

CHAPTER F

PROPELLER SHAFTS AND UNIVERSAL JOINTS

SECTION F1 — DESCRIPTION AND OPERATION

A divided propeller shaft incorporating resonance dampers is used to transmit engine torque to the rear axle unit.

The front shaft is connected to the gearbox output shaft by a ball and trunnion type universal joint, as shown in Figure F1. The rear end of the front shaft is carried in a ball race mounted in a carrier bracket, which is flexibly suspended from the frame (see Fig. F2).

This flexible mounting allows for correct alignment of front and rear shafts and also prevents any propeller shaft vibration being transmitted to the chassis.

A flange is keyed and locked to the tapered rear end of the front shaft and this flange is bolted to the combined Hardy Spicer needle roller universal and sliding joint on the front end of the rear shaft.

A Hardy Spicer universal joint on the rear end of the rear shaft is bolted to the flange of the rear axle bevel pinion.

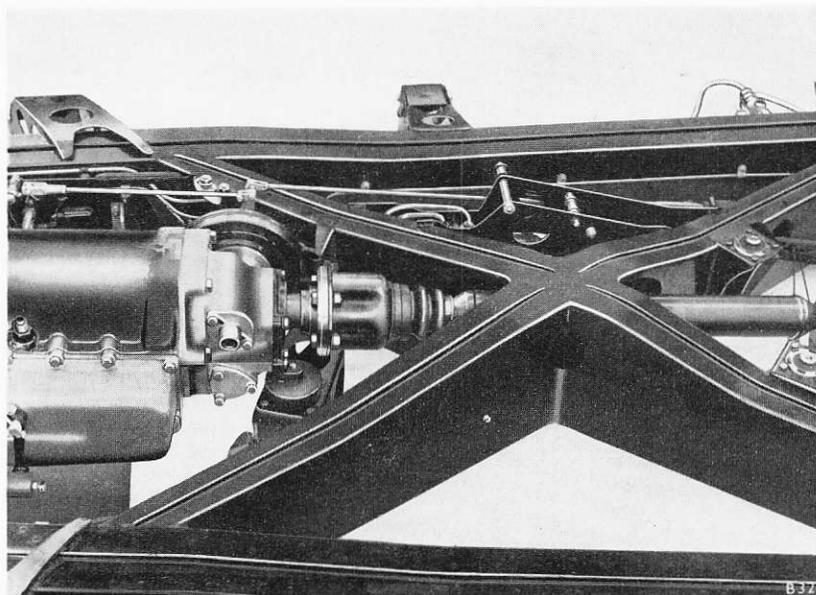


Fig. F1 Front universal ball and trunnion joint (early S1 chassis)

Before assembly, both shafts are dynamically balanced and care should be taken to ensure that this balance is preserved.

Correlation marks (2) are stamped on the rear flange of the front shaft, the rear end of the front shaft and on one of the Woodruff keys which locate the flange on the shaft (see Fig. F3).

Markings are made also with green paint on the body of the front coupling, the flange on the rear of the front shaft and on the coupling at the front of the rear shaft. If these marks become obscured during service and it is necessary to dismantle the propeller shafts, all parts should be marked as described prior to dismantling in order to ensure correct re-assembly.

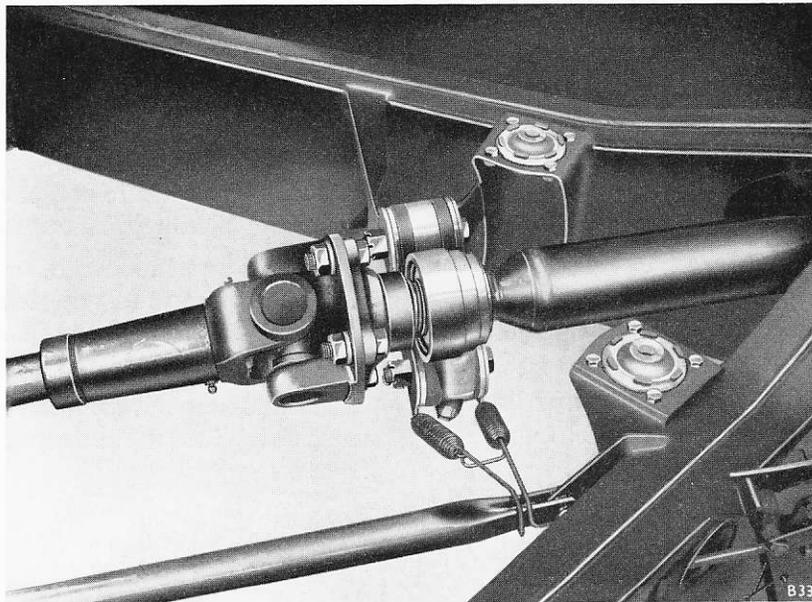


Fig. F2 Propeller shaft centre bearing

SECTION F2 — LUBRICATION AND MAINTENANCE

Every 5000 miles the condition of the rubber boot should be inspected. At the same time the bolts securing the universal joint to the gearbox output flange should be checked for tightness.

If for any reason this joint has to be disturbed, the securing bolts must be re-tightened after a run of approximately 10 miles to take up any slackness due to settling of the gasket between the joint faces.

The correct torque values for these bolts are:

S1 cars 45–50 lb.ft.

S2 cars 70–75 lb.ft.

The joint is packed with approximately 1½ oz. of Mobilgrease No. 2 on assembly after balancing. Examination of the joint should be carried out every 20,000 miles and if found to be externally dry, no maintenance is necessary apart from checking the torque tightness as previously described.

The centre bearing should be examined every 20,000 miles and re-packed with the correct grease.

The Hardy Spicer universal joint and the sliding joints are provided with grease nipples and should be lubricated every 10,000 miles with one of the approved

lubricants stated below:

Shell	Retinax 'A' (First recommendation)
B.P.	Energrease L2
Castrol	Castrolase LM
Mobil	Mobilgrease MP

SECTION F3—DISMANTLING AND ASSEMBLING

Propeller Shafts and Universal Joints — to remove and dismantle

Remove the four nuts and bolts securing the front joint to the gearbox output shaft.

Remove the two tension springs from between the centre bearing carrier housing and the equaliser bar.

To remove the propeller shafts without removing the centre bearing mounting, it is necessary only to unscrew the nut which is fitted with a lock-washer; this separates the bearing housing from the lower Silentbloc assembly of the bearing mounting.

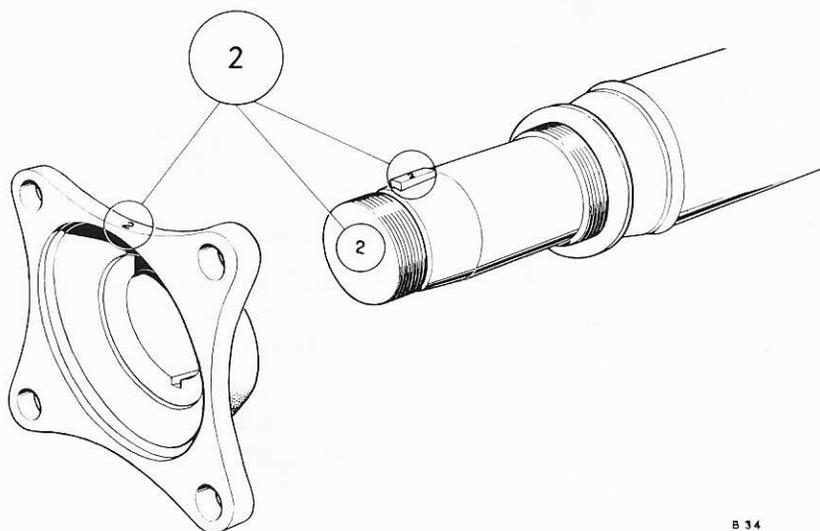


Fig. F3 Position of correlation marks on the front propeller shaft

Remove the split pin and unscrew the nut from the bolt securing the centre bearing assembly to the frame bracket (see Fig. F4). The mounting can then be detached from the bearing housing by removing the nut and lock-washer from the securing stud. Dismantle the mounting by removing the two 0.500 in. ($\frac{1}{2}$ in.) nuts and bolts which pass through the Silentbloc bushes.

Remove the four bolts, nuts and washers securing the rear universal joint to the rear axle pinion flange.

The front and rear shafts should then be withdrawn from the chassis as an assembly, transferred to a bench and separated by removing the four nuts and bolts attaching the rear flange of the front shaft to the front joint of the rear shaft. Secure the front shaft in a suitably shaped clamp and proceed as follows:

Remove the metal cover from the forward end of the joint body and push the body along the shaft sufficiently to facilitate removal of the two end buttons and the two outer races containing the 62 needle rollers. On early S1 cars a spring compression washer will be located under the end buttons, but later S1 and S2 cars have flat shim washers. A plain hardened washer is located below the outer races (see Fig. F5).

Note: When servicing the front universal joint, the spring compression washers should be replaced by shim washers. When carrying out this operation ensure that the spherical surfaces on the end pads are in light contact with the surfaces in the body, when the body is moved to various positions.

Tie back the housing and rubber boot and press out the trunnion pin. A force in excess of $2\frac{1}{2}$ tons will be required, but on no account should heat be used in this operation.

Remove the clips, rubber boot and housing and clean all parts for inspection.

Front Universal Joint — to assemble

Reverse the procedure for dismantling but the following instructions must be adopted when fitting the trunnion pin.

The trunnion pin should be fitted within 0.003 in. of true central position relative to the centre line of the shaft using a minimum press load of $2\frac{1}{2}$ tons. The pin must be fitted to this limit to assist correct dynamic balance of the shaft.

Check whether the trunnion pin is correctly fitted, by means of a depth micrometer, and then with the propeller shaft located between centres, check the vertical position of the pin with a dial indicator gauge (see Fig. F6). Care must be taken to ensure that the pin is truly vertical when this test is carried out.

Whenever the joint is dismantled, the opportunity should be taken to fit a new rubber boot.

Pack the joint with $1\frac{1}{2}$ oz. of Mobilgrease No. 2 before fitting the end cover and a new 'Klingerit' joint.

Sealing Boot — Front Universal Joint — to renew

Early S1 cars

On early S1 cars the rubber boot may be changed without removing the trunnion pin by adopting the following procedure:

Remove the propeller shaft assembly from the car and secure it in a suitably shaped clamp.

- (i) Dismantle the joint, removing all parts except the body and trunnion pin.
- (ii) Thoroughly clean the body, ball head and trunnion pin.
- (iii) A complete coating of grease (or suitable rubber lubricant), must be smeared on the outside and inside of the sealing boot, the entire surface of the ball head, pin and the inside of the body. (It is very important that this instruction is observed).
- (iv) Stretch the grease-covered boot over the trunnion pin and ball head as shown in Figure F7.
- (v) Ease the sealing boot into the body as far as possible.

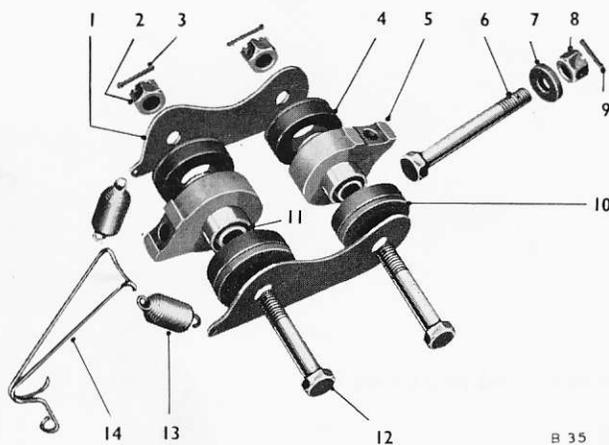


Fig. F4 Centre bearing support

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|------------------------------|----------------------------|
| 1. LINK | 8. NUT |
| 2. NUT | 9. SPLIT PIN |
| 3. SPLIT PIN | 10. FRICTION DISC |
| 4. RUBBER COMPRESSION WASHER | 11. SILENTBLOC BUSH |
| 5. HOUSING | 12. LINK ASSEMBLY BOLT |
| 6. MOUNTING BOLT | 13. SUSPENSION SPRING |
| 7. PLAIN WASHER | 14. SUSPENSION SPRING LINK |

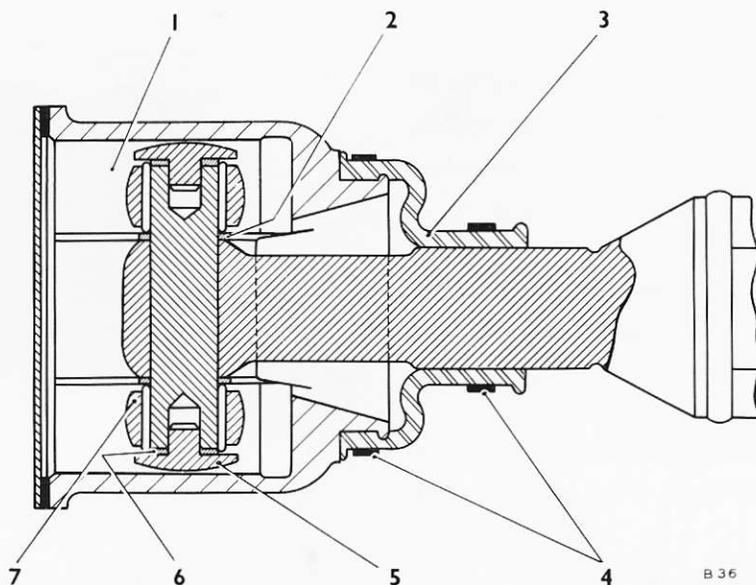


Fig. F5 Section through the front universal ball and trunnion joint

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|--|---|
| 1. JOINT BODY | 5. END PAD |
| 2. PLAIN HARDENED WASHER | 6. SHIM WASHER |
| 3. SEALING BOOT
(LATE S1 AND S2 CARS) | 7. OUTER RACE CONTAINING
62 NEEDLE ROLLERS |
| 4. SECURITY CLIPS | |

- (vi) Select a small tube of suitable diameter and gauge, then pass it between the sealing boot and the joint body. Pass a length of cord through the tube as shown in Figure F8 then remove the tube.
- (vii) Pass the tube between the sealing boot and the propeller shaft, then pass the cord through the tube to form a loop around the sealing boot as shown in Figure F9. Remove the tube.
- (viii) Whilst pulling on the ends of the cord, move the body back and forth until the entire sealing boot has passed through the body.
- (ix) Slide the sealing boot into position and secure it with the clips provided.

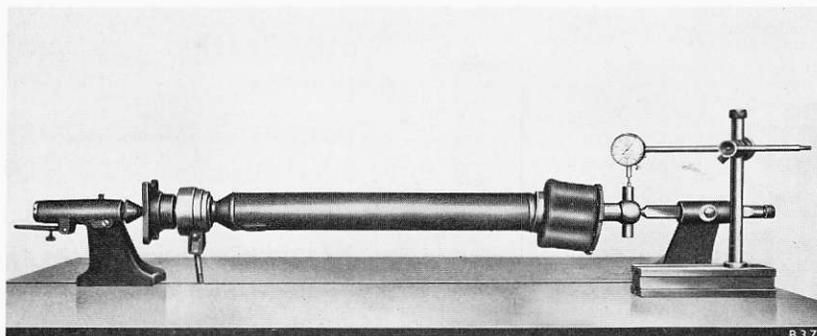


Fig. F6 Checking the centre pin

Late S1 and S2 cars

On later S1 and on S2 cars, the trunnion pin has to be removed to change the rubber boot. The instructions mentioned in 'Front Universal Joint—to assemble' regarding the trunnion pin must be adhered to.

During the production of S1 cars, the rubber sealing boot was modified from a convoluted form to the type shown in Figure F10 and modified clips were fitted.

This seal was later modified by increasing the neck of the boot and extending the width of the sealing land on the shaft stem.

Strap type security clips have been adopted with this long neck seal, the smaller clip being positioned as near as possible to the rear of the neck. These clips are of a more compact design and by virtue of their construction exert an evenly distributed radial clamping pressure.

Figure F10 shows a comparison between the convoluted, short and long neck sealing boots and their associated clips. After installing a propeller shaft fitted with either a short or long neck sealing boot, it is essential that the annular face of the seal is not restrained from assuming its free state.

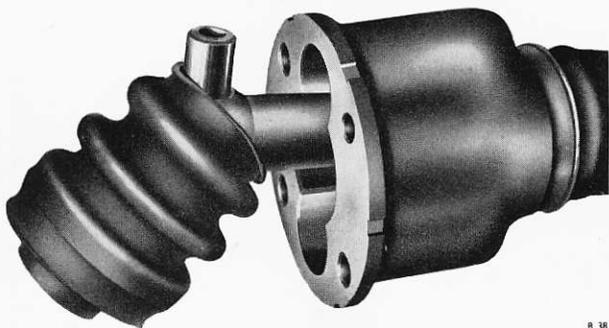


Fig. F7 Stretching the sealing boot over the trunnion pin

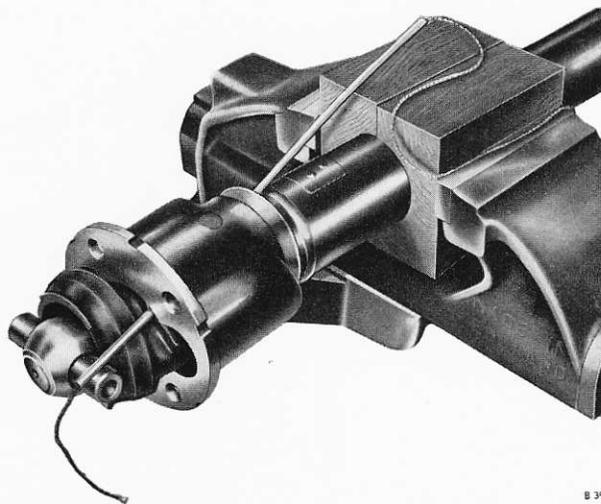


Fig. F8 Method of passing the cord through the tube (first position)

The rear clip should therefore be slackened sufficiently to permit the neck of the seal to assume a position which will relieve any strain, then re-tighten the clip.

When renewing the sealing boot, it is permissible to replace the short neck seal by a long neck seal, but when this is done, the small diameter clip should be repositioned from the end of the neck towards the annular face of the seal to ensure that it is clamping around the sealing land on the propeller shaft.

Centre Bearing — to remove and dismantle

To remove the centre ball bearing, the flange must be unlocked and pressed or drawn from the keyed, tapered end of the shaft. Ensure that correlation marks (2) are stamped on the end of the shaft, the flange and the Woodruff key, as shown in Figure F3. Remove both Woodruff keys from the shaft and the spring-loaded washer from the grease retainer.

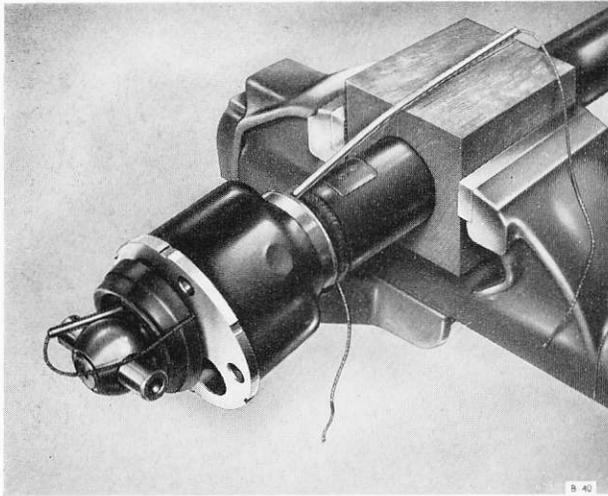


Fig. F9 Method of passing the cord through the tube
(second position)

Remove the housing and bearing from the shaft as an assembly by tapping the end of the shaft against a hardwood block. Remove the circlip and push the grease retainer and bearing from the housing.

Centre Bearing — to assemble and fit

Assembly is the reverse procedure of dismantling but the following points should be observed. Examine the bearing for wear and if necessary renew it. Fit a new 'O' ring and pack the bearing with Retinax 'A' grease or its approved equivalent.

Fit the Woodruff keys and flange, ensuring that the correlation marks (2) are in the correct relative positions. Renew the lock-washer and tighten the flange retaining nut to the torque loading of 150–180 lb.ft. An exploded view of the centre bearing is shown in Figure F11.

Hardy Spicer Universal Joints — to dismantle

To dismantle the Hardy Spicer joints, it is first necessary to clean and remove the paint from the yoke eyes. Remove the circlips securing the needle bearing races.

Tap the yokes with a hide mallet until the races are driven out of the eyes (see Fig. F12).

Hardy Spicer Universal Joints — to assemble

Fit the new seals, supplied with the universal spiders, on the sliding yoke.

Press the needle roller assemblies into the yoke eyes sufficiently to enable the circlips to be inserted, care being taken not to press the races more than necessary, otherwise the seals may be damaged. An exploded view of the joint is shown in Figure F13.

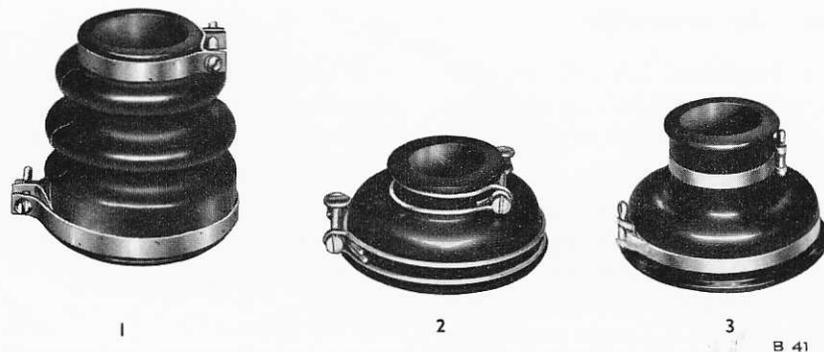


Fig. F10 Three types of sealing boots

1. CONVOLUTED

2. SHORT NECK

3. LONG NECK

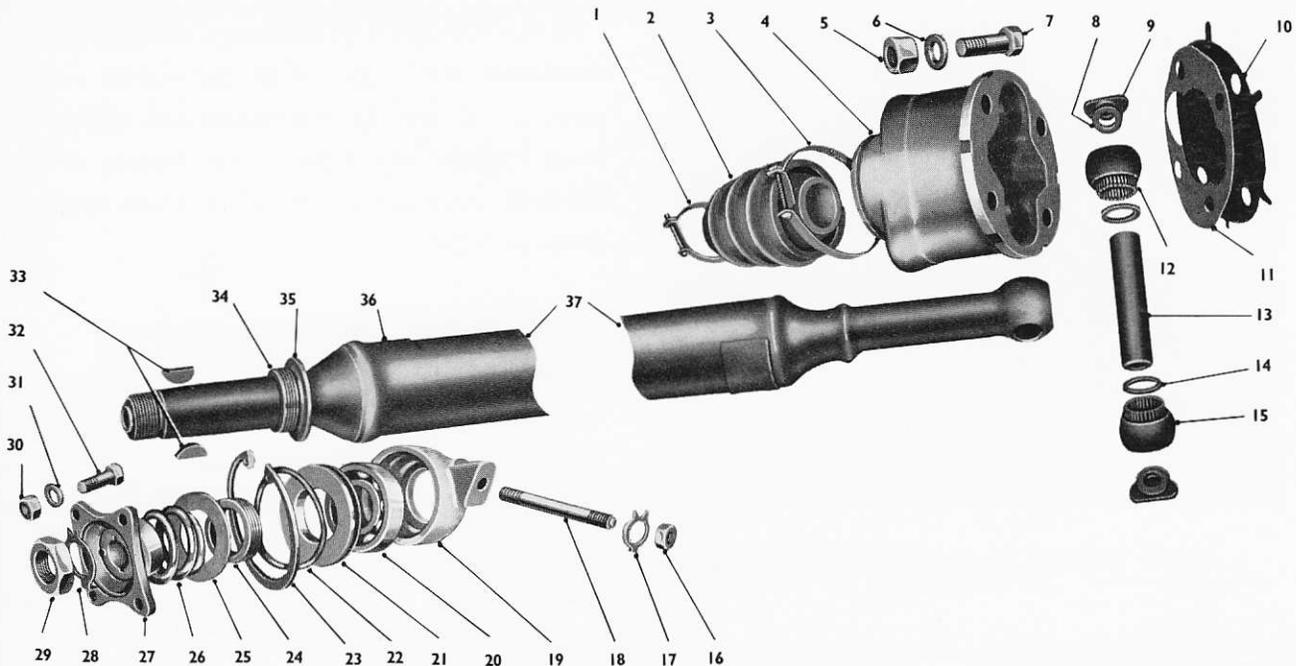


Fig. F11 Front propeller shaft and centre joint
(early S1 cars)

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|------------------------------|------------------------------|---------------------------|
| 1. RUBBER BOOT REAR CLIP | 13. PIN | 26. SPRING |
| 2. RUBBER BOOT | 14. WASHER | 27. FLANGE |
| 3. RUBBER BOOT FRONT CLIP | 15. NEEDLE AND RACE ASSEMBLY | 28. LOCKING WASHER |
| 4. BALL AND TRUNNION HOUSING | 16. NUT | 29. FLANGE RETAINING NUT |
| 5. NUT | 17. LOCKING WASHER | 30. NUT |
| 6. PLAIN WASHER | 18. MOUNTING STUD | 31. PLAIN WASHER |
| 7. BOLT | 19. HOUSING | 32. BOLT |
| 8. SPRING WASHER | 20. BEARING | 33. WOODRUFF KEYS |
| 9. END PAD | 21. SPACING RING | 34. GREASE SEAL |
| 10. END COVER | 22. RUBBER SEALING RING | 35. WASHER |
| 11. 'KLINGERIT' JOINT | 23. CIRCLIP | 36. BALANCE WEIGHTS |
| 12. NEEDLE AND RACE ASSEMBLY | 24. GREASE RETAINER | 37. FRONT PROPELLER SHAFT |
| | 25. SPACING WASHER | |

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Propeller Shafts — to assemble

Install the shafts as individual units; fit the front joint to the gearbox output flange, leaving the centre bearing carrier bolts slack until the rear shaft has been re-fitted.

Tighten the flange bolts on the three couplings; the four centre and four rear bolts should be tightened to 42–45 lb.ft. If the centre bearing mounting has been dismantled, the two large bolts through the Silentbloc bushes must be tightened to a torque loading of 60–65 lb.ft., while the front shaft is held in the correct position.

When fitting new friction discs to the centre bearing mounting, ensure that they are of the correct thickness, as discs fitted to S2 cars are thicker than those fitted to S1 cars and these must not be interchanged.

S1 cars:

Friction disc — RG 3466 — 0.187 in. ($\frac{3}{16}$ in.) thick

S2 cars:

Friction disc — UG 3632 — 0.250 in. ($\frac{1}{4}$ in.) thick

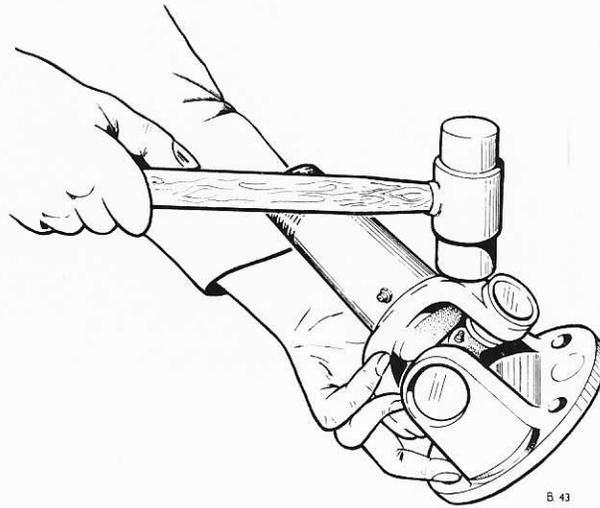


Fig. F12 Method of removing the races from the yoke eyes of the Hardy Spicer universal joint

The front shaft should lie along the centre line of the chassis in the plan view and slope downwards to the rear at approximately $1\frac{1}{2}$ deg. to the horizontal. It is usually sufficient for this to be lined up by eye, but a check should be made to ensure that there is adequate

vertical clearance — not less than $\frac{3}{32}$ in. on S2 cars — between the propeller shaft and the frame cruciform.

Lubricate the joints using Retinax 'A' or one of the approved lubricants.

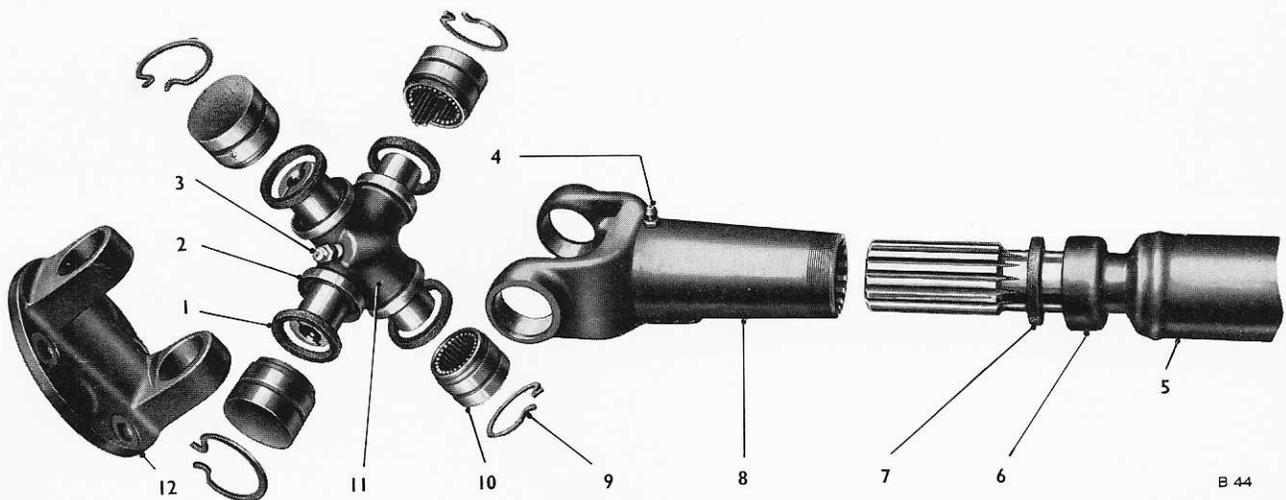


Fig. F13 Hardy Spicer universal joint dismantled

- | | | |
|-------------------------|-------------------------|------------------------------|
| 1. CORK GREASE SEAL | 5. REAR PROPELLER SHAFT | 9. CIRCLIP |
| 2. GREASE SEAL RETAINER | 6. GREASE SEAL RETAINER | 10. NEEDLE AND RACE ASSEMBLY |
| 3. GREASE NIPPLE | 7. GREASE SEAL | 11. UNIVERSAL JOINT SPIDER |
| 4. GREASE NIPPLE | 8. SLIDING YOKE | 12. FRONT YOKE |