

S E C T I O N 9

S T E E R I N G G E A R

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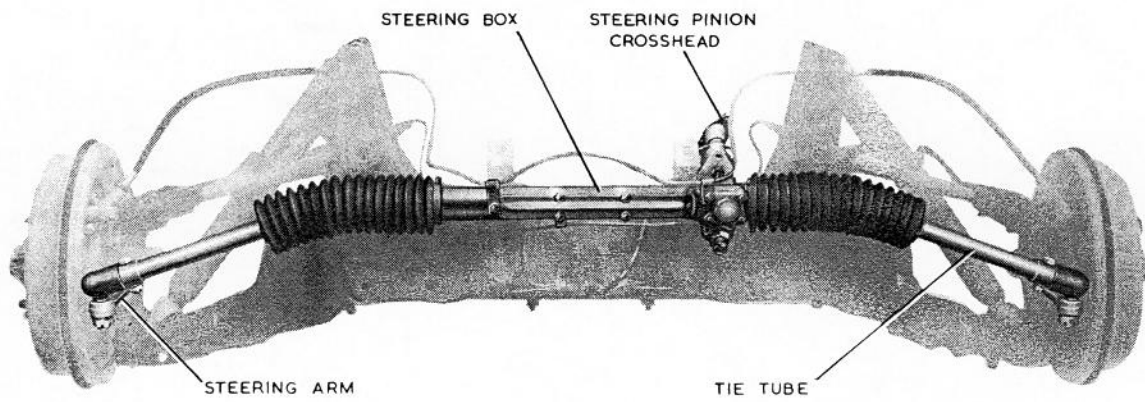


Fig.1 Steering box and tie rods.

S T E E R I N G G E A R

DESCRIPTION

The steering gear comprises three major items, i.e. the steering column, the steering box and the tie tubes together with the steering arms.

The steering wheel is serrated to the column and has a friction type adjustment which enables the wheel to be set at any position within its range of travel, see Fig. 3. The horn press button is mounted centrally in the wheel. The steering column mounting bracket (secured below the dashboard) incorporates a spherical housing which accommodates an insulated sleeve secured to the column; the horn cable emerges from the column immediately below the insulated sleeve to which it is secured by a clip.

A flexible coupling secured to the bottom of the column engages with the cross-head of the steering box.

The steering box assembly is bolted to the front face of the chassis front cross member, see Fig. 1. The pinion shaft is mounted in an eccentric bush which provides for adjustment of the backlash. A thrust washer is interposed between the pinion and the lower end of its bush and the end-float of the shaft can be adjusted by an adjusting bolt fitted to the lower end of the box.

Radial location of the rack in the box is ensured by a special locating bolt, the shank of which fits in a hole in the rack while the head engages a transverse slot in the box; this also limits the travel of the rack. At the

point of rack and pinion engagement, a spring-loaded pressure block assembly engages the rack and functions as a damper. Lubrication of the steering system is provided by the "One-shot" chassis lubrication system, see Section 11.

The tie tubes are attached to the ends of the rack and to the steering arms by spring-loaded ball and socket joints, the ball bolt fitted to the rack being adjustable. The outer ball joint is enclosed in an oil retaining sleeve and the inner by a telescopic rubber sleeve.

GENERAL DATA

Type...	...	...	...	...	Rack and pinion.
Wheel lock angles..	...	...	...	...	35° each way.
Front wheel alignment	...	...	...	...	0 to 0.1 in. (2.54 m.m.) "toe in".
Front wheel "toe out" on turns.	...	...	...	...	Nil at 20° outer wheel angle.
Backlash between rack and pinion	...	...	...	...	Nil with rack centralised.
Rack travel (controlled by rack locating bolt)	...	...	...	...	7.415 in. (18.834 c.m.).
End-float of pinion shaft	...	...	...	...	Nil.
Clearance of pinion shaft in steering box.	...	...	...	...	New 0.0007 in. (0.02 m.m.) to 0.0035 in. (0.09 m.m.). Worn 0.005 in. (0.13 m.m.).
Steering wheel					
Diameter..	...	...	...	...	17 in. (43.18 c.m.).
Type	...	...	...	...	3 spoke.
Turns (lock to lock)..	...	...	...	...	3.
Torque loading of pinion adjuster bolts..	...	...	...	...	10 to 15 lb. ft. (14.88 to 22.32 kg/m).
Torque required to move steering gear	...	...	...	...	2 lb.ft. (2.97 kg/m).
Torque loading of steering column mounting bracket retaining screw	...	...	...	...	26 lb.ft. (38.69 kg/m).

ADJUSTING STEERING BOX IN SERVICE

To check the end-float of the pinion shaft and the backlash of the pinion and rack, proceed in the following manner :-

1. Raise the bonnet.
2. Apply the hand brake and jack up the front of the car with the jack located under the centre of the chassis front cross member. Avoid damage to the pipes of the brake system.
3. Remove the dynamo to permit access to the pinion shaft bush retainer, then remove the right-hand road wheel. Release the clip securing the telescopic sleeve to the steering box and withdraw the sleeve sufficiently to reveal the end face of the steering box and the rack.
4. Test for pinion end-float by lightly pushing and pulling on the steering wheel with the steering box rack at approximately the full lock position. To avoid confusing movement of the flexible coupling with end-float of the pinion shaft, check by feeling the pinion shaft relative to the bush retainer, while an assistant performs the light pushing and pulling operation at the steering wheel. Eliminate any end-float by loosening the adjuster locknut, screwing in the adjuster to take up the end-float and securing the adjuster with its locknut when the adjustment has been completed.
5. Release the tabwashers and slacken the bolts securing the pinion adjuster.
6. Turn the steering wheel until the shoulder of the rack at the opposite end to the pinion location is aligned with the machined end face of the steering box, thus centralising the rack in the box, see Fig.2.
7. Rotate the pinion adjuster slowly until the backlash between the rack and pinion is eliminated.
8. Tighten the bolts evenly and diagonally to the torque loading given in the General Data but do not lock the bolts with the tabwashers at this stage.

Caution :- Do not exceed this torque loading or the bush may tighten on the pinion and turn in its housing.

9. Secure a spring balance to the end of one of the steering wheel spokes and, pulling tangentially and steadily on the balance, check that the load required to move the steering gear does not exceed the figure quoted in the General Data. When this test has been passed satisfactorily, lock the pinion adjuster retainer bolts with the tabwashers. If the load is excessive, slacken the adjuster slightly to relieve pressure on the pinion and re-test. If still outside the limit when tested, re-set the backlash as detailed in paras, 5, 6, 7 and 8, and again re-test.
10. Re-position the telescopic sleeve and secure it to the steering box with its clip. Replace the road wheel.
11. Refit the dynamo and adjust the belt correctly (see Section 2).
12. Lower the bonnet and remove the jack from the front of the car.

REMOVING AND REFITTING STEERING WHEEL AND COLUMN

1. Withdraw the horn button assembly from the centre of the steering wheel and disconnect the cable. The assembly can be withdrawn by hand.
2. Remove the spring clip from the top of the steering column. Slacken the adjusting nut on the steering wheel fairing, then withdraw the steering wheel as shown in Fig. 3. Withdraw the end cap, spring strip, splined end cap and distance piece from the column.
3. Remove the nut, shake-proof washer, horn cable, bolt, insulating washers and the insulating tube, then detach the steering column bracket from its mounting beneath the dashboard.
4. Disconnect the cable from the sleeve clip and remove the clip. Disconnect also the cable from the side of the bracket. Slide the bracket, complete with spherical housing and insulating sleeve, from the column.
5. Detach the steering column from the flexible coupling, detaching one end of the earthing connection.
6. Pull the steering column into the body of the car until the cross-head is clear of the engine mounting and dynamo. Lower the inner end of the column and pull it (from the cross-head end) until it is clear of the draught excluder.

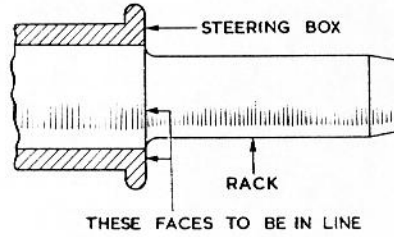


Fig. 2 Central position of rack.

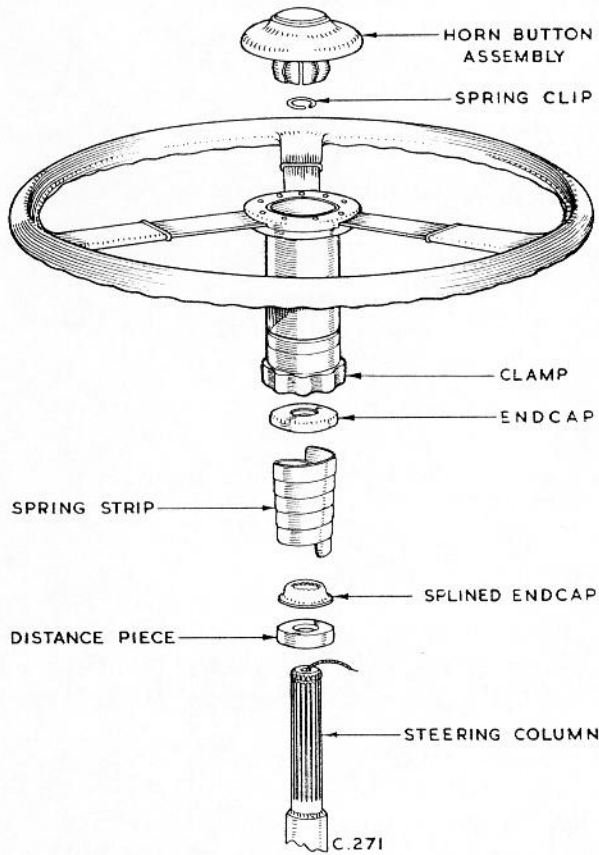


Fig. 3 Steering wheel fitments.

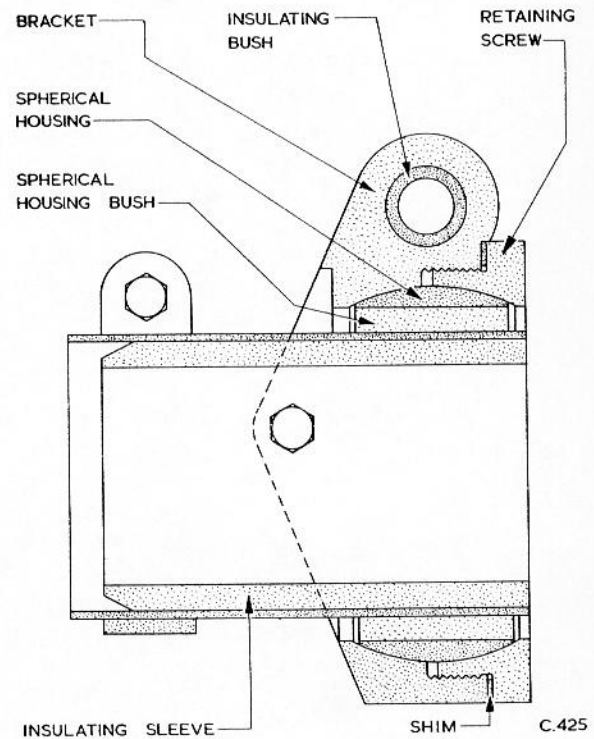


Fig. 4 Mounting bracket details.

If it is desired to dismantle the steering column bracket, proceed as follows. Using a suitable "C" spanner, unscrew the retaining screw, taking care to preserve the shims fitted between the bracket and screw. Separate the bracket, spherical housing and bush, sleeve and insulating sleeve, see Fig.4. If the spherical housing bush is unserviceable, remove it from the housing with a suitable drift.

Check that all parts are clean and serviceable, then re-assemble the bracket in the following manner. If a new spherical housing bush is to be fitted, assemble the bush on the shank of a shouldered drift turned to a diameter of 1.5005 in., and press the bush into the spherical housing. Fit the spherical housing to the bracket then screw in the retaining screw with sufficient shims interposed so that the housing is just free to move when the retaining screw is torque tightened to the figure quoted in the General Data. Assemble the sleeve and insulating sleeve to the spherical housing bush. Assemble the sleeve retaining clip loosely to the sleeve.

Refit the steering wheel and column in the following manner :-

1. Insert the serrated end of the steering column in the bore of draught excluder and into the body of the car until the cross-head flange is clear of the engine mounting and dynamo. Raise the serrated end of the column and push the column back through the draught excluder until the cross-head abuts the flexible coupling.
2. Secure the cross-head of the column to the flexible coupling with split-pinned nuts, bolts and washers, fitting the free end of the earth connection beneath the head of one of the bolts.
3. Pass the bracket assembly (retaining screw uppermost) over the end of the column and slide it into position.
4. Secure the bracket to its mounting beneath the dashboard with its insulating washers, tube, bolt, shake-proof washer and nut, then tighten the clip, fitting the horn cable beneath the nut.

5. Connect the other cable to the side of the bracket where it is retained by a 4 B.A. bolt, nut and shake-proof washer.
6. When fitting the steering wheel, adjust the column so that the road wheels are in the "straight ahead" position, then fit the steering wheel in the position which does not obstruct the instrument panel, i.e. the two upper spokes forming a "V". Fit the circlip. Adjust the wheel position then secure it by tightening the adjusting nut.
7. Connect the cable to the horn button and press the button assembly into position in the centre of the steering wheel.

REMOVING AND REFITTING STEERING BOX

Raise the front of the car to permit access to the steering box.

1. Disconnect the two lubrication pipes from the unions on the steering box and the header, remove the pipe clip from the locating bolt cover plate, then withdraw the pipes.
2. Remove the clips and withdraw the telescopic sleeves from each end of the steering box. Note the position of the tie tube locknuts (i.e. count the number of threads exposed) then slacken the locknuts and unscrew the inner ball bolts from the rack.
3. Withdraw the split pins and remove the nuts, bolts and washers securing the steering column flexible mounting to the crosshead of the pinion shaft. One end of the earthing connection is fitted beneath one of the nuts.
4. Remove the four 7/16in. B.S.F. bolts and washers and detach the steering box from the front cross-member of the chassis.

Before commencing to refit, ensure that the mating faces of the steering box and front cross-member of the chassis are clean, then proceed as follows :-

1. Secure the box in position with four 7/16in. B.S.F. bolts and shake-proof washers.

2. Check that the torque load applied at the pinion shaft cross-head to operate the rack does not exceed $1\frac{1}{2}$ lb.ft. If a greater torque loading is required to operate the rack, it is probable that slight distortion of the chassis front cross-member is being transmitted to the steering box. Loosen the four securing bolts slightly and check with feeler gauges between the feet of the steering box and their location on the cross-member to determine the extent of the distortion. Shims 0.002in. (0.05 m.m.) and 0.003in. (0.08 m.m.) thick are available; use these to obtain the correct alignment.
3. When this is satisfactory, screw the inner ball bolt of each tie rod into the rack to the setting noted prior to removal. This will minimise adjustment to the tracking which must be made as described in Section 7. When a satisfactory adjustment has been made, secure the ball bolts with their locknuts and check through the inspection hole that there is full thread engagement.
4. With the steering box now connected to the front suspension and wheel hub units, repeat the torque load check; the rack must operate within the torque loading quoted in the General Data. Make this second check with the suspension gaiters and the telescopic sleeves disconnected. If the maximum load is exceeded, check the fit of the swivel pins in the stub axles as described in Section 7.
5. When the check is satisfactory, refit the gaiters to the suspension and the telescopic sleeves to the steering box.
6. Connect the two lubrication pipes to the box and to the header. Remove the cover plate from the steering box and operate the "One-shot" lubrication system pedal until oil begins to pour from the box. This "bleeding" will ensure that the pipes are primed. Refit the cover plate, and secure the pinion supply pipe clip to its left-hand lower securing stud.
7. Finally re-connect the flexible coupling to the pinion shaft cross-head with two 5/16in. B.S.F. bolts, washers, nuts and split pins, fitting the earthing connection beneath one of the nuts.

DISMANTLING AND RE-ASSEMBLING STEERING BOX

Referring to Fig.5, proceed as follows :-

1. Remove the nuts and spring washers and detach the cover plate and gasket; withdraw the locating bolt from the rack.

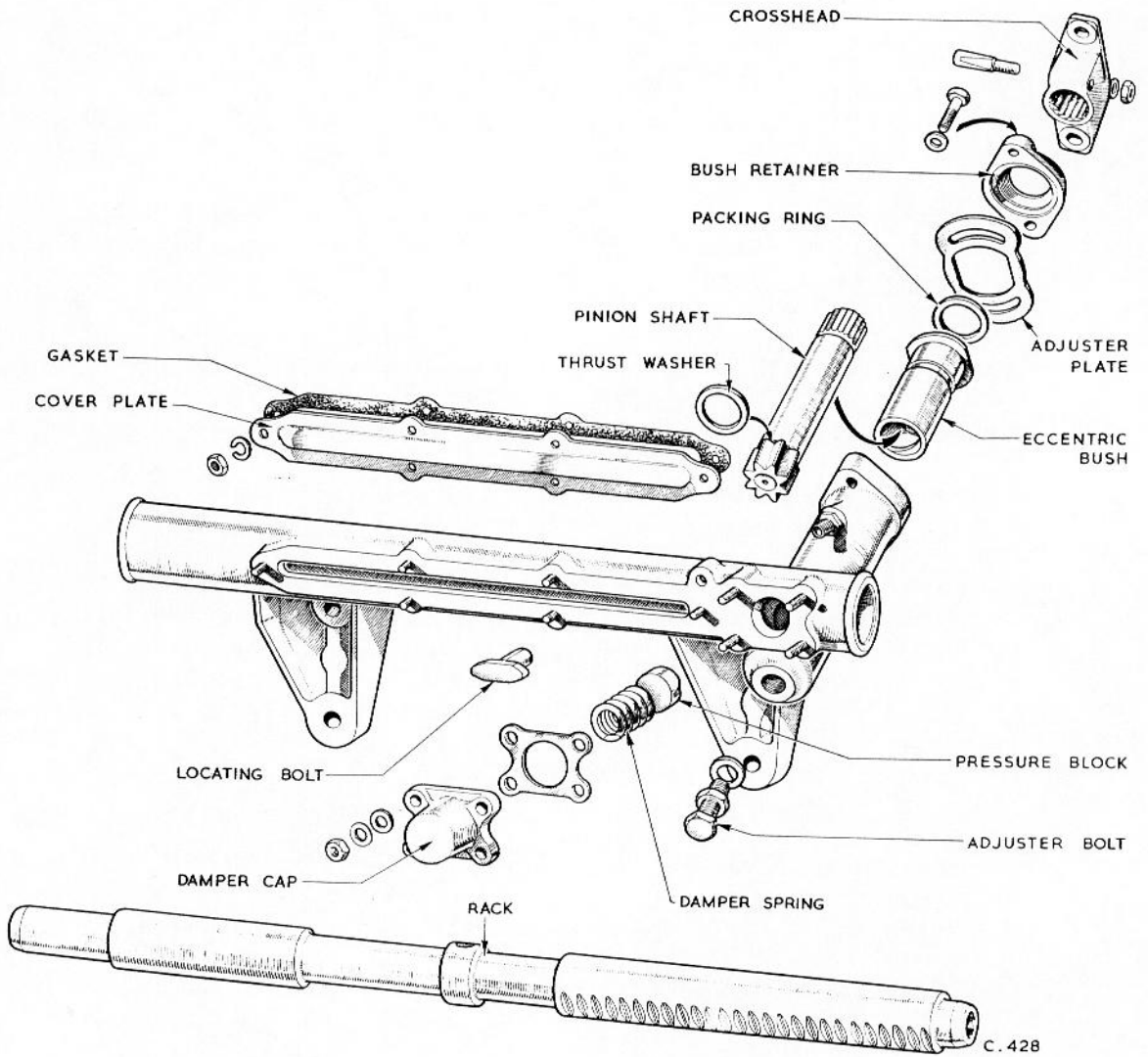


Fig.5 Steering box assembly.

2. Unscrew the damper cap nuts evenly and diagonally to ease the tension on the damper spring then remove the cap, gasket, spring and pressure block, and if fitted, the damper cap packing washer.
3. Withdraw the rack from the opposite end of the steering box to that mounting the pinion shaft.
4. Remove the nut and washer, tap out the cotter then detach the cross-head from the serrations of the pinion shaft. Release the lock-washers and remove the two 5/16in. B.S.F. set-bolts and detach the pinion adjuster bush retainer and packing ring.
5. Remove the pinion shaft end-float adjuster bolt and its locknut and washer, then withdraw the pinion shaft, complete with thrust washer and eccentric bush. Separate these components.

Before re-assembly, ensure that all parts are clean and serviceable and that the oil passages are free from obstruction. During assembly, lubricate the rack and pinion shaft with approved oil.

Note :- If a new rack or steering box is to be fitted, make checks 1, 2, 3 and 4 detailed subsequently during assembly. If the original rack and steering box are to be fitted, but with a new damper unit, omit check 1. When all the original parts are to be assembled, omit checks 1, 2 and 3 but always make check 4.

Position the rack in the steering box before commencing each check so that the rack protrudes as far as possible at the end of the steering box opposite to the pinion location. Attach a suitable spring balance to the pinion shaft end of the rack and exert an even steady pull to the spring balance while making the check. An initial high loading may occur before the rack commences to move, but ignore this and record the load at which the rack is kept moving steadily. The maximum loading should occur when the rack is centralised in the steering box.

1. Assemble the rack to the steering box and fit its locating bolt and the cover plate, together with its gasket. Check that the load required to move the rack in the box does not exceed 1½ lb.ft. (2.23 kg/m.) (Check 1).

2. Fit the damper pressure block to the steering box, followed by the spring and cap, with a gasket interposed between the cap and steering box.
3. Secure the cap to the steering box with four $\frac{1}{4}$ in. B.S.F. nuts, plain and shake-proof washers. Check that the load required to move the rack in the steering box does not exceed 2 lb.ft. (2.57 kg/m.) (Check 2).
4. Fit the thrust washer and eccentric bush to the pinion shaft then fit them to the steering box, engaging the teeth of the pinion with those of the rack.
5. Adjust the eccentric bush to take up all backlash between the pinion and rack when the rack is centralised in the steering box, see Fig.2. Fit the packing ring to the bush retainer and assemble the pinion adjuster and retainer over the end of the shaft. Secure them with two $\frac{5}{16}$ in. B.S.F. set-bolts and tab-washers and tighten the bolts, evenly and diagonally to the torque loading given in the General Data.
6. Fit the bolt adjuster, locknut and washer, and adjust the bolt so that all pinion shaft end float is taken up; secure the bolt in this position with the locknut. Check that the load required to move the rack in the steering box does not exceed 2 lb.ft. (2.97 kg/m.) (Check 3).
7. Check the assembly finally by torque loading the pinion shaft cross-head (Check 4). The rack should move when a torque load of 2 lb.ft. (2.57 kg/m.) (maximum) is applied.

If the components fails to pass a check satisfactorily, correct it before proceeding with the assembly. The recommended action is as follows :-

Check failed	Action recommended
Check 1	Lap the rack to the box, check locating bolt clearance - re-check.
Check 2	Insert packing piece between damper cap and steering box - re-check.
Check 3	Re-adjust end-float and backlash - re-check.

TIE TUBES

The ball joints at each end of the tie tubes are carefully lapped to their mating sockets when the assembly is first fitted to the car; maintain this finish since failure to do so will have a detrimental effect on the steering.

REMOVING AND REFITTING TIE TUBES

Remove the tie tubes from the steering arms and steering box in the following manner :-

1. Withdraw the split pin; using a $\frac{1}{2}$ in. B.S.F. spanner, remove the slotted nut and washer securing each tie tube ball bolt to the steering arms, see Fig.6. Separate the ball bolts from the steering arms; these have a taper joint and it is necessary to use a suitable extractor such as TFN.5006.
2. Release the clips and withdraw the telescopic sleeves from the steering box.
3. Note the position of the inner ball bolt locking nuts by counting the threads visible beyond the nuts. This will minimise adjustments after re-assembling. Loosen the locknuts and unscrew the tie tube ball bolts from the rack; remove the tie tubes.

Adopt the following procedure to refit the tie tubes :-

1. Screw the inner ball bolt of each tie tube into the threads of the rack, positioning the bolts as noted prior to removal, see para.3 above. Do not tighten the locknut or secure the telescopic sleeve to the steering box.
2. Fit the outer ball bolts to the steering arms and secure them to the arms with the washers, slotted nuts and split pins.
3. Adjust the tracking of the wheels as described in Section 7.
4. Refit the telescopic sleeves to the steering box and secure with their clips.

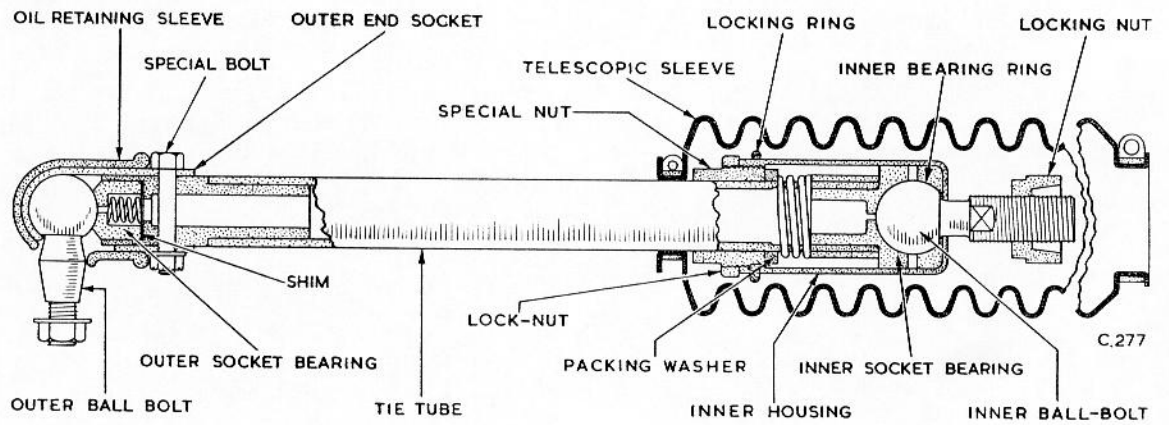


Fig.6 Tie tube assembly.

DISMANTLING AND RE-ASSEMBLING TIE TUBES

To dismantle the tie tube assembly, proceed as follows, referring to Fig.6.

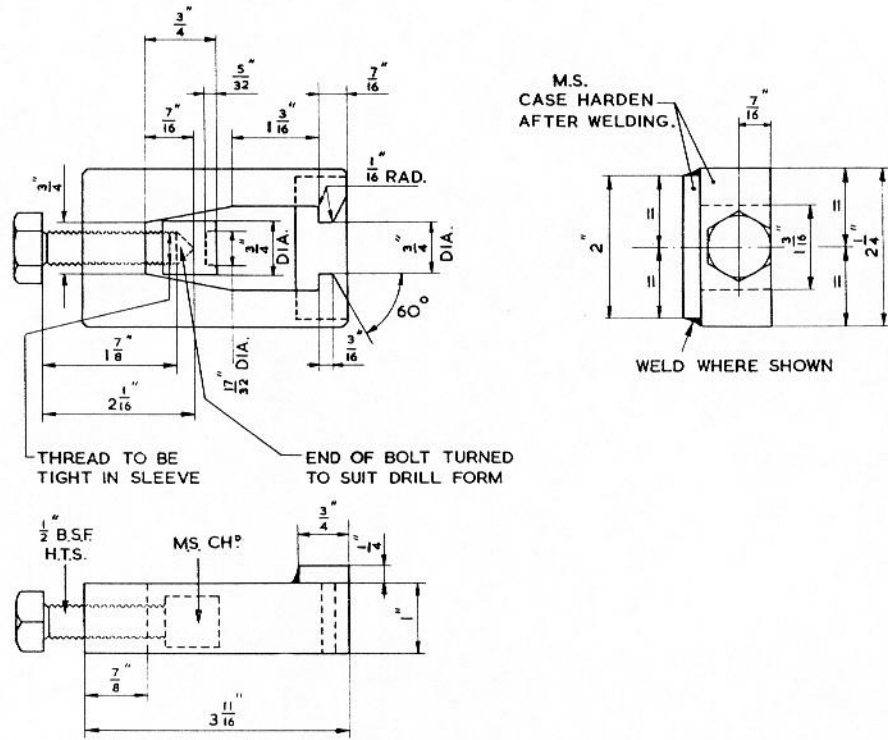
1. Withdraw the split pin, remove the slotted nut, washer and special bolt and withdraw the outer end socket, complete with ball bolt and oil retaining sleeve, from the tie tube.
2. Withdraw the outer socket bearing, spring and shims from the tie tube.
3. Withdraw the ball bolt from the inner end of the socket. Remove the oil retaining sleeve from the socket.
4. Loosen the clip and slide the telescopic sleeve from the tie tube.
5. Release the locknut and remove the locking ring then unscrew the inner housing from the special nut.
6. Remove the locking nut from the inner ball bolt and remove the ball-bolt and its inner bearing ring from the inner housing; separate the ball bolt and inner bearing ring.
7. Remove the inner socket bearing from the tie tube.
8. Remove the special nut, locknut, inner spring and packing washer from the tie tube.

Re-assemble the tie tube assembly in the following manner, using the appropriate lubricant on all parts.

1. Assemble the inner spring, packing washer and the special nut over the outer end of the tie tube, in that order, and locate the spring against the ferrule at the inner end of the tie tube.
2. Fit the inner bearing ring to the inner housing and pass the threaded end of the ball bolt through their common bore; screw the locking nut on to the ball bolt.
3. Fit the inner socket bearing to the inner end of the tie tube.
4. Hold the special nut stationary and screw on the inner housing until the spring is compressed fully. Slacken the special nut $1/10$ th. of a turn, then further slacken the nut until the locking ring in the inner housing is aligned with one of the locking ring slots of the special nut. This setting will be from $1/10$ th to $6/10$ ths of a turn back from the fully compressed position. Fit the locking ring and screw on and tighten the locknut.

5. Assemble the telescopic sleeve, large end first, over the outer end of the tie tube and pass it along the tube until its small end is located adjacent to the special nut; tighten the sleeve securing clip.
6. Fit the outer ball bolt into position in the outer end socket then fit the oil retaining sleeve.
7. Assemble the outer socket bearing and its original shims but without the spring to the end of the tie tube, then fit the outer end socket and ball bolt. Check the alignment of the bolt holes in the socket and tie tube. The thickness of the shims must be adjusted so that there is no clearance between the ball bolt and its seating in the outer end socket and socket bearing when the bolt holes are aligned.
8. Dismantle the parts and re-assemble with the correct thickness of shims between the tie tube and outer socket bearing and with the spring in position. Secure the outer end socket to the tie tube with the special bolt, 5/16 in. slotted nut, washer and split pin. On this final assembly, fill the tie tube with approved oil.

SPECIAL TOOLS



EXTRACTOR FOR TIE ROD & STEERING ARM T.F.N. 5006