

STEERING





SERVICE INSTRUCTION LEAFLET

ISSUED BY
ROLLS-ROYCE LIMITED

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Subject : RECONDITIONING OF STEERING COLUMN
& BOX, PHANTOM III.

Date
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STEERING:

The steering is of the cam and roller type. A double toothed follower roller mounted in the jaws of the rocking shaft, engages with the cam. The cam portion takes the form of a modified worm gear. All working parts are carried in anti-friction bearings and are immersed in oil.

NOTE: Retailers in the British Isles are advised that steering columns and boxes requiring major repairs should be returned to the London Service Station.

1. TO REMOVE THE STEERING COLUMN AND BOX:

- (i) Jack up front of car until road wheels are well clear of ground.
- (ii) Remove exhaust manifold from right-hand side of engine.
- (iii) Remove right-hand side undershield from front of chassis.
- (iv) Disconnect horn wire, (projecting from the control tube at base of steering box) from the small junction box on inside of frame.
- (v) Remove pinch-bolts from the three control levers at base of steering box and slide them downwards off their tubes.
- (vi) Bend back tabs of lockwasher (51, Fig.2) and unscrew nut (50) until it is flush with the thread of the stationary tube.
- (vii) There are two small nuts on the lower face of the steering box, remove the one nearest the pendulum lever (drop arm) and from beneath it remove the spring washer and the locking tab. The purpose of this locking tab, one end of which engages with a small hole in the stationary tube, is to ensure the correct angular positioning of the latter.
- (viii) Using an aluminium drift, give the nut 50, (already slackened back) a few sharp taps towards the steering box to loosen the stationary tube from its tapered seating in the guide (49) to permit at a later stage, the withdrawal of the control tube assembly. Remove the nut and lockwasher. A receptacle should be placed at the bottom of the steering box to catch the oil.
- (ix) Remove the junction screw (31 Fig.1) from the rocking shaft and the cap nut (24) from the ball end pin at lower end of pendulum lever and then remove the oil feed pipe (28) from the lever.
- (x) Remove the nut (32) securing the pendulum lever to the rocking shaft (30). Normally it is not necessary to disconnect the pendulum lever from the side steering tube.

IMPORTANT

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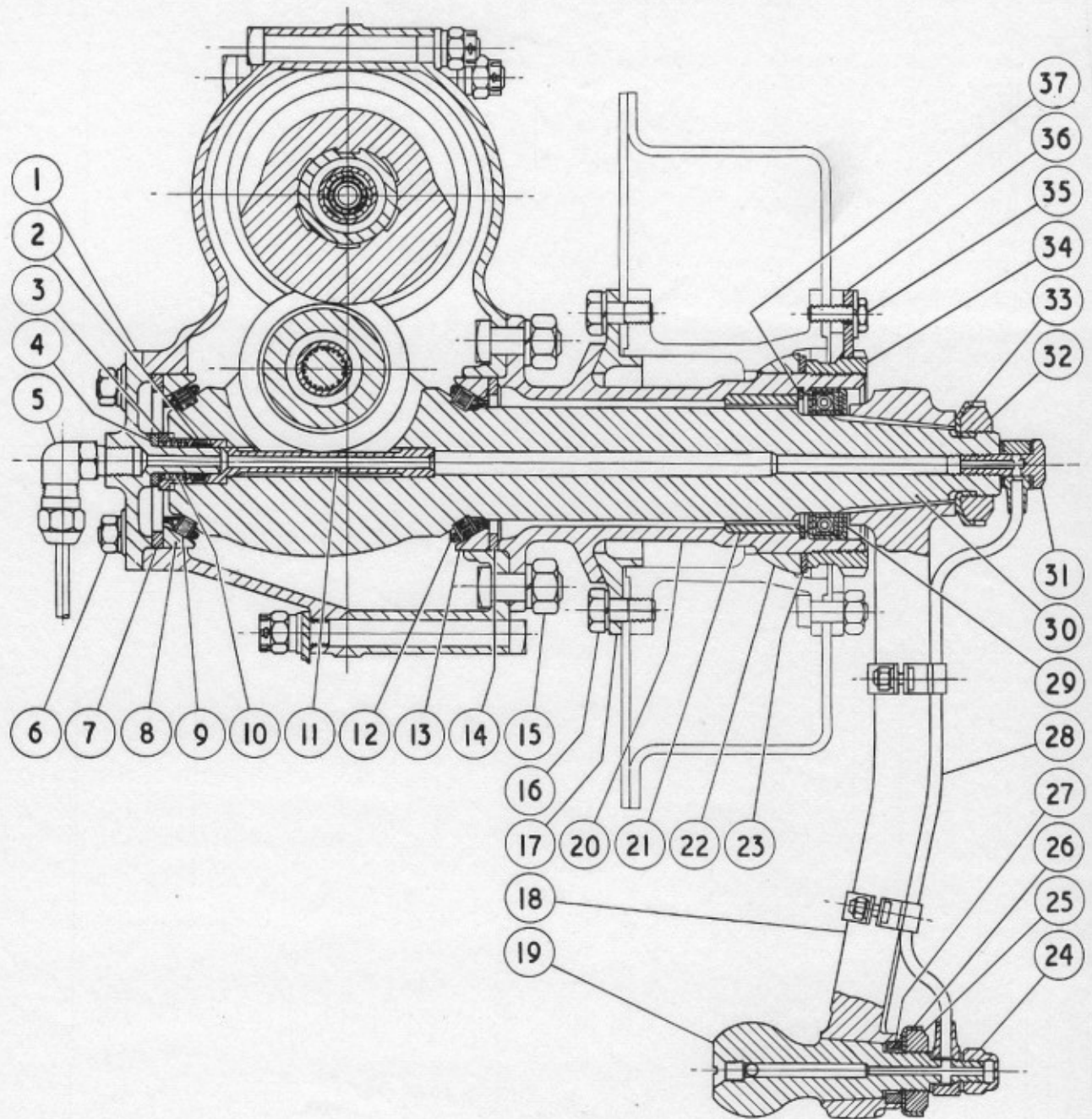


FIG. 1. SECTION - ROCKING SHAFT.

- | | |
|---|--------------------------------------|
| 1. End cover - Rocking shaft. | 19. Ball end Pin. |
| 2. Gland Packing " " | 20. Support Sleeve. |
| 3. Gland Bush " " | 21. Bush - Rocking shaft. |
| 4. Gland Washer. " " | 22. Spherical ring (split). |
| 5. Elbow connection. | 23. Washer - Support Sleeve Nut. |
| 6. Nut - End cover. | 24. Cap Nut - Ball end Pin. |
| 7. Adjusting Washer(range of)
(Identical to Item 14. | 25. Nut " " " |
| 8. Roller Bearing race
(Identical to Item 13. | 26. Lockwasher " " " |
| 9. (Roller Bearing
(Identical to Item 12. | 27. Locating Washer. |
| 10. Spring - Gland Bush. | 28. Oil pipe. |
| 11. Sleeve - Rocking Shaft. | 29. Oil Seal "Perfect". |
| 12. Roller Bearing. | 30. Rocking shaft. |
| 13. Roller Bearing race. | 31. Junction Screw. |
| 14. Adjusting Washer(range of) | 32. Nut - Pendulum Lever. |
| 15. Nut - Support sleeve. | 33. Lockwasher. " " |
| 16. Setscrew - Spigot Plate. | 34. Serrated nut - Support sleeve. |
| 17. Spigot Plate. | 35. Setscrew - Lock Plate. |
| 18. Pendulum lever. | 36. Lock Plate - Support Sleeve Nut. |
| | 37. Retaining ring - Bush. |

- (xi) Withdraw the pendulum lever from the rocking shaft, using extractor R-3140.
NOTE: If owing to lack of bodywork clearance, the extractor cannot be placed in position on the lever, proceed as follows:-
- a) With the pendulum lever vertical, place a blunt chisel (having a long gradual taper) between the lever and the serrated nut (34), (on side of frame) and give the chisel a few hard blows which will release the lever from the rocking shaft.
- (xii) From outside of frame, remove the setscrew (35) and the lock plate (36). With the serrated spanner, R-3206, unscrew the serrated nut (34) and remove the washer (23) and the spherical (split) support ring (22). Should the latter two parts prove obstinate to remove at this stage, they can be left in position until the steering is released.
- (xiii) Disconnect the oil feed pipe from the elbow (5) and unscrew the elbow from the side cover of the box.
- (xiv) Remove the six setscrews (16) securing the circular spigot plate (17) to the frame.
NOTE: Prior to removing the setscrews, it is recommended that the position of the spigot plate be marked in relation to the inside of the frame to assist when refitting the steering.
- (xv) Disconnect the riding control lever from the bracket attached to the lower portion of the steering box. This bracket and control lever are not fitted to early series chassis.
- (xvi) From the engine side of the dash, remove the four small nuts securing the split aluminium collar (fume seal) to the pedal gap plate and slide the collar down the steering column towards the box.

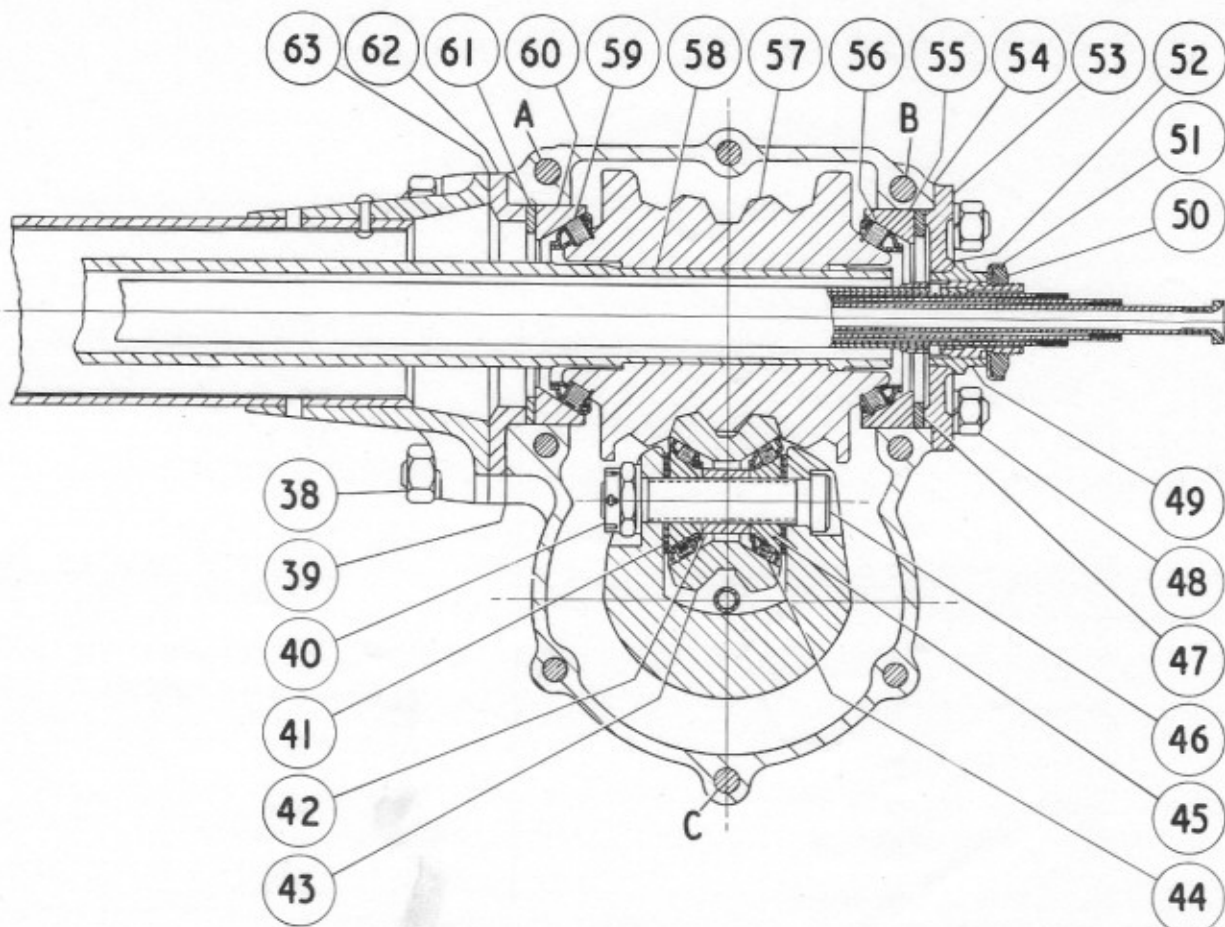


FIG. 2. SECTION - STEERING CAM & ROLLER.

Notation for Fig.2.

38. Nut - Steering Column.	52. Vellumoid Joint.
39. Vellumoid Joint.	53. Cover - Bottom end.
40. Castellated Nut.	54. Vellumoid joint.
41. Adjusting Washer/s(range of)	55. (Roller bearing race (Identical to Item 60.
42. Distance piece - roller race.	56. (Roller Bearing (Identical to Item 59.
43. Roller.	57. Steering Cam.
44. Roller Bearing.	58. Steering Cam Tube.
45. Roller Bearing race.	59. Roller bearing.
46. Bolt - Roller race.	60. Roller Bearing race.
47. (Adjusting Washer(range of) (Identical to Item 61.	61. Adjusting Washer(range of)
48. Nut - Bottom end cover.	62. Flange.
49. Guide - Stationary tube.	63. Vellumoid Joint.
50. Nut - Stationary tube.	
51. Lockwasher - Nut.	

- (xvii) Remove the front floor boards. Remove nuts and bolts from the aluminium clutch pedal gap plate and slide plate up lever, leaving the foot brake and accelerator pedal gap plate in position.
- (xviii) Disconnect the clutch pedal adjusting rod from the clutch pedal lever by removing the split pin and collar from the lever.
- (ix) The next operation is to undo the steering wheel retaining nut as follows:-
- a) Pull the control assembly away from the steering wheel.
 - b) Remove the five screws from the hub of the steering wheel and remove the locking plate from the nut.
 - c) With the special split box spanner, R-3191, undo the steering wheel retaining nut.
- (xx) Next remove the lower half of the support bracket for steering column and carefully lower the column. Remove the control tube assembly. Remove the felt packing strip from the groove in the stationary control tube.
- (xxi) Remove the steering wheel, using the extractor HB-15257.
- (xxii) If not already removed, then remove the washer (23) and the spherical (split) support ring (22) from the support sleeve (20). See sub-paragraph (xii).
- (xxiii) Remove the steering column and box by passing it forwards, i.e. towards the radiator and lifting the box in an upwards direction, taking care not to damage the plating of the steering column.

2. TO DISMANTLE THE STEERING COLUMN AND BOX:

NOTE: It will be necessary to make correctly shaped wood vice clamps so that the steering column can be held in a vice. These can be made from a piece of hard wood 4" (100 m/m) square by about 3" (75 m/m) long and bored 2" (50.8 m/m) diameter, so as to be a good fit around the steering column tube, and finally split by sawing in two.

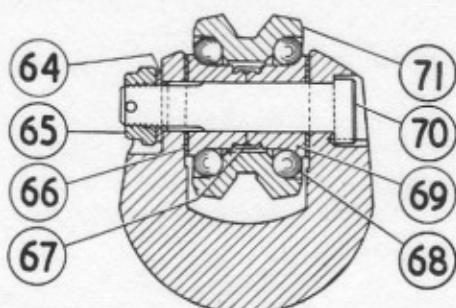
- (i) Drain the oil from the steering box. Place the wood clamp on the steering column near the box and hold the column in a vice.

- (ii) Remove all bolts securing the halves of the box together. Loosen the six nuts (15 Fig.1) securing the support sleeve (20) to the right-hand side half of box.
NOTE: If a bracket for the riding control lever is fitted to the lower portion of the steering box, then prior to removing the two retaining bolts, mark the position of the bracket in relation to the box. It can be fitted the wrong way round. The square hole in the bracket should point towards the lower end of the steering box.
- (iii) Remove the bottom end cover (53 Fig.2) and the adjusting washer (47) and tie the washer to the cover.
- (iv) Remove the four nuts (38) securing the steering column to the box, pull the box away from the column about 3" (75 mm) and detach the flange (62) from the lower end of the column.
- (v) Pull the halves of the box apart and collect the roller race (55) and the roller bearing (56) from bottom of box and also tie them to the bottom end cover.
- (vi) Withdraw the cam tube (58) from the steering column. Collect the flange (62), the adjusting washer (61), the roller race (60), and the roller bearing (59), and tie these parts together.
- (vii) Remove the rocking shaft. Collect the gland washer (4). Remove from inner end of rocking shaft, the gland spring (10), the gland bush(3), and the gland packing (2).
- (viii) Remove the end cover (1), the adjusting washer (7), the roller race(8), and tie these parts and the roller bearing (9) to the end cover.
- (ix) Undo the six nuts (15) and remove the support sleeve (20). Remove the adjusting washer/s (14), the roller race (13), and tie these parts and the roller bearing (12) to the sleeve.
- (x) Thoroughly clean all dismantled parts, taking care not to get the various adjusting washers mixed, because they should be restored to their original positions when re-assembling the box.
- (xi) Examine parts as necessary for wear, especially the roller bearings and races, rejecting those considered unfit for further service.

3. TO REMOVE THE CAM ROLLER ASSEMBLY FROM THE ROCKING SHAFT:

NOTE: If the splines of the rocking shaft (30 Fig.1) are found to be twisted caused by shock, then a new rocking shaft complete with the cam roller assembly fitted can be supplied, in which case, it would not be necessary to remove the cam roller assembly from the existing shaft.

- (i) It should only be necessary to remove the cam roller assembly from the rocking shaft if:-
 - a) The cam roller assembly is of the roller bearing type as shown in Fig.2. (See Item 44). This must be removed and replaced by a cam roller assembly of the ball bearing type as shown in Fig.3.
 - b) A "flat" on the cam track of the roller, (71 Fig.3) caused by shock.
 - c) Rocking shaft damaged due to corrosion, sufficient to necessitate a new shaft.



- 64. Plain Washer.
- 65. Castellated Nut.
- 66. Adjusting Washer/s (range of)
- 67. Retaining Clip.
- 68. Ball.
- 69. Inner Race (2 Off)
- 70. Bolt.
- 71. Roller.

FIG. 3. CAM ROLLER ASSEMBLY.

- (ii) The castellated nut (40 Fig.2) on the rocking shaft has been blended in order to prevent the cam from fouling the nut. If the blended portion of the nut is not in the same position after fully retightening, reblend by filing as necessary.
- (iii) Remove the bolt (46), the cam roller assembly and the adjusting washers (41) from the rocking shaft.

4. TO FIT A NEW CAM ROLLER ASSEMBLY TO THE ROCKING SHAFT:

NOTE: There are three types of bolts (46) carrying the inner races of the roller assembly, i.e.:-

- a) Bolt with long splines which is redundant. (F87135)
- b) Bolt with short splines near threaded end. (F89837)
- c) Bolt without splines, but having a register on the circular head. (F89446)

When ordering a new cam roller assembly, it will be advisable to state which of the above three types of bolts are fitted to the existing rocking shaft. If a new rocking shaft is to be supplied, the non-splined bolt 'C' (F89446) will be the only one suitable for use.

- (i) Before attempting to fit a new roller assembly to the rocking shaft, it is advisable to check that the inner machined faces of the rocking shaft gap, against which the adjusting washers rest, are parallel to each other. If these faces are found to be out of truth, they should be trued up with a spot facing cutter suitably mounted up inside the gap - failing this, then use a scraper or carborundum stone.
- (ii) The next operation is to determine the thickness of the adjusting washer/s (66 Fig.3) required to ensure contact of the inner end faces of the two races (69) of the cam roller assembly when fitted to the rocking shaft. When the inner end faces are brought into firm contact, this gives the correct amount of pre-load on the roller. Reference to Fig.3 will show that the two races are held together by a retaining ring (67) to prevent the assembly from coming adrift. Proceed as follows:-
 - a) Hold the roller assembly between the jaws of the rocking shaft and with feeler gauges, determine the clearance between the end face of one inner race and the corresponding inner machined face of the rocking shaft and take note of the clearance. The feelers should be a good push fit.

- b) If for example, the clearance is found to be .020" (.50 m/m), then fit an adjusting washer .010" (.25 m/m) thick to each side of the roller assembly. The washers must be a good push fit to prevent any end float of the inner races, it is therefore a question of trial and error. Should the clearance for example be found to be less than .007" (.17 m/m), then it is permissible to fit an adjusting washer to one side of the rocking shaft only.
- c) Fit the bolt (70) and tighten up the nut. If the adjusting washer/s have been correctly chosen, it should be just possible to rotate the roller with the thumb. If the roller is found to be at all slack, fit a thicker adjusting washer or washers.
- d) Blend the castellated nut if necessary. See Paragraph 3, subparagraph (ii) and lock with a new split pin of correct size.

5. TO ASSEMBLE THE STEERING COLUMN & BOX & ADJUST AS NECESSARY THE PRE-LOAD ON THE ROLLER BEARINGS OF THE STEERING CAM & ROCKING SHAFT:

NOTE: Prior to commencing the assembling operations, polish and lightly smear with grease the roller bearing race housings of the steering box. If the oil seal (29 Fig.1) should be found to be worn, usually indicated by the presence of oil on the pendulum lever, then a new oil seal should be fitted. The tip (leather) of the seal must always point towards the steering box. The seal seldom requires replacing.

- (i) Refit the support sleeve (20), fully tightening up the six nuts (15). Place the right-hand half of box, i.e. the support sleeve, in a vice, with open end of box facing upwards.
- (ii) Fit the adjusting washer (14) and the roller race (13) to the housing. Place the roller bearing (12) on the rocking shaft and lower the shaft into the box, taking care not to damage the oil seal.
- (iii) Lay the steering cam tube (58) in position, propping it square with the box. Place a roller bearing (56 & 59) on each end of the cam followed by the roller races (55 & 60). Apply jointing compound to the large faces of the two halves of the box, taking care that no compound is allowed to enter the roller race housings.
- (iv) Place the left-hand half of box on to the right-hand half, ensuring that the roller races of the cam are correctly located in their respective housings. Fit four or five bolts to keep the box halves in position and lightly tighten up the nuts. The two upper outer bolt holes ('A' & 'B' Fig.2) and the lower bolt hole 'C' are drilled to take close fitting bolts and the bolts must be fitted to these holes first.
- (v) Slide the original adjusting washer (61), along the cam tube followed by a new Vellumoid joint (39), the flange (62) with the spigot end towards the cam. Place the adjusting washer, the joint and the flange in position at upper end of box. Place another new Vellumoid joint (63) on the four studs and attach the steering column to the box - screwing up the four nuts (38) finger tight.
- (vi) Attach the steering wheel temporarily to the cam tube.
- (vii) Remove the guide (49), and fit a new Vellumoid joint washer between it and the bottom end cover. If a packing washer is fitted, then fit a joint washer to each side of the packing washer to prevent oil leakage.

- (viii) Fit the original adjusting washer (47) against the roller race at lower end of box. Place a new Vellumoid joint (54) on to the bottom end cover and fit it to the box lightly tightening up the nuts. The end cover should be positioned so that the two studs in it are parallel with the rocking shaft and the small slot in the guide facing towards the pendulum lever.
- (ix) Place the remaining roller bearing (9) on to the end of rocking shaft, followed by the roller race (8) and the original adjusting washer (7). Place a new Vellumoid joint on the end cover (1), and refit, lightly tightening up the four nuts.
- (x) Place the wooden clamp on the steering column near the box and hold the column in the vice, positioning it, so that the rocking shaft is horizontal and the steering wheel clear of the bench.
- (xi) Temporarily place the pendulum lever on the rocking shaft and lightly tighten up the nut (32).

6. TO ADJUST THE PRE-LOAD ON THE ROLLER BEARINGS OF THE STEERING CAM:

- (i) Rotate the steering wheel, which should be quite free, until the roller is near to one end of the cam, i.e. not quite up to one full lock position. Hold the steering wheel with one hand and with the other, take hold of the end of the pendulum lever and check that it can be moved to and fro a little, i.e. approximately $\frac{1}{8}$ " to $\frac{3}{16}$ " (3-4 m/m) travel, thus ensuring that there is slackness between the cam and roller which is necessary.
- (ii) If previously fitted, fit the bracket for the riding control lever to the steering box, making sure it is placed the correct way round. (See 'Note' beneath sub-paragraph (ii) of Paragraph 2). Fit the remaining bolts to the box halves and tighten up each nut until the split pin holes are in line.
- (iii) Next, tighten the steering column nuts (38) and then the nuts (48) at bottom end of box. During all tightening operations, frequently rock the steering wheel and pendulum lever to ensure that internal parts are not binding.
- (iv) If, when tightening up the nuts of the bottom cover, it is found that the steering wheel is stiff to turn, this indicates that the adjusting washer (47) fitted to the lower end of box is too thick. If, on the other hand, the steering wheel is found to be free after tightening up the nuts, this indicates that the adjusting washer is too thin. The lower adjusting washer (47) should be of a thickness (determined by trial and error) that when fitted it should require a load (pull) of 1 to $1\frac{1}{2}$ -lbs. (.45 - .68 Kgs) applied to the rim of the steering wheel to move it rotationally. This check should be made with an accurate spring balance, reading up to about 6-lbs. (2.72 Kgs). During this load check, it must be ascertained that the end of the pendulum lever can still be rocked to and fro a little, indicating a certain degree of slackness between the roller and the cam, otherwise a false reading would be obtained.

7. TO ADJUST THE PRE-LOAD ON THE ROLLER BEARINGS OF THE ROCKING SHAFT:

Having obtained the correct amount of pre-load on the roller bearings of the steering cam, proceed as follows:-

- (i) Rotate the steering wheel until the roller is near to one end of the cam where it should remain during the following check/s.

- (ii) Tighten the nuts of the rocking shaft end cover (1 Fig.1) and check the roller bearings of the rocking shaft for pre-load by applying a spring balance to the lower end of the pendulum lever. It should require a load (pull) of $\frac{1}{2}$ -lb. (.22 Kgs) to move the lever. During this load check, it must again be ascertained that the end of the pendulum lever indicates a little play between the cam and roller as previously explained.

NOTE: To increase the pre-load on the roller bearings, fit a thicker adjusting washer (7) behind the end cover (1), to decrease the pre-load, fit a thinner washer. A new Vellumoid joint once fitted, should not be damaged during the various operations, because these same joints must be retained so as not to upset the pre-loading.

8. TO MESH THE ROLLER WITH THE STEERING CAM:

Rotate the steering wheel slowly, but should the steering stiffen appreciably as the roller approaches the centre of the cam, i.e. if it requires a load of more than 3-lbs. (1.36 Kgs) applied to the rim of the wheel to move it, then do not continue to turn. This indicates that the roller is too close to the cam and it will therefore be necessary to fit a thinner adjusting washer (7) behind the end cover (1) - say .010" (.25 m/m) thinner at this stage. At the same time, it will also be necessary to compensate the previously adjusted pre-load on the roller bearings of the rocking shaft, by fitting a correspondingly thicker adjusting washer (14) behind the roller race (13), after removing the six nuts (15) securing the support sleeve. Take care that the bolts do not fall into the box. Continue the adjustment by the method described above until it requires a load of $1\frac{1}{2}$ to $1\frac{3}{4}$ -lbs (.68 - .79 Kgs) to move the steering wheel when the roller is in its tightest meshed position in relation to the cam. When the correct loading (meshing) between the roller and cam is being approached, the adjusting washers (7 and 14) can be altered in steps of .005" (.12 m/m) thickness. Should the steering wheel have been slack throughout the turn due to failure of the roller to make contact with the centre of the cam, then the procedure should be reversed so as to bring the roller towards the cam.

9. TO CENTRALISE THE STEERING CAM WITH THE ROLLER (ROCKING SHAFT).

Having correctly meshed the roller with the cam, proceed as follows to centralise the steering cam with the rocking shaft.

- (i) Starting from one full lock position, rotate the steering wheel to the other full lock position, noting the number of steering wheel turns required. If for example, it amounts to $3\frac{1}{4}$ turns, then turn the steering wheel back one and five eighth's of a turn which will set the cam in the straight ahead position. Without moving the steering cam tube from this position, remove the steering wheel and replace it so that the spoke nearest the oil hole in the hub of the wheel is upright. Repeat the above check, altering the position of the steering wheel one spline one way or another should it be found necessary.
- (ii) Again starting from one full lock position, rotate the steering wheel very slowly towards the other lock, simultaneously holding the end of the pendulum lever with the other hand, lightly shaking it to and fro until the position of minimum slack between the cam and roller has been found. Note the angle of the steering wheel spoke nearest the oil hole in the hub. Continue to turn the wheel, noting the angle of the same spoke immediately slackness again appears. The tightest meshed portion will normally extend over half a turn of the steering wheel. (i.e. 180°). If the steering cam is correctly centralised with the rocking shaft, then the tightest meshed portion should extend an equal amount on either side of the straight ahead position of the steering wheel when this is turned.

NOTE: Cases have arisen where a slight variation in the machining of a cam, or, a small amount of wear on the roller track of the cam has caused the tightest meshed portion not to extend to half a turn of the steering wheel (i.e. 180°). This need not be detrimental, providing the range is not less than 120°.

- (iii) If it is found that the tightest meshed portion is to the left of the straight ahead position, an adjusting washer (61 Fig.2) about .005" (.12 m/m) thinner should be fitted to the upper end of the box. At the same time it will also be necessary to compensate the previously adjusted pre-load on the roller bearings of the steering cam by fitting a correspondingly thicker adjusting washer (47) at the lower end of the box. Continue the adjustment by the method described above until the tightest meshed portion has been centralised. If the tightest meshed portion is to the right of the straight ahead position, then the procedure described above must be reversed.
- (iv) Fit split pins to bolts of steering box.
- (v) Remove the rocking shaft end cover (1) and insert a new cork gland packing (2), into the end of the rocking shaft followed by the original gland bush (3), making sure that the lugs of the latter are in line with the corresponding slots in the rocking shaft. Next, refit the spring (10) and the gland washer (4) and replace the end cover.

10. TO REFIT THE STEERING COLUMN AND BOX TO THE CAR:

- (i) Place the spigot plate (17) on the sleeve of the box the correct way round, as shown in Fig. 1, and enter the steering column and box partially in position on the car.
- (ii) Rotate the spigot plate (17) until the mark on it, previously made, lines up with the corresponding mark on the frame and fully tighten up the six setscrews (16).

NOTE: Care must be taken during the assembly of the steering column and box to the car not to trap the flexible metal conduit encasing the cables to the head lamps, especially when tightening up the serrated nut (34 Fig.1). This conduit should lay over the support sleeve (20) and not beneath it.

- (iii) Place the steering wheel in position. It may be placed on any spline at this stage.
- (iv) Place the large plain washer on to the end of the cam tube followed by the lock plate and the steering wheel retaining nut and screw on the nut a few threads.
- (v) Enter the control tube assembly in to position and loosely attach the steering column to its support bracket at rear of dash by screwing up the two nuts of the cap finger tight.
- (vi) Place the split spherical ring (22) in position followed by the washer (23) and screw on the serrated nut (34) a few threads at this stage.
- (vii) Refit the clutch pedal gap plate.
- (viii) Move the split aluminium collar (fume seal) up the column clear of the cylinder head, but do not place it on its four retaining studs. (later)

- (ix) Gradually tighten up the serrated nut (34) sufficiently to draw the box lightly into position against the spigot plate (17), after which it should still be possible to move the steering on its mounting.
- (x) From inside of dash, place the collar (fume seal) on to the four studs of the pedal gap plate and check with a feeler gauge that the clearance between the rubber ring of the collar and the column is equal, as near as possible, the whole way round. If necessary, move the steering in direction required.
- (xi) Next, simultaneously tighten up the serrated nut (34), the two nuts of the steering column support bracket (rear of dash) and the four nuts securing the collar to the pedal gap plate. Checks should be made during these operations that the gap between the rubber fume seal and the column has not been disturbed. With the serrated nut fully tightened up, secure it with the lock plate (36) and the spring washer and setscrew (35).
- (xii) Refit the elbow connection (5) to the side cover of the box and re-connect the oil pipe.
- (xiii) The next operation is to track up the front wheels and correctly position the pendulum lever on the splines of the rocking shaft as follows:-
 - a) Lower the front of the car to the ground.
 - b) Track up the front wheels with the rear ones until the front wheels are in the straight-ahead position.
 - c) Rotate the steering wheel until the cam is in the straight-ahead position as described in Paragraph 9, sub-paragraph (i).
 - d) With the pendulum lever still connected to the side steering tube and without disturbing the position of the rocking shaft, place the lever on to the shaft engaging the nearest spline if the lever and shaft do not coincide.
 - e) Place a new lockwasher (33) on the shaft, tighten up the nut (32) and lock.
- (xiv) With the front wheels still in the straight ahead position, replace the steering wheel on the splines of the cam tube so that the spoke nearest the oil hole in the wheel is upright. If the splines offset the spoke slightly to the left, it can be kept in this position; if it is offset to the right, then the wheel should be altered one spline to give a left bias to the spoke.
- (xv) Using the split box spanner, R-3191, tighten up the steering wheel retaining nut, place the locking plate over the nut and secure the plate with the five countersunk headed screws.
- (xvi) Lift the control tube assembly a few inches and fit a new felt packing strip to the annular groove in the stationary tube. Soak the strip in oil before fitting. If difficulty is experienced in pushing the control tube assembly into position, then press and trim the felt strip to suit.
- (xvii) With the control tube assembly pushed fully home, rotate it until the small hole in the threaded taper piece at the lower end of the stationary tube is in line with the slot in the guide (49). Fit the locking tab over the small stud on the bottom end cover (the stud nearest the pendulum lever) engaging it with the slot in the guide and the hole in the threaded taper piece. Fit the spring washer over the locking tab and secure with the nut.

- (xviii) Lightly rotate the control quadrant a little one way or the other until the lettering on it is square, a second operator should then place a new lockwasher (51) on to the lower end of the stationary tube and tighten up the nut (50) and lock it.
- (xix) Refit the three control levers to the control tubes and reconnect the horn cable.
- (xx) If a bracket is fitted to the lower portion of the steering box, then attach the riding control lever to it.
- (xxi) Refit the oil pipe (28) to the pendulum lever - fitting a new aluminium joint washer (4 off) on each side of the two banjo connections of the pipe.
- (xxii) Re-connect the clutch pedal adjusting rod to the clutch pedal.
- (xxiii) Refit the right-hand side undershield and the exhaust manifold.
- (xxiv) Fill up the steering box with a recommended oil/s of viscosity S.A.E. 30.
- (xxv) Finally inspect that no split pins and lockwashers have been omitted and also that there are no oil leakages from the steering box, especially when it is warm.



SERVICE INSTRUCTION LEAFLET

ISSUED BY
ROLLS-ROYCE LIMITED

RR/N2

SB/VA.1/SF.

Subject : TO FIT A NEW CROSS STEERING TUBE.
(PART 20/25-H.P. CHASSIS & ALL 25/30-H.P. CHASSIS)

Date of Issue 18th April, 1949

GENERAL:

The following procedure and parts are applicable to 20/25-H.P. chassis having the letters as listed below:-

20/25-H.P.

GEX	GSY	GLZ	GBA	GXB	GNC	GED
GWX	-	GTZ	GGA	GUB	GRC	GMD
GDX	-	GYZ	GHA	GLB	GKC	GYD
GAE	GAF	GLG	GYH	GBJ	GXX	
GWE	GSF	GPG	GOH	GLJ	GBK	
GFE	GRF	GHG	GEH	GCJ	GTK	

25/30-H.P. All Series:

New Cross Steering Tubes (G-55638a) are supplied with one end piece (G-55476) unbrazed to the tube because there is usually a variation in the width between the ball end pin centres of the cross steering levers from one chassis to another.

CAUTION:

It is of the utmost importance that no attempt must be made to weld the loose end piece to the tube or braze it with the use of an oxy-acetylene welding plant. The tube and end piece are made from 3½% nickel steel, and this is susceptible to burning and crystallization, the loose end piece must therefore be brazed to the tube by using a coal gas flame or a large paraffin blow lamp.

PARTS NORMALLY SUPPLIED:

Part No:	Title:	No.Off:	Part No:	Title:	No.Off:
G.55638a	Cross steering tube	1	K.4819	Taper pin	2
G.55476	End piece (loose)	1	K.4602	Split pin	6
G.53171	Packing Washer	8	(K.4608	Split pin	2
			(For ball end pins		

TO FIT A NEW CROSS STEERING TUBE:

- (i) Remove the cross steering tube complete with ball end pins from the car and collect the locating washer fitted to the underside of each cross steering lever.

NOTE: With the cross steering tube in position on the car, it will be observed that the nut of the tapered cotter pin fitted between the two clamping bolts at each end of the tube face towards the front of the car, and this must be borne in mind when fitting the two cotter pins to the end pieces of the new cross steering tube as described in paragraph iv (d).

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- (ii) Slacken off the steering joint nut (9 Fig.1), of the original tube from one to two flats and remove the two clamping bolts from the end of the tube and then carefully remove the tapered cotter pin (5) situated between the clamping bolts.
- (iii) Unscrew the steering joint nut from the sleeve (12) and remove all parts from the end of the tube taking care to note the position of any packing washers (shims) that may be found to be fitted. Slide or lightly tap the steering joint nut down the tube which will expose the retaining ring (3) fitted beneath it. Remove the retaining ring and the nut. Repeat for the opposite side of the tube. Keep right-hand and left-hand parts removed in separate containers and thoroughly clean all parts.
- (iv) The next operation is to assemble all the parts removed (with the exception of the cotter pins) from the original tube to the new tube and loose end piece in order to set a gap of .008" to .015", (as shown at point 'A', Fig. 1), at each end of the tube as described below and then drill and ream the tube to take the tapered cotter pins also described below.

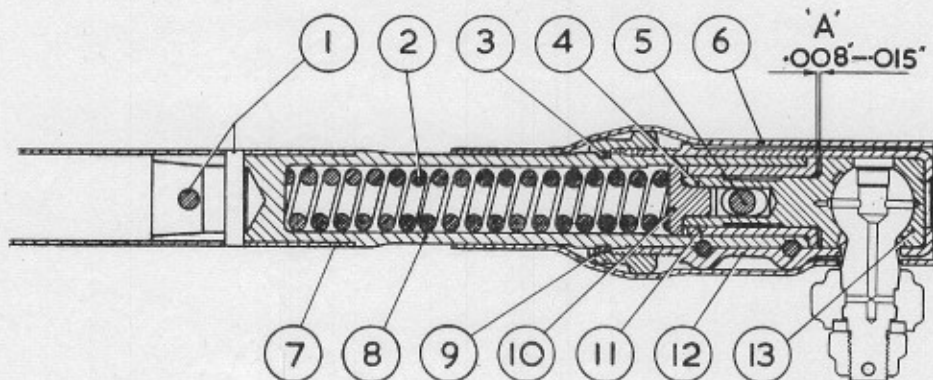


FIG. 1. SECTION THROUGH CROSS STEERING TUBE JOINT.

- | | |
|------------------------------------|------------------------------|
| 1. Taper Pins. | 8. Cross steering tube end. |
| 2. Spring. | 9. Nut. |
| 3. Retaining Ring. | 10. Plunger. |
| 4. Ball pad - inner. | 11. Bush-ball pad. |
| 5. Cotter pin. | 12. Sleeve - steering joint. |
| 6. Leather cover - steering joint. | 13. Ball pad - outer. |
| 7. Cross steering tube. | |
- a) Place one of the steering joint nuts (9) on the tube or the loose end piece and then fit the retaining ring (3) in the groove provided.
- b) Place the spring (2) into the tube and assemble to the tube the remainder of the parts (including any packing washer/s should they have originally been fitted) in their proper sequence (See Fig. 1) including the ball pin.

NOTE: When assembling the steel bush, (11) to the tube, it must be placed (rotationally) so that the hole in it will be in line with the cotter pin holes in the sleeve (12) in order to allow a clear passage when drilling the tube to take the cotter pin.

With the outer ball pad (13), in position in the sleeve, slide the sleeve into position on the tube. Engage the threads of the steering joint nut with those of the sleeve and screw up the nut until there is a gap of .008" to .015" at point 'A' Fig.1, i.e. between the rear face of the inner ball pad (4) and the corresponding face of the steel bush (11), into which the ball pad is fitted. The clearance is necessary so that the spring can operate freely.

Having obtained the correct gap, fit the two clamping bolts in position and tighten up the nuts, but do not split pin them at this stage. The heads of the bolts must be fitted in the location provided on the sleeve.

- c) Repeat for the opposite end of the tube.

NOTE: The $\frac{1}{4}$ " nuts of the clamping bolts have a spherical seating, whereas the nuts for the cotter pins are standard.

- d) From the large and small tapered cotter pin holes in the sleeve, mark off the end piece and drill two holes, i.e. one on either side of the end piece to take the cotter pin. Drill one hole .343" diameter ($\frac{11}{32}$ ") and the other hole .281" dia. ($\frac{9}{32}$ ") and finally ream with a 1 in 20 taper (on diameter) broach or reamer to allow $\frac{1}{16}$ " draw on the tapered cotter pin. Fit the cotter pin (see "Note" below).

- e) Repeat for the opposite side of the tube.

NOTE: The nuts of the clamping bolts at the brazed end of the tube should now be checked for tightness and then split pinned, also tighten up the nut of the cotter pin and secure with a split pin. Ascertain that the steering joint nut is tight, but it should not be overtightened.

Tighten up the nut of the cotter pin in the loose end of the tube, but do not split pin the three $\frac{1}{4}$ " nuts, at this stage, because all parts on the loose end piece will have to be removed prior to the brazing operation.

- (v) The next operation is to temporarily fit the cross steering tube to the car in order to adjust the tube for correct length to give a toe-in of $\frac{1}{8}$ " to the front wheels. Proceed as follows:-
- a) Jack up the front of the car until the tyres only make light contact with the ground.
- b) With the nuts of the cotter pins facing towards the front of the car, temporarily fit the cross steering tube. The locating washer as fitted to the underside of each of the cross steering levers must be correctly positioned. The castellated nut of the ball end pins need not be fully tightened up at this stage.
- c) Check the toe-in of the front wheels. It is usually found when fitting a new cross steering tube that there is too much toe-in. If the toe-in exceeds $\frac{1}{8}$ ", then it will be necessary to shorten the end of the tube by degrees until the correct amount of toe-in has been obtained.

- (vi) Having adjusted (filed) the tube to the correct length, add an internal chamfer .025" + .010" at 45° at end of tube. Remove all parts from the loose end piece including the steering joint nut and its retaining ring and peg and braze the loose end piece to the tube as follows:-
- a) Thoroughly clean the inside of the tube and the loose end piece and apply flux as necessary to both parts and insert the end piece into the tube as far as it will go. With the set portion of the tube facing downwards, rotate the end piece until the two grooves in it for the clamping bolts are in line (parallel) with the two similar grooves on the opposite end of the tube. With the end piece in this position, drill and ream for the two taper pins (K-4819) as detailed on Fig. 2, (The taper pins have a taper of 1 in 48 on dia.), and braze the end piece to the tube, using a coal gas flame or a large paraffin blow lamp.
- NOTE: A feeder hole, .160" dia. is drilled in the tube for brazing purposes. Do not drill through this hole into the end piece.
- b) Finish off ends of taper pins flush with the tube after brazing and clean up tube as necessary.
- (vii) Place the steering joint nut (9) in position and refit its retaining ring (3). Re-assemble all remaining parts to the tube and split pin the three $\frac{1}{4}$ " nuts and check the steering joint nut for tightness.
- (viii) Fit the tube to the car (with nuts of cotter pins facing to front of car), again making sure that the locating washers as fitted beneath the cross steering levers have been correctly positioned. Fully tighten up the two castellated nuts of the ball end pins and secure with the new split pins K-4608 supplied. Refit the leather covers.

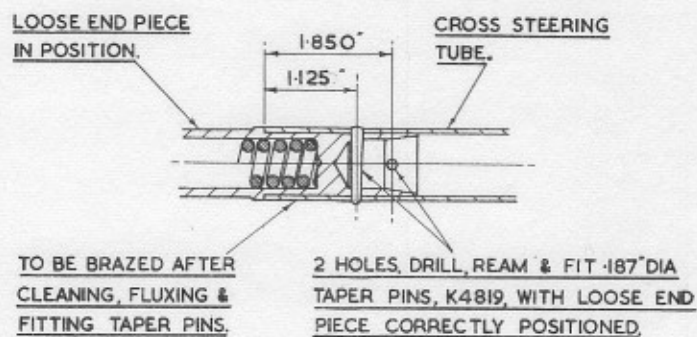


FIG. 2.

FRICITION (LOAD) TEST:

The friction of the cross steering tube should be tested by clipping a 10" lever to the centre of the tube to determine the load required to twist the tube on the ball pins. This load should be from 8 to 9-lbs. applied to the end of the lever at a 10" radius. The load should be equally divided per ball pin, i.e. 4 to $4\frac{1}{2}$ -lbs. on each pin. If it is found that there is insufficient load, then fit one or more of the packing washers, G-53171 (supplied) behind the spring/s. If the load is found to be too high, then remove any packing washers that may have been fitted originally; if none have been fitted, then reduce the large (inner) face of the steel plunger (10) by .005" at a time.

Finally inspect that no split pins have been omitted.