SECTION C.

FRONT SUSPENSION

LIST OF ILLUSTRATIONS

C.1. - GENERAL DESCRIPTION

The front suspension is of the fully independent type with unequal length upper and lower wishbones, incorporating coil springs and damper units.

A stub-axle carrying the hub assembly is bolted into the vertical link, which in its turn carries the outer ends of the wishbones, the steering arms and the brake calipers. The vertical link, lower trunnion into which it is fitted, steering arm and front hub are all handed, therefore care must be taken when fitting replacements. The wishbones are not handed, but upper and lower halves are of different lengths.

An anti-roll bar is attached to the chassis by rubber insulated links, and is connected at both ends to the lower ends of the dampers.

C.2. - SUSPENSION AND STEERING GEOMETRY

Under normal service conditions, the only item requiring attention is the front wheel alignment. The necessity for a full geometry check is required following rectification of repair damage to the front suspension or steering, or if excessive tyre wear is evident, or steering difficulties are experienced.

The only angles which are adjustable are those for the wheel alignment, the castor, camber and steering axis inclination being set in production and are non-adjustable.

Preparation of Vehicle

When checking suspension (front or rear) and steering geometry, the following requirements must be met:-

1. The vehicle should be on a perfectly level floor and in such a position that will permit some forward movement, this being necessary for certain types of checking equipment.
2. The tyres must have the same amount of wear and be inflated to the normal running pressures (see 'Technical Data').
3. The front hub bearings must have the correct amount of end-float (see 'Technical Data').
4. The vertical link trunnion bushes and steering arm bushes (to steering rack) must be in good condition with no undue wear or mal-adjustment.
5. The wheels must be checked for 'run-out' (see Section 'G'). The points of maximum 'run-out' should be positioned so that they are clear of the contact points on the checking gauge.

6. Move the car backwards and forwards to settle the front wheels in the straight ahead and true running attitude; the camber angle and front wheel alignment can now be checked.

7. With the vehicle standing on its wheels, insert wood blocks beneath each front lower wishbone fulcrum and beneath each rear chassis leg adjacent to the wishbone pivot but NOT touching the pivot. Load the vehicle with weights on the front and rear centre line until the blocks are just nipped, not bearing heavily down. The height dimensions of the blocks should be:-

Front 6.125 in. (15.5 cm.)
Rear 6.00 in. (15.2 cm.)

8. Place one of the turntables with its lock pin in position, in the front centre of each front wheel. The run-on ramps should be positioned at the rear of the turntables (in front of wheel).

9. The other run-on ramps should be at the front of each rear wheel, so that, when the front wheels are on the turntables, the vehicle will be level. The run-on ramps will not be required if the turntable gauges are sunken flush with the floor level.

10. Keeping the front wheels in the straight-ahead position, slowly move the car on to the turntables so that the centre of the wheels are over the centre of the turntables.

11. Attach the special clamping device to lock the wheels.

Tools and Appliances

There are many different types of tools and appliances available for checking front suspension and steering geometry, but only a reputable brand should be used.

Whatever the equipment used, the manufacturer's instructions must be carefully observed and the vehicle must be loaded with the weights shown.

The equipment for checking front suspension and steering geometry shown here is obtainable from Dunlop Co.Ltd.

The equipment required for geometry checks is as follows:-

Optical wheel alignment gauge (Dunlop 'AGO/30').

Camber, castor and steering axis inclination gauges (Dunlop 'CG/4-5').

Front wheel turntable gauges with wheel ramps to suit.

The ramps are used to keep the car on a level plane, but will not be necessary if the turntable gauges are sunken flush with the floor (part of Dunlop 'CG/4-5' kit).

Front Wheel Alignment

The front wheels are considered to toe-in when the setting of the front wheels is

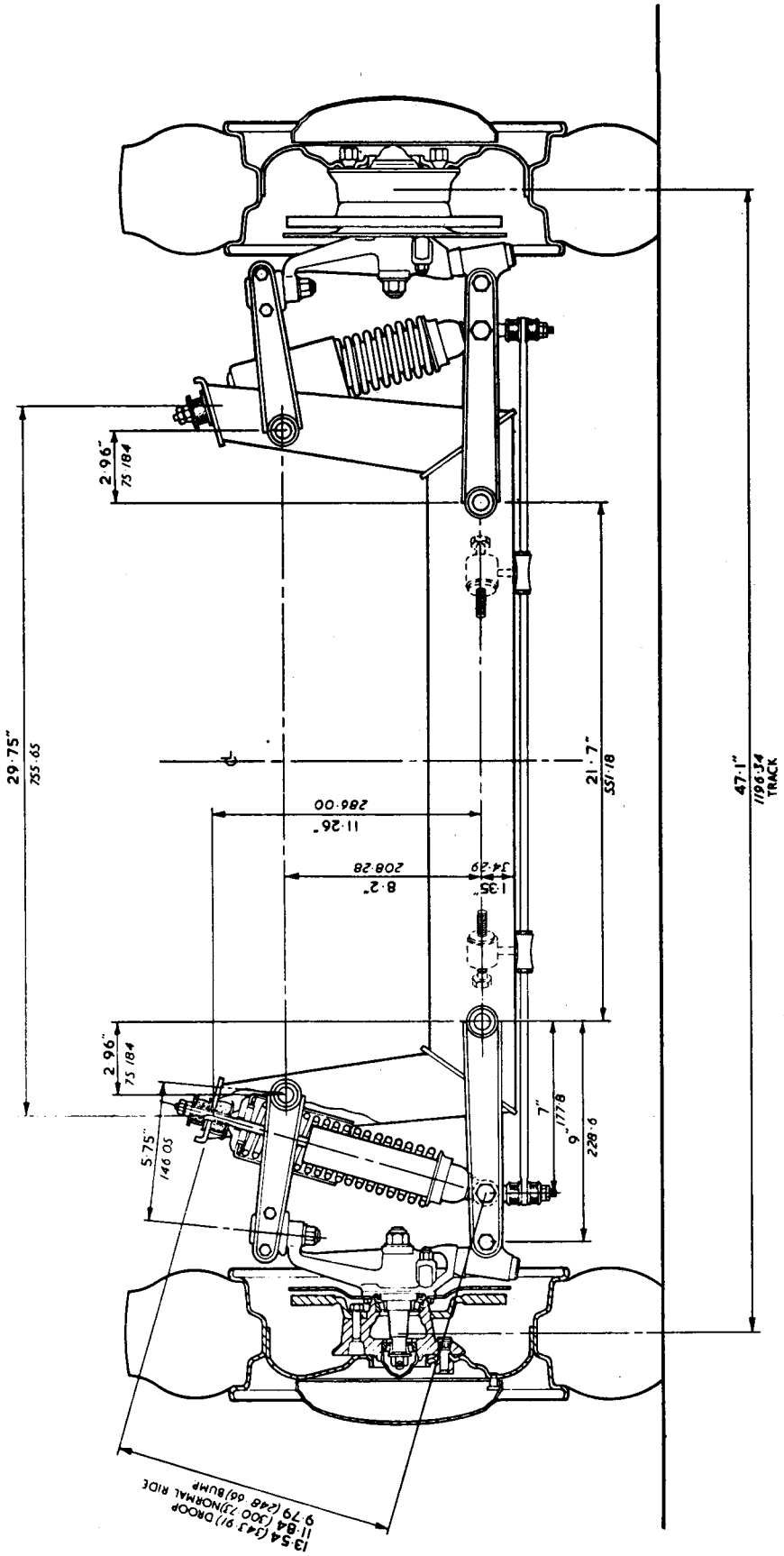

Fig. 1. GENERAL ARRANGEMENT OF FRONT SUSPENSION

36-C8.

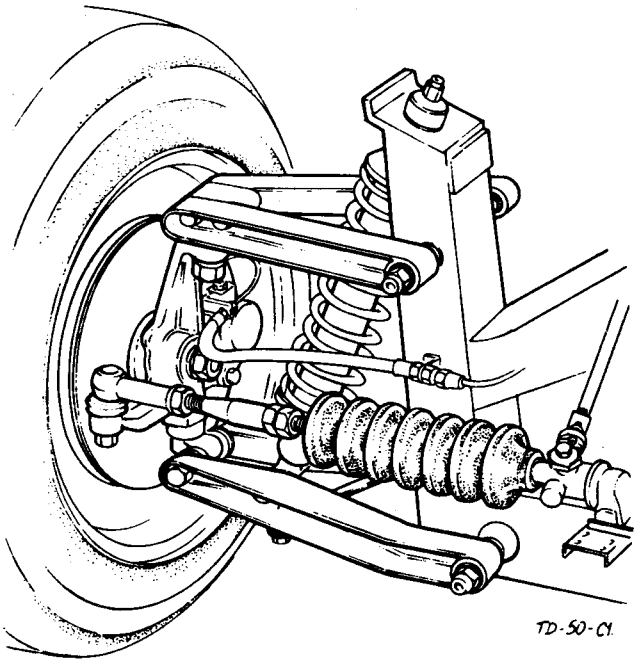

Fig. 2. LAYOUT OF FRONT SUSPENSION

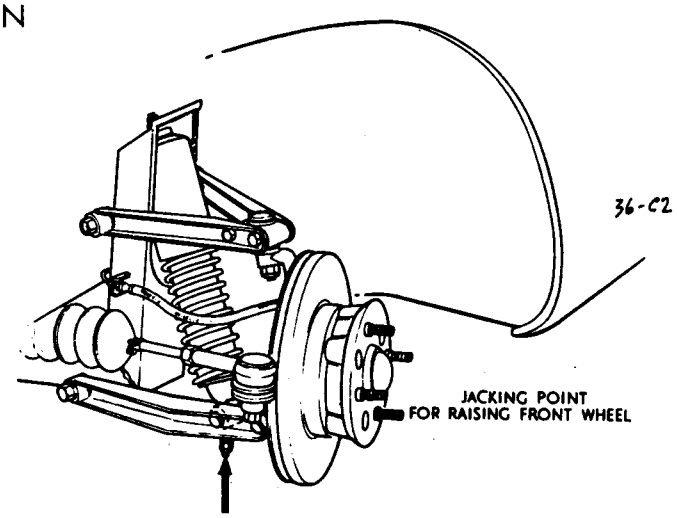

Fig. 3. JACKING POINT

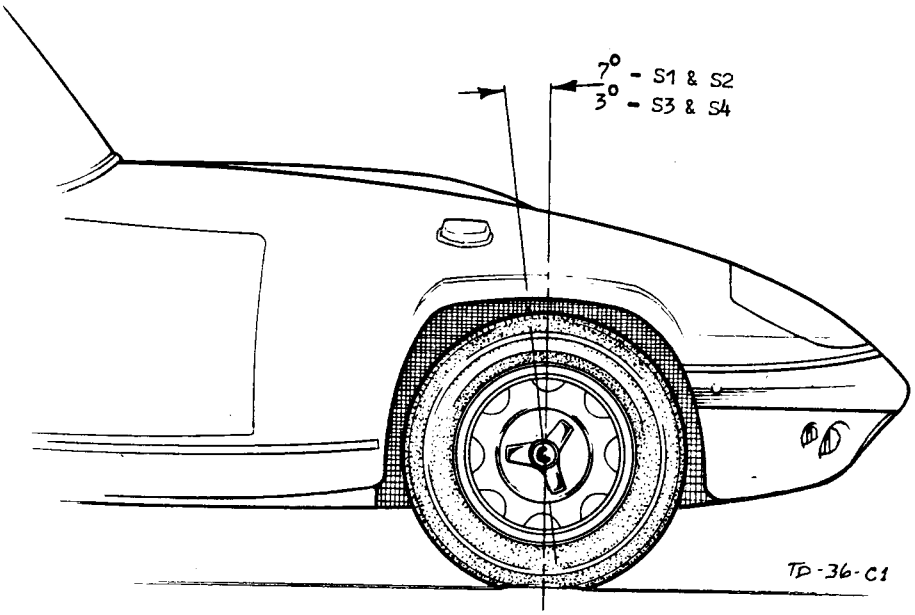

Fig. 4. CASTOR ANGLE

such that the distance between the front of the wheels is less than that at the rear of the wheels, when measured in the same plane. The correct 'toe-in' is given in 'Technical Data'.

1. Prepare the vehicle in the manner described under 'Preparation of Vehicle'.
2. Set the front wheels in the straight ahead position.
3. Check the front wheel alignment with a suitable checking gauge.
4. If the alignment is such that the amount of toe-in is incorrect, slacken the tie-rod locknuts at both ends of the steering rack and clips securing the outer ends of the bellows.
5. Rotate BOTH tie rods EQUAL amounts by hand or with suitable 'grips', in the appropriate direction until the correct amount of toe-in is obtained. Rotate the wheels through 180° and take a second check. Adjust the tie-rods to the mean of the two readings, thus allowing for wheel rim run-out.
6. Finally, lock the tie-rods in position, taking care not to alter the setting. Re-tighten the bellows clips.

Front Wheel Camber Angle

This is the angle of inclination of the road wheel from the vertical when viewed from the front (see Fig.1.). Inclination outwards at the top of the wheel is termed 'positive camber', and inclination inwards is termed 'negative camber'. If the road wheel is set vertically, the camber will be zero.

This angle is non-adjustable, but should be checked in the event of accident damage or if steering difficulties are experienced (see 'Technical Data').

1. Prepare the vehicle in the manner described under 'Preparation of Vehicle'.
2. Apply a suitable checking gauge and note the reading. If the camber is incorrect, check the stub axle for distortion, and ball pins, trunnions and bushes for wear.

Castor Angle

Viewed from the side of the vehicle, this is the angle at which the pivoting axis of the front suspension assembly is inclined from the vertical. Inclination rearwards is termed 'positive castor', and inclination forwards is termed 'negative castor'. If the pivoting axis is vertical, the castor will be zero.

This angle is non-adjustable, but should be checked in the event of accident damage or if directional instability is experienced (see 'Technical Data').

1. Prepare the vehicle in the manner described under 'Preparation of Vehicle'.
2. Using the Dunlop equipment mentioned under 'Tools and Appliances', fit the gauges

with the castor dial to the left of spindle and secure with knurled knob. The gauge should be set horizontal.

3. Remove lock pins and adjust turntable scales to ZERO.
4. Steer the wheel 20° IN (right-hand wheel to left, or left-hand wheel to right).
5. Set both castor and k.p.i. gauge dials to ZERO.
6. Centre the bubble in level by turning lower knurled screw.
7. Steer the wheel 20° OUT (opposite lock).
8. Centre the bubbles in the levels. Note that the k.p.i. gauge has two scales on its dial (blue R/H wheel, red L/H wheel), arrows indicating in which direction the dial should be turned for the particular wheel position.
9. If the castor angle is incorrect, check that the wishbones mounting pins, vertical link, lower trunnion and upper ball joint with their associated parts are secure and not damaged.

Steering Axis Inclination (K.P.I.)

Viewed from the front of the vehicle, this is the angle at which the pivoting axis of the front suspension assembly is inclined inwards from the vertical. (See Fig.1.).

This angle is non-adjustable, but should be checked in the event of accident or if steering difficulties are experienced (see 'Technical Data').

1. Prepare the vehicle in the manner described under 'Preparation of Vehicle'.
2. Apply the checking gauge as described under 'Castor Angle' and note the gauge reading.
3. If the steering axis inclination is incorrect, check the wishbones to vertical link mounting points for wear or looseness.

NOTE:- Whilst the checking of the camber, castor and steering axis inclination angles are described separately, they are, in fact, a combined operation.

C.3. - ANTI-ROLL BAR

To Remove

1. Release the locknut, followed by the nut and washers securing the roll bar to the lower ends of the damper units. Push the bar down clear of the dampers.
2. From the rear of the bar, release the nuts and bolts securing the links to the chassis.

To Replace

1. Replacement is a direct reversal of the removal procedure, except that it is important to note the supporting links for the anti-roll bar are handed (Part No. 26 C 005L/H and 26 C 006R/H).

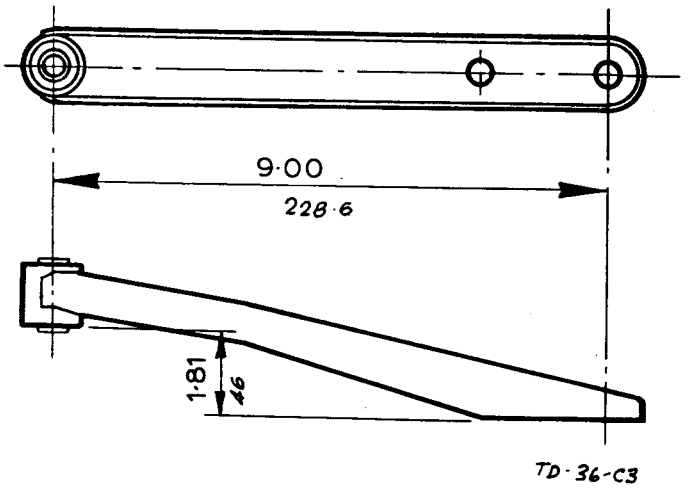

Fig. 5. LOWER WISHBONES

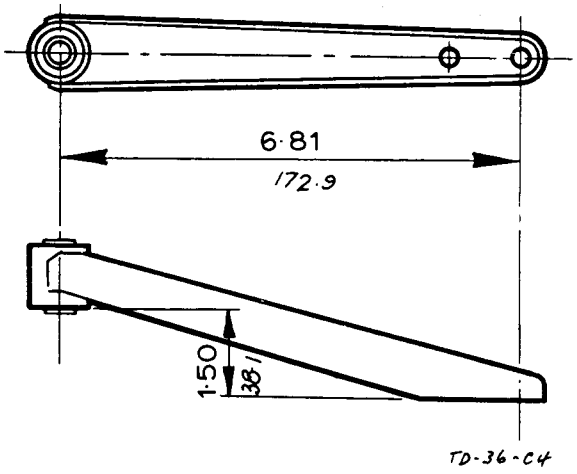

Fig. 6. UPPER WISHBONES

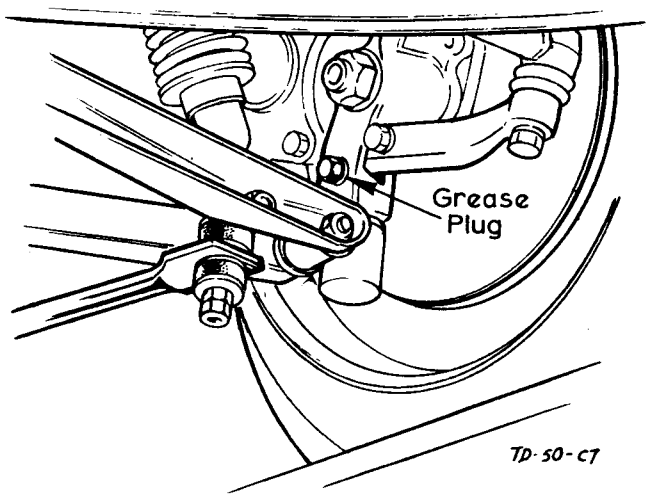

Fig. 7. VERTICAL LINK GREASE POINT

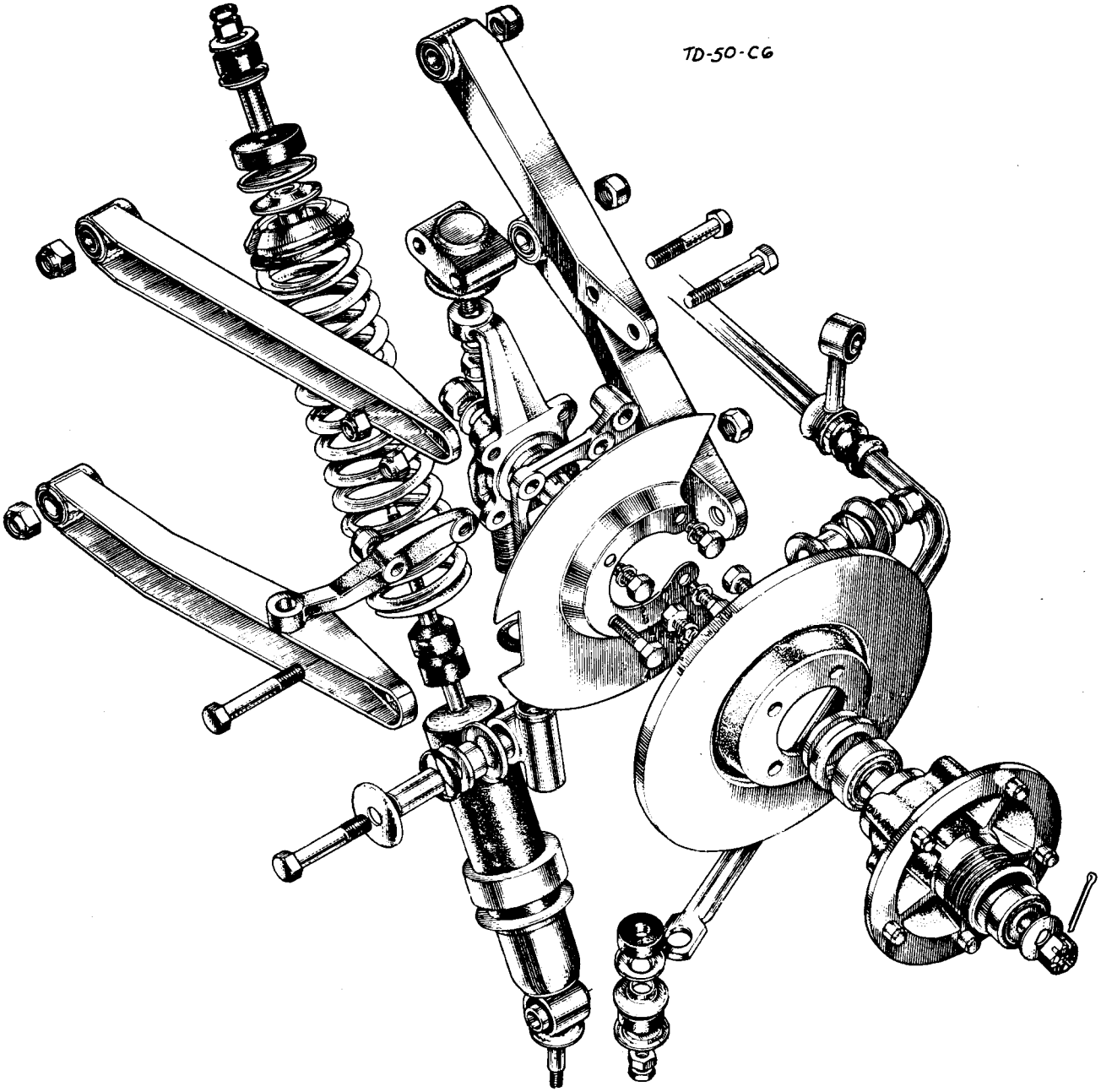

Fig. 8. FRONT SUSPENSION COMPONENTS

2. When replacing roll bar ends to the dampers, the sequence of fitting is:-
Washer, bush, washer roll bar, washer, bush, washer, nut, locknut.

C.4. - LOWER WISHBONES

To Remove

1. Remove the road wheel on the side of the vehicle from which the wishbones are to be removed (see Section 'G').
2. Release the nut and remove the bolt securing the damper to the wishbones .
3. Release the nut and remove the bolt securing the wishbones to the lower trunnion. Push the wishbones down and remove bolt after releasing the nut securing the wishbones to the chassis.

To Replace

1. Reverse the removal procedure, tightening all bolts to the toque loadings given in 'Technical Data', with the car in the normal ride position.

C.5. - UPPER WISHBONES

To Remove

1. Remove the road wheel (see Section 'G').
2. Release the nuts and remove the bolts securing the outer ends of the wishbones to the upper ball joint.
3. Remove the nuts securing the inner ends of the wishbones to the chassis fulcrum pin.

To Replace

1. Reverse the removal procedure, tightening all bolts to the torque loadings given in 'Technical Data', with the car in the normal ride position.

C.6. - WISHBONE BUSHES

1. Remove the wishbones (Section 'C.4.' and 'C.5.').
2. Using a suitable pilot drift, the outer periphery of which must bear on the outer sleeve of the bush, press out the bush.

To Replace

1. Reverse the removal procedure.

C.7. - DAMPER AND SPRING

To Remove

1. If it is required to replace either the damper or the spring, it is recommended that the complete assembly be removed.
2. Remove the anti-roll bar securing nuts to the dampers (Section 'C.3.').

3. Remove the outer ends of the lower wishbones (Section 'C.4.').
4. From the upper end of the damper, release the locknut, nut and washers securing the damper to the chassis. Do not misplace the washers from the top of the damper spindle (between top of damper and chassis) when removing the damper.
5. Using a suitable tool, compress the road spring and clamp in the compressed position. Lift off the top spring abutment (which is slotted to clear the damper spindle) and its rubber ring. Pull off the spring, bump rubber and lower rubber distance ring. There is no necessity to remove the rubber sleeve from the damper body as all new dampers are supplied with the rubber sleeve fitted.

To Replace

1. Push the rubber distance ring fully down to the shoulder on the damper body. Push the bump rubber down the damper spindle until it abuts the damper body. Place the compressed spring in position, followed by the rubber ring and top spring abutment. Slowly release the compression from the spring until the top abutment is correctly located (with its spigot inside the top coil of the spring).
2. Replace the seat, washer and mounting rubber to the damper spindle. Insert damper spindle through mounting hole in chassis and replace cup washer (belled end towards chassis), mounting rubber, cup washer (belled end uppermost) nut and locknut.
3. Replace the outer ends of the lower wishbones to the damper trunnion.
4. Replace the ends of the anti-roll bar to the lower ends of the dampers.

NOTE:- Longer springs, which increase the front ride height to suit all market requirements are available from the Parts Division of Lotus Cars (Service) Ltd. These springs (Part No. 26 C 010A) must be used in pairs when fitted as replacements.

C.8. - VERTICAL LINK

To Lubricate

1. At the lower end of the inner face of the vertical link, immediately above the trunnion is a hexagon headed plug, which should be removed and a screwed grease nipple fitted at intervals of every 6,000 miles (10,000 km.).
2. Replace blanking plug after lubricating the lower steering swivel (trunnion). See Section 'O' for recommended lubricant.

To Remove

1. Remove the front hub from the side of the car on which it is desired to remove the vertical link (see Section 'G').
2. Release the steering rack ball-joint (see Section 'H').

3. Remove the brake caliper (see Section 'J').
4. Release the outer ends of the lower (Section 'C.4.') and upper (Section 'C.5.') wishbones and remove vertical link.
5. If the stub axle is damaged, this can be removed and a new part fitted by releasing its nut and washer. The stub axle is held by a taper in the vertical link.

To Replace

1. Replace the stub axle (see paragraph '5' above).
2. Attach the upper end of the vertical link (ball joint) to the outer ends of the upper wishbones and the lower end (trunnion) to the lower wishbones. Attach the damper to the lower wishbones.
3. Replace the brake caliper and the steering rack ball joints.
4. Replace front hub.
5. Tighten all bolts to the loadings given in 'Technical Data'.

C.9. - UPPER BALL JOINT

To Remove

1. Loosen the nut securing the ball joint to the vertical link, but do not yet remove.
2. Remove the bolts securing the outer ends of the upper wishbones to the ball joint and push wishbones down clear of the joint.
3. Using a hide-faced hammer, tap the underside of the ball joint to free its taper, hitting the nut to avoid damage to the thread. Remove nut and release ball joint.

To Replace

1. Replacement is a direct reversal of the removal procedure.
2. Tighten nut to loading given in 'Technical Data'.

C.10. - LOWER TRUNNION

To Remove

1. Remove the vertical link (Section 'C.8.').
2. Remove the bolts securing the brake disc dust cover, brake caliper mounting plate and steering arm to the vertical link (4 bolts).
3. Unscrew the trunnion from the vertical link. Remove the dust seal.

To Replace

1. Using a '90 EP' gear oil, adequately lubricate the trunnion before reassembling to the vertical link, after first fitting the dust seal. Ensure damper mounting hole is parallel to the caliper mounting plate flange.

2. Carry on with remainder of assembly by reversing the removal procedure. Tighten all bolts to the loadings given in 'Technical Data'.

C.11. - SUSPENSION SECURING NUTS.

Commencing at Chassis No.8797 all suspension securing nuts have been changed from 'Stover' type to 'Nyloc' type.

It is important to note that where nuts are tightened, then loosened, again tightened (as when setting-up the suspension), this process can with a 'Stover' nut strip the threads from the bolt, the nut when being re-tightened having a tendency to cut its own thread.

When a 'Stover' nut is removed for replacing with a 'Nyloc' nut, the bolt also MUST BE REPLACED.