw the three self-tapping screws securing the draught excluder (28) to the floor. Remove the plate and the draught excluder (29).
4. Disconnect the fork end (48) from the handbrake lever (44).
5. Release the tabs of the locking plate (37) and withdraw two bolts (49), (50) securing the attachment plate (34) to its mounting bracket.
6. Remove the exhaust down pipe and the nyloc nut (36) locking the pivot bolt (42) to the chassis frame. Withdraw the pivot bolt.
7. Withdraw the handbrake lever (44) from beneath the car.

Dismantling

1. Detach the attachment plate (34) from the ratchet (33).
2. Withdraw the pawl pivot pin (47) whilst applying pressure to the press button (1). Withdraw the ratchet (33).
3. Remove press button (1), spring (2) and plain washer (3) from the push rod (4).
4. Withdraw the push rod (4) and pawl (53) from the lever (44).

Refitting

1. Fit the pivot bolt (42) through the lever assembly (44) and the attachment plate (34).
2. From beneath the car, feed the lever (44) through the floor assembly and attach it to the chassis with the pivot bolt (42). Do not tighten the bolt at this juncture.
3. Refit the lever attachment plate (34) to the chassis.
4. Tighten the pivot bolt (42), allowing the lever (44) sufficient freedom of movement, and attach the locking nut (36) from inside the cruciform.
5. Refit the exhaust down-pipe.
6. Secure the fork end (48) of the cable to the brake lever (44). Refit the draught excluder (29), its cover plate (28) and the moulded hand grip (43).
7. Lower the car and remove the chocks from the wheel.

Re-Assembly

1. Attach the pawl (53), pointing rearwards, to the push rod (4), and fit the rod into the lever (44) so that its shape corresponds with that of the lever.
2. Fit the plain washer (3), spring (2) and press button (1) to the push rod.
3. Hold the press button (1) down and fit the ratchet (33), teeth facing the pawl (53) into the lever (44). Manipulate the pawl (53) and insert the pivot pin (47) through both lever and pawl. Secure the pivot pin.
4. Secure the attachment plate (34) to the ratchet (33) and the nyloc nut (35), allowing sufficient freedom of movement for the plate to swing on the ratchet.

Handbrake

Under normal circumstances, adjustment of the rear brakes will automatically provide satisfactory handbrake adjustment. Stretched cables will necessitate further adjustment as follows :—

1. Jack up the rear wheels, release the handbrake and lock the brake drums by screwing each brake adjuster fully in.
2. Remove the clevis pin (2) and re-adjust the primary cable to position the compensator lever as shown on Fig. 15. Re-connect the cable.
3. Remove the clevis pins (1) and adjust the transverse cables to remove slackness. Re-connect the cables. The cables are too tight if the clevis pins cannot be easily inserted without straining the cables.
4. Turn each adjuster back one notch to release the brakes and lower the jack.

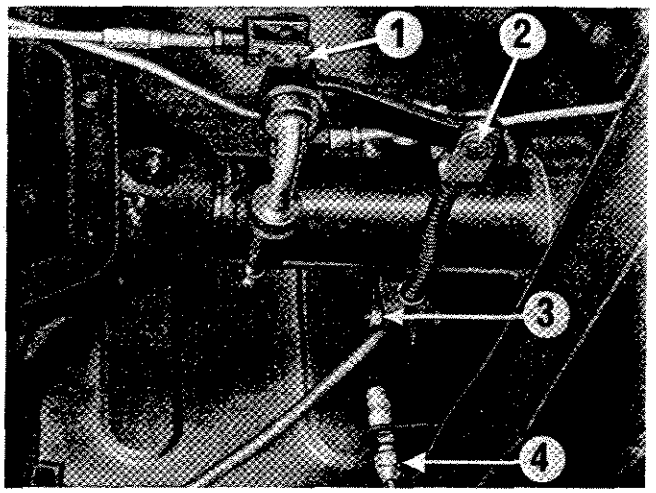


Fig. 14. Handbrake compensator

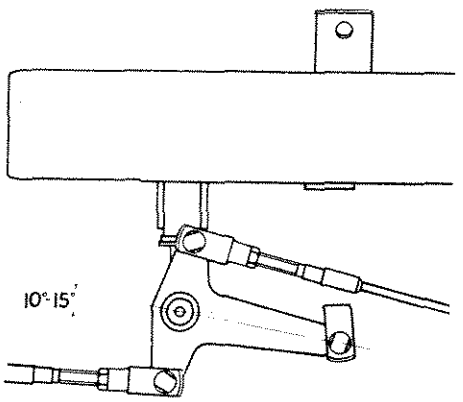


Fig. 15. Angle of handbrake compensator

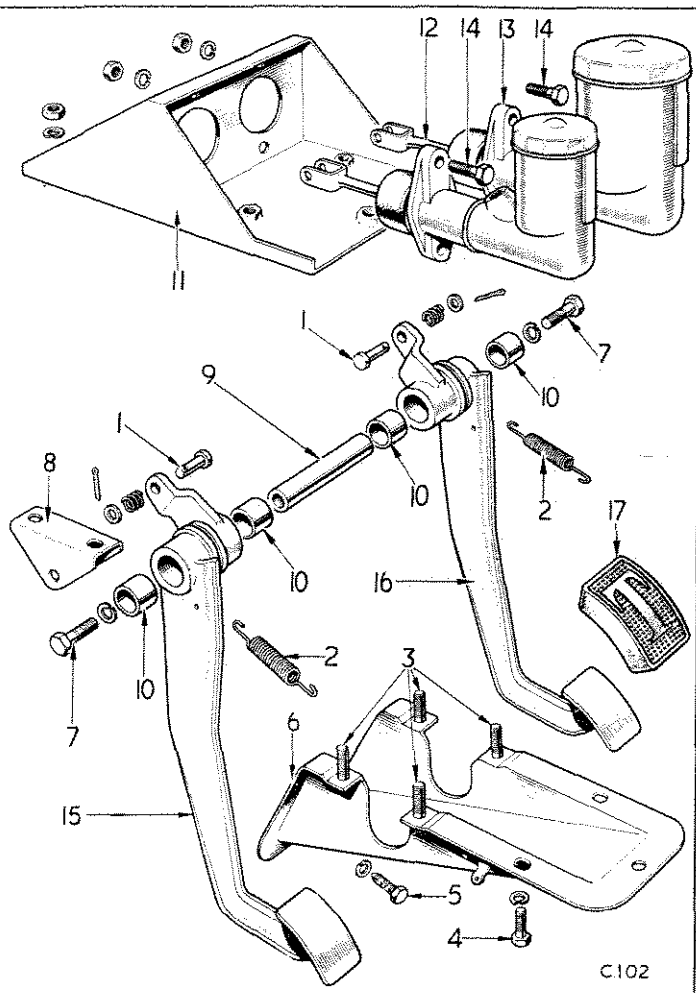


Fig. 16. Clutch and brake pedal details

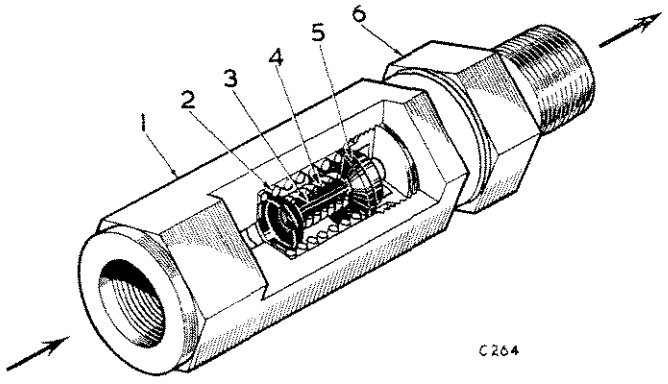


Fig. 17. Section through brake restrictor valve

Brake and Clutch Pedals

To Renew Bushes

1. Remove clevis pins (1).
2. Remove pedal return springs (2).
3. Remove four nuts from the studs (3) and three setscrews (4) and setscrews (5).
4. Detach the complete brake pedal assembly from beneath the bulkhead.
5. Detach the pedal shaft cover (6) from the pedal assembly.
6. Remove setscrews (7) and detach pedal shaft support brackets (8).
7. Detach pedals from pivot shaft (9).
8. Renew the pedal bushes and re-assemble the components by reversing the dismantling sequence.

Brake Restrictor Valve

A restrictor valve is fitted between the pipeline from the brake master cylinder and the 5-way union. The restrictor maintains a low pressure in the hydraulic system to prevent the disc brake pads and pistons moving away from the disc and causing excessive brake pedal travel at the next application of the brakes.

The restrictor valve consists of a body (1) and end cap (6) containing a spring loaded valve assembly. Operation of the brake pedal causes the hydraulic fluid to compress the spring (3) and lifts the valve (5) from its seat against the disc (4). Fluid is then displaced through the pipe lines and applies the brakes.

When the brake pedal is released the resultant differential pressure acting on the disc (4) causes it to lift off its seat, compressing the spring (2). When the differential pressure falls to a point when the spring pressure (2) is greater than the force applied to the disc (4) by the returning fluid, the disc returns to its seat and maintains a low pressure in the hydraulic system.

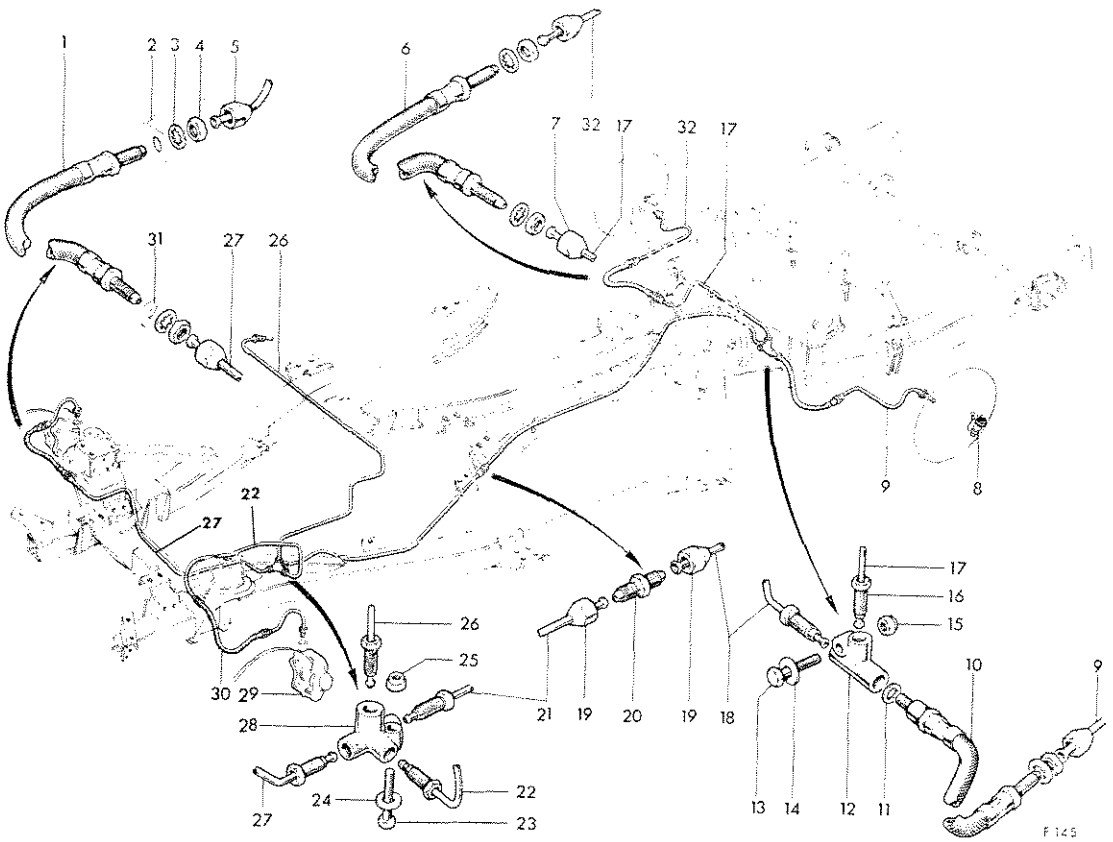


Fig. 18. Hydraulic Pipes and Couplings (TR.4A I.R.S. — R.H.D.)

1 R.H. front flexible hose
2 Support bracket — hose to caliper
3 Shakeproof washer
4 Nut
5 Tube nut — female
6 R.H. rear flexible hose
7 Tube nut — female
8 Wheel cylinder — L.H. rear
9 Pipe — hose to L.H. rear cylinder
10 L.H. rear flexible hose
11 Copper washer
12 Three-way union
13 Bolt
14 Washer
15 Nyloc nut
16 Tube nut — male
17 Pipe — three-way to R.H. rear hose
18 Pipe — three-way to connector
19 Tube nut — female
20 Pipe connector
21 Pipe — connector to four-way union
22 Pipe — four-way to L.H. front hose
23 Bolt
24 Washer
25 Nyloc nut
26 Pipe — four-way to master cylinder
27 Pipe — four-way to R.H. front hose
28 Four-way union
29 Disc brake caliper — L.H. front
30 L.H. front flexible hose
31 Bracket welded to chassis
32 Pipe — hose to R.H. rear cylinder