The R-R Servo on Small HP Cars

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Rolls-Royce introduced four-wheel brakes in 1925 on the 20 h.p. chassis. Prior to that time, all Rolls-Royce chassis had brakes on the rear wheels only: a two-part system that consists of a pair of brake shoes on each rear wheel—one connected to the foot brake and the second to the hand brake. With the addition of front brakes, Rolls-Royce incorporated a servo mechanism to actuate the front brakes and to supplement rear braking. The servo mechanism used on all pre-war Rolls-Royce chassis is similar in design, including the Bentley 3½ and 4¼ chassis (except for the Wraith).

A properly adjusted and working servo is essential to good braking since up to 55% of the car's braking power is from the front brakes. This article outlines the problems related to the servo, its adjustment, and rebuilding. The adjustment and rebuilding of the servo does not require specialized tools and can be accomplished by any owner who has some mechanical aptitude.

The letter references in this article refer to the parts' designation used by Rolls-Royce in the owner's handbook (*photo 1*). Numbers that appear in parenthesis refer to parts' designations assigned by the author in photos 2–12.

The Rolls-Royce Servo—How It Works

The pre-war Rolls-Royce servo incorporates a pair of dry, disc-clutch linings which engage a disc drum when the foot brake is applied, thereby transferring power to the front brakes through a series of linkages and supplementing the pull on the rear brakes. The servo is "powered" by a driving plate (*1-photo 2*) connected to a worm gear on the left side of the gear box that turns in proportion to the ground speed of the car. As a result of the servo arrangement, front braking is dependent on both the pressure applied to the brake pedal and the road speed of the car since the servo revolves proportionately with the rear wheels.

Two braking nuances result from the gearbox driving the servo. First, a loss in braking effectiveness may be apparent when the car is moving very slowly. This is a result of "servo lag," or the servo turning too slowly to actuate fully the front brakes, leaving only the direct link to the rear brakes operative. Secondly, if the rear wheels lock during braking, the servo quits revolving and ceases to load the front and rear brakes regardless of pedal pressure. Since the front brakes are entirely servo-operated, this reduces the risk of also locking the front wheels and allows the driver more control of the car during violent braking applications.

Servo lag is most noticeable when you come to a stop, ease forward slightly and re-apply the brakes. The lack of braking under these circumstances is the result of not travelling far enough or fast enough for the servo to fully load the front brakes. Although it may seem as if you have no brakes, you in fact have direct control of the rear brakes through the brake pedal pressure. You should consider using the hand brake under these circumstances for auxiliary braking power. It takes approximately one foot of forward movement for the servo to wind up and engage. The same applies to reverse. If one goes from forward to reverse, or vice versa, it takes about two feet of movement before the servo engages.

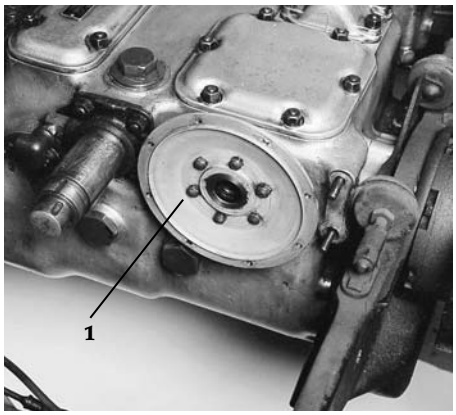

Photo 2: Driving plate (1) or left side of gearbox. Caution: do not pull this plate away from the gearbox. There is a washer inside the gearbox that will fall off in the gearbox if the driving plate is pulled out too far.

The foot brake is linked to the servo by a pair of levers **A**. When the brake pedal is depressed, a pair of cam levers **A1** & **A2** are forced apart. This brings the servo's friction clutch linings attached to the inner and outer drive plates (*2 & 5-photo 3*) in contact with the disc drum (*3*). If the car is moving, this transfers the rotational movement of the servo (approximately ¼ turn of the driving plate) through the coupling rods **R** or **F** to the balance lever **T** which engages the front brakes and augments the pull on the rear brakes. The remaining proportion of rear braking is achieved through direct pressure of the foot brake and is independent of the servo's operation. Servo-assisted braking on the Rolls-Royce is equally effective for backward as well as forward movement of the car.

A frictional dampening device **T1** is incorporated into the servo to prevent the violent application of the front brakes. A pneumatic damper **Td** was used on later models to eliminate noise from the servo levers when the brakes are released.

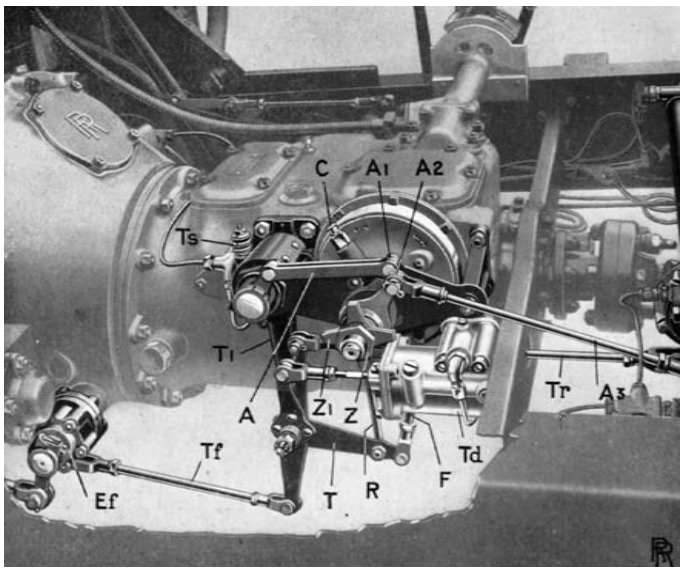

Photo 1: Rolls-Royce Servo as pictured in 20/25 owners' handbook.

A1 & A2: cam levers
A3: servo coupling to rear brakes
C: hand oiling point
Ef: front brake equalizer
F: forward movement servo coupling
R: rear movement servo coupling
T: balance lever
T1: frictional damper
Ts: spring for frictional damper
Td: pneumatic damper
Tf: front equalizer servo coupling
Tr: rear equalizer servo couplin
Z: adjusting nut
Z1: buffer springs

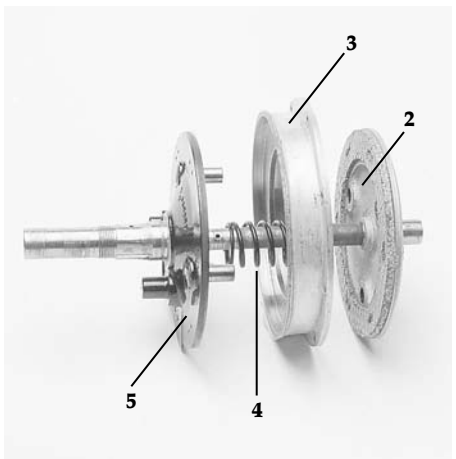

Photo 3: Inner driving plate (2) and outer driving plate (5) that carry servo linings, spring (4) that separates inner and outer driving plates and disc drum (3).

Modifications Made to the Rolls-Royce Servo

R. Haynes lists the following modifications made to the pre-war servo in his book *Rolls-Royce Small Horsepower Brake Systems* (available from RROC club stores).

20HP

The four star-shaped springs **Z1** behind the serrated adjusting washer (*15-photo 7*) were introduced at chassis number GAJ42.

20/25

At chassis GOS22, the servo damper **Td** was introduced, and steel staples replaced hollow rivets that hold the servo liners. Beginning with GAU1, the cam levers **A1** & **A2** were modified to include four .250″ steel balls (*11a-photo 4*). Fully floating (non-stapled) servo liners commenced with GBJ1.

Bentley 3½ and 4¼ Litre (except M-Series)

The A, B and C-Series servo design is similar to the 20/25 HP servo from chassis number GOS22. The fully floating servo liners were introduced on the 3½ litre at chassis B-2-DG.

Bentley 4¼ (M-Series)

The M-Series incorporates fully floating servo liners. The damper arrangement and its connection to the servo is different from the earlier series.

Identifying Servo-Related Braking Problems

Heavy pedal pressure and poor braking may indicate an "inefficient" servo according to *Service Instructions for Rolls-Royce Cars* (TSD 2066). Five primary causes for "inefficient brakes" are noted in *table 1*.

If the servo is suspected to be the cause of the braking problem, a visual inspection should determine if excess oil may be contaminating the linings since oil on the linings is the major cause of servo-related problems. Determine the source of the oil and rectify the problem before proceeding. Sources of oil contamination may include excessive lubrication by hand, overuse of the one-shot central lubrication system, or oil leaks from the gearbox. Service instructions specify that the outer bearings of the servo, which are oiled by hand, should get only one or two drops of oil every 5,000 miles. An oil contaminated servo lining should be replaced. A glazed servo lining may be roughened with emery cloth to possibly restore its efficiency. If you are going to the trouble of taking down your servo, go ahead and replace the linings.

CAUSE	DUE TO	REMEDY
1. Brake liners glazed or worn out	Wear and tear	Reline
2. Oil on brakes	(a) Too much oil in differential (b) Excessive use of one shot	Clean out drums and reline
3. Servo inefficient	(a) Servo liners glazed, worn or oily (b) Incorrect adjustment	Reline servo Re-adjust servo
4. Water on brakes	Ingress of water during washing	Dry off by application of brakes
5. Incorrect adjustment worn out	Wear or neglect	Re-adjust

Table 1

Initial Preparation

Access to the servo is attained by removing the floorboards. Jack up one rear wheel clear of the floor and chock the remaining wheels. Release the hand brake and put the transmission in neutral so that the drive shaft may be rotated by hand.

The following tools will aid disassembly:

- 3/16″ British Standard Fine (BSF) wrench
- ¼″ BSF wrench
- 5/16″ BSF wrench
- cotter pin extractor
- needle nose pliers
- large adjustable wrench
- C spanner
- 3/32″ drill bit and drill
- flat blade screwdriver

Parts needed:
(*see table 2*)

- 2 servo clutch linings (G55679 for stapled linings)
- 12 staples (G54240)–see notes regarding conversion to free-floating linings
- 9 cotter pins
- coarse valve grinding compound or emery cloth

Disassembly

In order to keep the various parts straight and to speed reassembly, you may want to number a set of containers (author uses small ziplock bags) that correspond to the following steps to hold your parts. These steps refer to the late 20/25 (chassis GOS22 to GBK22) and may differ slightly depending on the chassis.

(1) Remove the one-shot oil line (¼″ BSF) connected to **Td**.

(2) Remove clevis pin from **Td** damper fork connected to the top outside arm of **T**. *NOTE: The various clevis pins have a collar with a hole through which a cotter pin is inserted to hold the collar and pin in place.*

(3) Remove clevis pin on **Tr** connected to top inside arm of **T**. Remove clevis pin at rear of **Tr** and remove **Tr**. Do not alter any of the

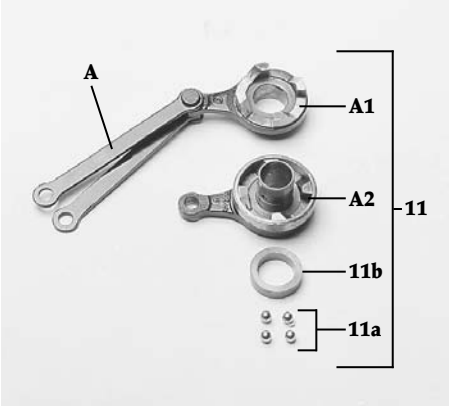

Photo 4: Cam levers A1 and A2. The bushing (11b) fits over the shaft of A2. The four .250 steel balls fit at the base of the inclined ramps of A2.

SERVO CLUTCH LINING SPECIFICATIONS			
	Outside diameter	**Inside diameter**	**Lining thickness**
Stapled type	4.675″	3.375″	.187″
Floating type	4.670″	3.405″	.187″
Bentley M (four .875″ slots on inside diameter)	4.665″	3.000″	.187″
Wraith type (eight .750″ slots on inside diameter)	4.795″	3.550″	.162″

Table 2

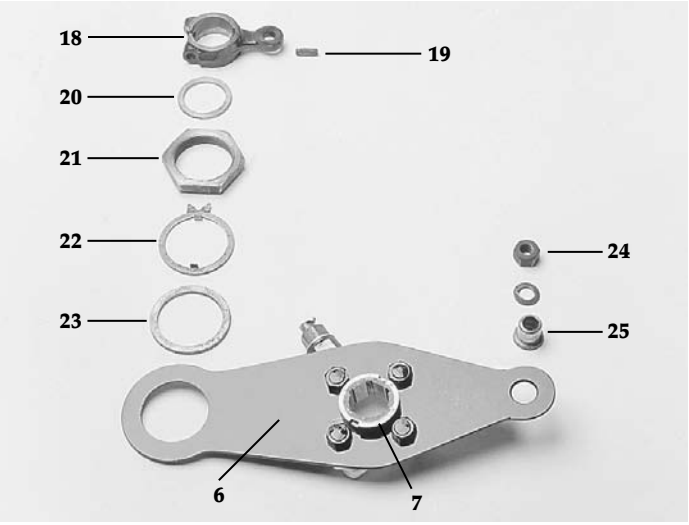

Photo 5: Bridge support plate (6) and mounting hardware.

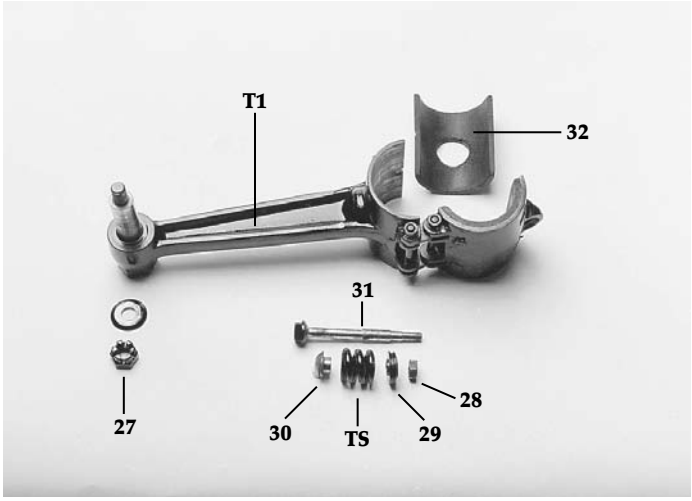

Photo 6: Frictional damper (T1) showing removable lining (32) and bolt with spring (Ts) to adjust tension of T1.

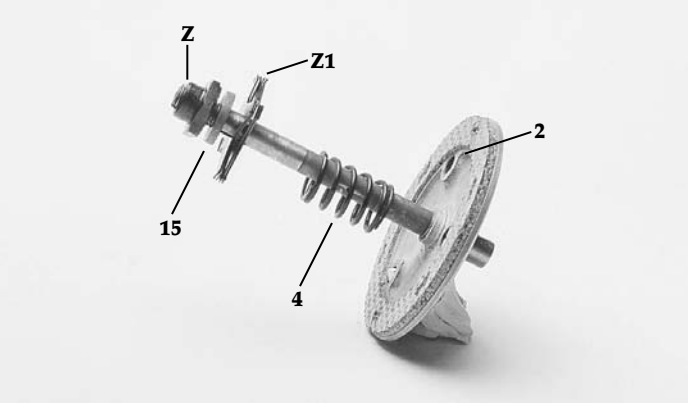

Photo 7: Inner drive plate (2) and parts carried on its hollow shaft. Z is the adjusting nut to adjust the servo clearance.

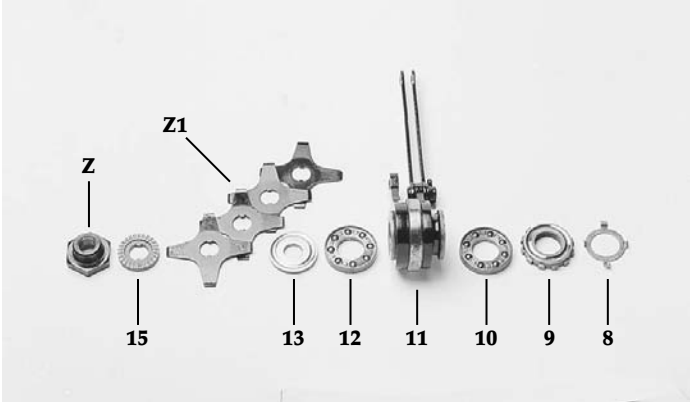

Photo 8: Sequence of parts that fit on servo shaft in front of bridge support plate.

rod lengths in order to maintain the existing angles of the brake lever geometry. *NOTE: The rear of rod* ***Tr*** *has a long slotted fork.*

(4) Remove clevis pin on **Tf** connected to the bottom arm of **T**.

(5) Remove clevis pin at front of **A** that links the pair of arms to lever (*18-photo 5*).

(6) Remove clevis pins on **A3**. Detach rod **A3**.

(7) Remove the pinch bolt (3/16" BSF) and washer from lever (*18*). Remove lever (*18*). Remove the collet key (*19*) on the arm along with the washer (*20*) that separates the lever from the nut (*21*).

(8) Bend back the tab on the locking tab washer (*22*) and remove nut (*21*). Remove the tabbed washer (note orientation of this washer with two small tabs that face in) and the flat washer (*23*) that follows.

(9) Remove nut (*28-photo 6*) on pinch bolt (*31*) that holds **T1** in place. Count the number of turns of the nut (*28*) so that it can be replaced with the same tension. In replacing the nut, an approximate adjustment may be made by fully tightening the nut and backing it off one full turn. This nut adjusts the dampening load on the friction device. If it is adjusted too tightly, the servo may "shudder" when the brakes are applied. If the tension is too loose, the brakes may "thud on" when applied. Withdraw the pinch bolt (*31*) with bottom spring collar (*30*), spring **TS**, and top spring collar (*29*). **T1** contains a split friction lining that is riveted at the top. The bottom lining (*32*) is removable and has an oil hole that matches a similar hole in **T1**.

(10) Unscrew the two 1/4" BSF nuts that secure the damper **Td**. The rear nut has little clearance and a 1/4" BSF socket speeds removal. Remove **Td**. On reassembly, be sure that the nuts are on the outside and the bolts enter from the back (*gearbox*) side of the damper. Check to be sure the damper piston does not stick. The damper **Td** is designed to damp only when the rod is pulled out. A faulty damper may be the result of the 1/8" steel ball, located under the large brass screw on the top outside edge of the damper, being missing or stuck.

(11) Remove nut (*24-photo 5*) (5/16" BSF) from the right side of bridge support plate (*6*) and the lock washer.

(12) Remove the circlip, nut **Z** and serrated washer (*15-photos 7 & 8*). Note that the washer is slotted to fit on the servo shaft and the serrations on **Z** mate with the serrations on the washer.

(13) Remove four star-shaped buffer springs **Z1**. Note the orientation of the springs (*photos 7 & 8*). One pair has its tabs facing out, the other pair faces in.

The servo can now be removed in several subassemblies and disassembled on the bench. *CAUTION: In removing the sub-assemblies, hold the disc drum* (3-photo 9*) against the gearbox when withdrawing units. There is a washer inside the gearbox that will fall to the bottom of the gearbox if the driving plate* (1-photo 2*) is pulled out too far. See also* FL*99-3, p. 5781 for a photo of this washer.*

- Remove parts 10–13 (*photo 8*) as a single unit. This includes **A1** and **A2**; and the pair of arms **A** connected to **A1**.
- Withdraw as a single unit the nut (*9-photo 8*), bridge supporting plate (*6-photo 5*) and outer driving plate (*5-photo 3*). Balance lever **T** and **T1** are included in this subassembly.
- Remove spring (*4-photo 3*).

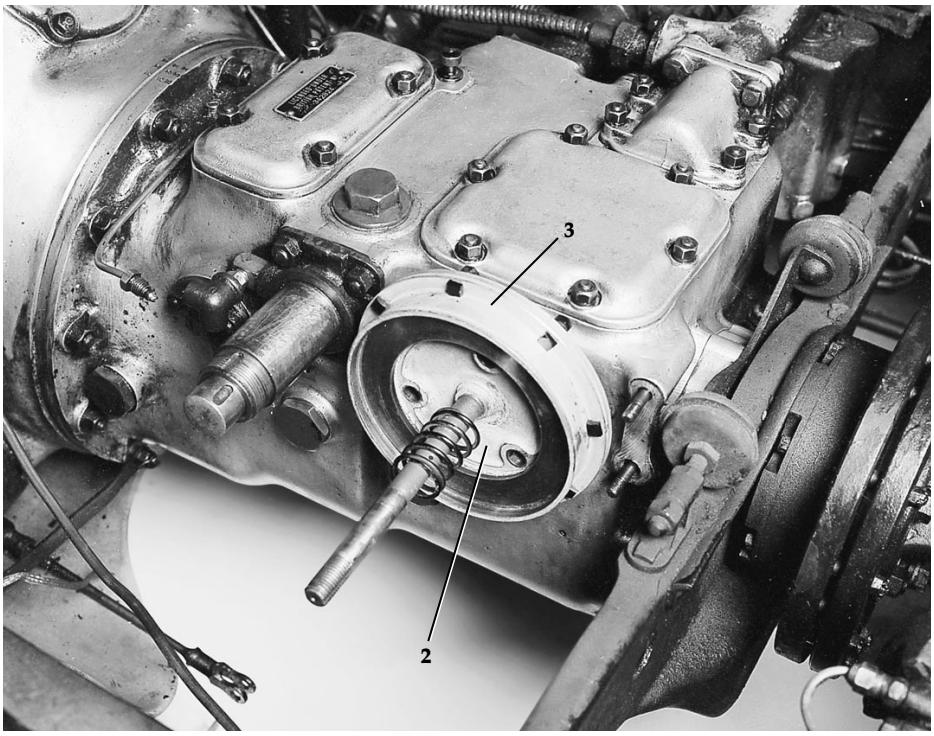

Photo 9: Disc drum (3) shown attached to driving plate by eight 3/16" BSF bolts.

- Remove the eight 3/16"BSF nuts and bolts that secure the disc drum (*3-photo 9*) to the driving plate (*1-photo 2*). Rotate the drive shaft by hand to gain access to each nut sequentially. Upon reassembly, note that the square head bolts are filed down on one edge so they fit tightly against the disc drum (*3*).
- Remove disc drum (*3*) and inner drive plate (*2-photo 9*) as a unit. There is a small space between the inside edge of the disc drum (*3*) and the inner drive plate (*2*) where you can separate these parts. *CAUTION: Do not pull the driving plate (*1-photo 2*) away from the gearbox.*

Disassembly of Sub-assembly Units

(14) Remove outer ball race (*13-photo 8*) and ball cage (*12*). The outer ball cage (*12*) and inner ball cage (*10*) are interchangeable and will fit either way.

(15) Servo cam levers **A1** and **A2** include a bronze bushing (*11b-photo 4*) and four .250" steel balls (*11a*). When refitting, insert the steel balls at the foot of each cam incline of **A2** with a little grease to hold the balls in place. Replace lost or damaged balls with standard .250" steel balls.

(16) Remove cotter pin and castellated nut (*27-photo 6*) (5/16" BSF) on **T** that attaches **T1**. Remove **T1**.

(17) Remove clevis pin on **F** connected to the back of arm **T**. Note that **F** and **R** connect to the back of arm **T**. **F** has a slotted fork and **R** has an eye at its base (*photos 1 & 10*).

(18) Remove cotter pin and collar from **R**. Remove **T**.

(19) Bend back the two locking tabs on the washer (*8-photo 8*) that holds the retaining nut (*9*) in place. Remove retaining nut (*9*) with C spanner and then remove locking tab washer that follows. On reassembly, note that the locking tab washer has two tabs that face in.

(20) Remove the bridge support plate (*6-photo 5*) that includes a splined* bronze bushing (*7*). On reassembly, note that the splined bushing is slotted (fits one way) and the flat edge of the bushing faces out. (*Later series chassis used a smooth bushing.)

(21) Remove the outer arm **F** (*photos 1 & 10*) and its bushing from the servo shaft. On reassembly, note that the arm is on the right side and the bushing with the beveled edge faces in. The rod connected to F has an adjustable end connected to a slotted fork.

(22) Remove the inner arm **R** and its bushing. Note that this lever is on the left and the bushing with the beveled edge faces in. The rod connected to **R** is not adjustable.

The outer drive plate (*5-photo 3*) has three pins which engage holes on the inner drive plate (*2*). A light coating of oil on the pins will help ensure that they do not bind on reassembly.

This completes the disassembly of the servo. Clean and inspect all parts before reassembling.

Servo Relining

The servo liners are attached to the inner and outer drive plates (*2 & 5*) by staples on 20 h.p. and 20/25 chassis prior to GBJ1. On all Bentley 4¼ chassis, Bentley 3½ chassis beginning with B-2-DG and on the 20/25 chassis beginning with GBJ1, the liners are free-floating and are not "stapled" to the drive plates. Remove the stapled liners by prying back the staple legs and pulling them out.

If the faces of the disc drum (*3-photo 3*) have a polished look, they should be dressed to a consistent dull gray by rubbing coarse valve grinding compound or emery cloth on the face of the disc drum with one of the old liners. This gives the disc drum faces a little more bite and will promote servo efficiency. On models with free-floating linings, dress four surfaces. Be sure and clean off any excess grinding compound on the disc drum before reassembly.

Conversion of Stapled Liners to Free-Floating

The early-style stapled linings are easily converted to free-floating linings. It's as simple as putting in the new linings without staples. Fill the staple holes in the inner and outer drive plates (*2 & 5-photos 3 & 12*) with solder. An alternative method of filling the staple holes in the servo plate is with J.B. Weld or Metal-2-Metal, hard epoxy-type body fillers that can be drilled and tapped. An advantage of the conversion to free-floating linings and the filling of the staple holes is fewer points for oil to sneak in and contaminate the new linings.

Replacing Stapled Servo Liners

On models with stapled linings, note that the staple pattern is different for the inner and outer drive plates. You should match the staple pattern of the liners to the appropriate drive plate before proceeding. Rolls-Royce supplied servo liners come with the staple dimple preformed for the crown of the staple; however, they are not pre-drilled for the staple legs.

Once you have matched the servo liner to the proper drive plate, drill a 3/32"pilot hole in the

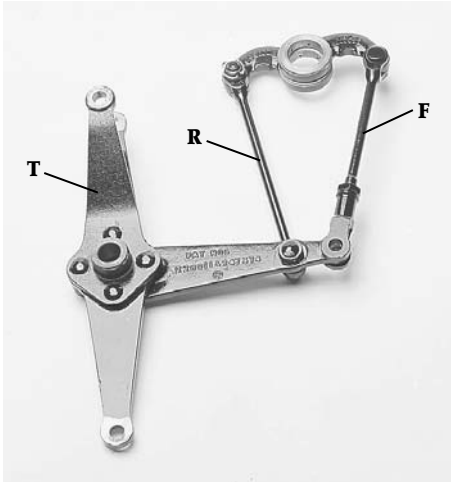

Photo 10: T balance arm showing connections to R and F. Note that F has a forked slot that connects to the back of T balance arm.

corner of one of the staple dimples. Use a small wire or drill bit to line up this hole to one on the drive plate. Proceed to drill the second hole from the drive plate side through the lining. Check that the staple fits through the drive plate. If it does not, carefully bend its legs until it slips easily through. You should use new staples to hold the servo liners in place since the old ones may be weakened or damaged by removal.

Insert the staple from the lining side and tap down lightly until it seats in the dimple of the liner. The crown of the staple should be below the surface of the liner. A small jig can be made to hold the staple tightly against the liner while you tap down the staple legs. Insert the next staple opposite the first and continue the above procedure until all staples have been snugly fitted.

With the liner installed on the drive plates, lightly rub the liners on a piece of emery cloth resting on a flat surface to remove any surface irregularities.

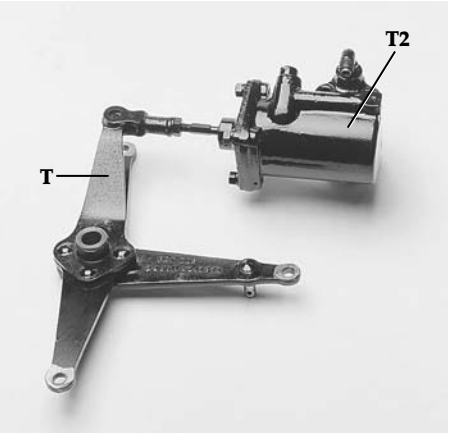

Photo 11: Pneumatic damper Td connected to outside top arm of balance lever T.

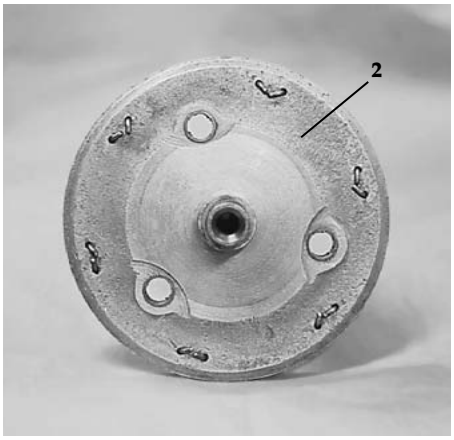

Photo 12: Back side of inner driving plate (2) showing staples holding on servo liner.

Servo Reassembly

Reassembly (in Rolls-Royce parlance) is the reverse of the above steps. The following notes will expedite the process.

- Install the following parts on the outer drive plate (*5-photo 3*) shaft. Orient the outer drive plate with the tab on the edge in the six o'-clock position.
- **R** and its bronze bushing (flat face of bushing faces out)
- **F** and its bronze bushing (flat face of bushing faces out)
- Bridge support plate (*6-photo 5*) and splined bushing (*7*). Note that the large hole on the bridge support plate is on the left side.
- Lock washer (*8*) and retaining nut (*9*) with flat face of the retaining nut facing in. Tighten nut and secure with fold over tabs on lock washer (*8*).
- Put servo lining on inner drive plate (*2-photo 3*). Fit disc drum (*3*) and spring (*4*) over inner drive plate shaft.
- Fit servo lining on outer drive plate (*5*). Fit outer drive plate (*5*) and attached components on to the shaft of inner drive plate (*2*). You may want to trial fit the inner and outer drive plates without the spring to assure a smooth fit on the three pins. The inner and outer drive plates may be stamped with matching locating marks, usually an "O", to guide reassembly.
- Add inner ball cage (*10-photo 8*).
- Fit **A1** and **A2** installed as a unit with four .250 balls. Since **A1** and **A2** can be reassembled in four positions, note that the levers are staggered about ⅜"with **A1** forward and **A2** trailing (*photo 1*).
- Add outer ball cage (*12-photo 8*), outer ball race (*13*), four buffer springs **Z1** (note orientation of tabs on springs), washer with serrations (*15*) facing out and nut **Z**. Hand tighten **Z** to hold components on shaft.
- Refit the circlip on the end of the shaft.
- Connect **T1** to **T** balance arm and secure with castellated nut (*27-photo 6*) and cotter pin.
- Connect **R** to **T** balance arm.
- Connect **F** to **T** balance arm.
- Fit the servo assembly on the drive plate (*1*). A bit of jiggling is required to simultaneously refit **T1**, the bridge support plate (*6*) and inner drive plate (*2*).
- Attach **T1** with bolt (*31-photo 6*) and spring Ts and adjust tension.
- Refit parts 18–23 (*photo 5*) in reverse numerical order to secure left side of bridge support plate (*6*).
- Attach nut (*24-photo 5*) and washer to right side of bridge support plate (*6*). The dowel should be inserted through the hole on right side of bridge support plate.
- Refit eight 3⁄16" BSF bolts that attach disc drum (*3-photo 9*) to driving plate (*1-photo 2*).
- Reattach the linkages to **A**, **A2**, **Tr** and **Tf**.
- Refit damper **Td** and attach arm to **T** balance arm.
- Reconnect one-shot oil line to **Td**.

After the various clevis pins and other parts are reconnected, the brake pedal should be applied several times to seat the liners before final adjustment of the servo can be made.

Adjustment of the Servo

Correct adjustment of the servo is dependent on setting the proper clearance between the friction clutch linings and the disc drum. The clearance is determined by measuring the length of travel between the outer drive element (*5*) and the edge of the disc drum (*3*) when the foot brake is depressed.

With the brakes in the off position, push the disc drum (*3*) towards the gear box as far as it will go and maintain the pressure. If the servo clearance is adjusted correctly, the outer drive plate (*5*) should move 1⁄32" toward the disc drum (*3*) when the foot brake is applied lightly.

Adjustment of the servo is made by turning the serrated nut **Z** one click at a time until the 1⁄32" clearance is obtained. Turning the nut clockwise reduces the clearance. The nut **Z** has 25 radial serrations that engage similar serrations on a washer (*15*) that is slotted to secure it from rotating on the servo shaft. You should check the clearance with each click (1⁄25 turn) of the nut **Z**. Excessive force should not be applied to the nut **Z** to avoid damaging the serrations since they are designed to hold the servo clearance once set. *NOTE: Over-tightening of the adjusting nut **Z** may result in the servo sticking and the brakes dragging. A setting that is too loose will take extra pedal pressure and will reduce braking efficiency.*

An alternative method of adjusting the servo is described in the owner's handbook and is based on the distance of brake pedal travel to engage the servo.

Final Testing

Jack up one rear wheel clear of the floor and chock the remaining wheels. Clamp the rear brake linkage in the off position. Release the hand brake and put the transmission in neutral, open the garage door, start the engine and shift into top gear. At this point, the raised rear wheel and the servo drum should be turning. If the servo is not turning, turn the car off and check the adjustment of **Z**. With the rear wheel turning, press the foot brake to be sure that the servo is engaging and does not drag when the brakes are released. Make adjustments to **Z** as necessary. You can bed the linings by applying the brakes hard several times. After the preliminary stationary test in the garage, the car can be road tested. (Be sure and remove the clamp holding off the rear brakes before road testing.) You may want to leave the floorboard out to observe the servo's action during initial break-in. *NOTE: The new servo liners will not impart full braking power until they have had a chance to bed.*

After the new liners have bedded, check the servo clearance again—hopefully for the last time. Rolls-Royce notes that a servo should normally "run 20,000 miles without the need of any adjustment."

References

Adjustment of Servo Motors—All Models, by R. Haynes, Rolls-Royce Enthusiasts' Club (RREC) Bulletin, #31, pp. 11–12, and RREC Technical Manual 1972, p. 172.

Brakes—Yet Again, by D. Stewart Watson, RREC Bulletin, #149, p. 56.

Overhauling Your Servo, by R. E. Kirby, RREC Bulletin, #96, pp. 14–18, RREC Technical Manual 1978, pp. 70–76.

Overhaul of Servo Motor—All Models, RREC Bulletin, #31, pp. 12–14, and RREC Technical Manual 1972, p. 173.

The Rolls-Royce Mechanical Servo, by Nigel H. Hughes, RREC Bulletin, #6, pp. 2–3, and RREC Technical Manual 1972, pp. 170–171.

Rolls-Royce Small Horsepower Brake Systems (Overhaul of the brake systems of Rolls-Royce 20HP, 20/25, 25/30, Wraith, Bentley 3½ & 4¼ chassis), by R. Haynes, published by RREC, ©1983.

Rolls-Royce 20/25 H.P. Car (handbook).

Service Instructions for Rolls-Royce Cars (T.S.D. Publication 2066), Rolls-Royce Limited, Chapter J–Brakes.

Servo Adjustment and Overhaul Pre-War Cars, by. R. E. Kirby with notes by R. Haynes, RROC Flying Lady, #69–6, pp. 1212–1215.

Servo Braking, by Donald Bastow, RREC Bulletin, #149, pp. 55–56.

Servo Brake Systems—How It Works, by Richard C. Hitchcock, RROC Flying Lady, #69–5, pp. 1198–1200.

Servo Operation, by G. Ashley-Carter, RREC Bulletin, #149, p. 56.

Servo Overhaul—late 20hp chassis GVO74, by Nick Jago, RREC Bulletin, #119, pp. 14–15.