SECTION J
REAR AXLE AND SPRINGS

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REAR AXLE SHAFTS - BEVEL PINION AND CROWN WHEEL - DIFFERENTIAL GEARS - REAR ROAD SPRINGS - REAR SHOCK DAMPER.

SECTION J

REAR AXLE AND SPRINGS

List of Illustrations:

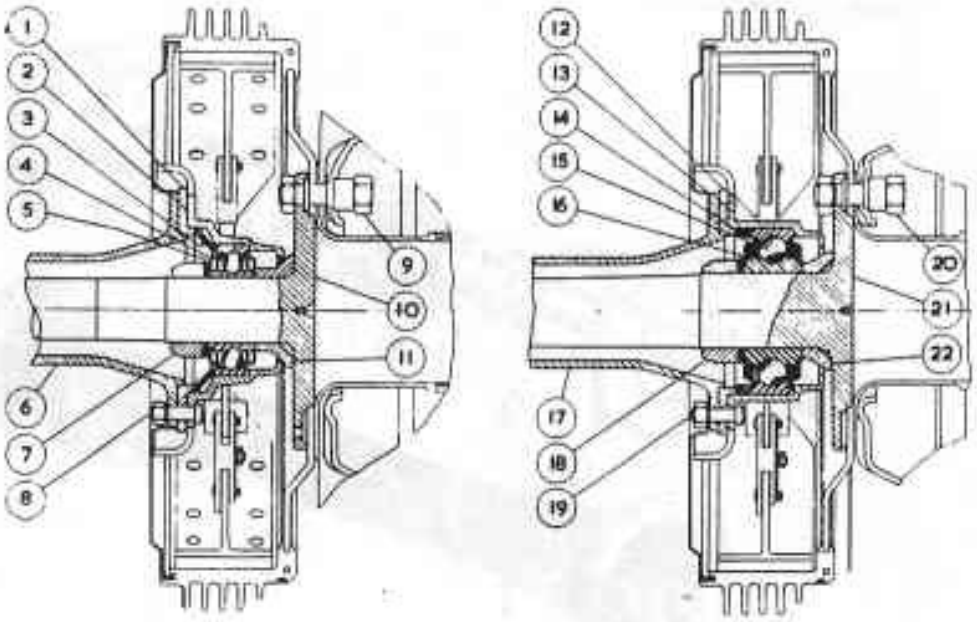
REAR AXLE AND SPRINGS

Rear Axle Ratios:	11:41	Standard Silver Wraith, Silver Dawn, Bentley.
	12:41	Special export Bentley.
	13:40	Bentley Continental Sports.
	8:34	Silver Wraith (Long Wheelbase), Phantom IV.
Oil Capacity:	1½ pts.	Silver Wraith (Standard), Silver Dawn, Bentley.
	3 pts.	Silver Wraith (Long Wheelbase), Phantom IV.

REAR AXLE:

General:

The rear axle is of the semi-floating type with off-set hypoid spiral bevel final drive. The load is taken by single row journal ball bearings at the outer ends of the axle shafts, each bearing being permanently lubricated and sealed.



EARLY TYPE — FIG. J1. AXLE BEARING ASSEMBLIES — LATER TYPE

1 & 12.	Spigot plate	6 & 17.	Axle tube
2 & 13.	Bearing housing	7 & 18.	Collar
3 & 14.	Adjusting piece	8 & 19.	Bolt
4 & 15.	Ball bearing	9 & 20.	Nut, wheel studs
5 & 16.	Spring plate	10 & 21.	Axle shaft
		11 & 22.	Distance piece

The axle shafts are forged integrally with the wheel hubs and can be extracted without dismantling the axle.

Axle Shafts:

To remove a half-shaft:-

1. Remove wheel, undo the three countersunk brake drum retaining screws, withdraw wheel disc support and drum.

2. Remove the five $\frac{3}{8}$" bolts, Phantom IV ten setscrews, retaining bearing housing to axle tube, hold brake carrier in position and withdraw shaft. The shaft should be withdrawn carefully to avoid damage to oil seals adjacent to crown wheel bearing.

It should be noted, that the axle shafts differ in length, the R.H. shaft being longer than the L.H. shaft.

On early models, the wheel bearing housings 2, Fig. J1, are different to current production, 13, Fig. J1, the axle shafts also being of a smaller diameter. They are interchangeable as a whole and the procedure for dismantling and assembly are similar.

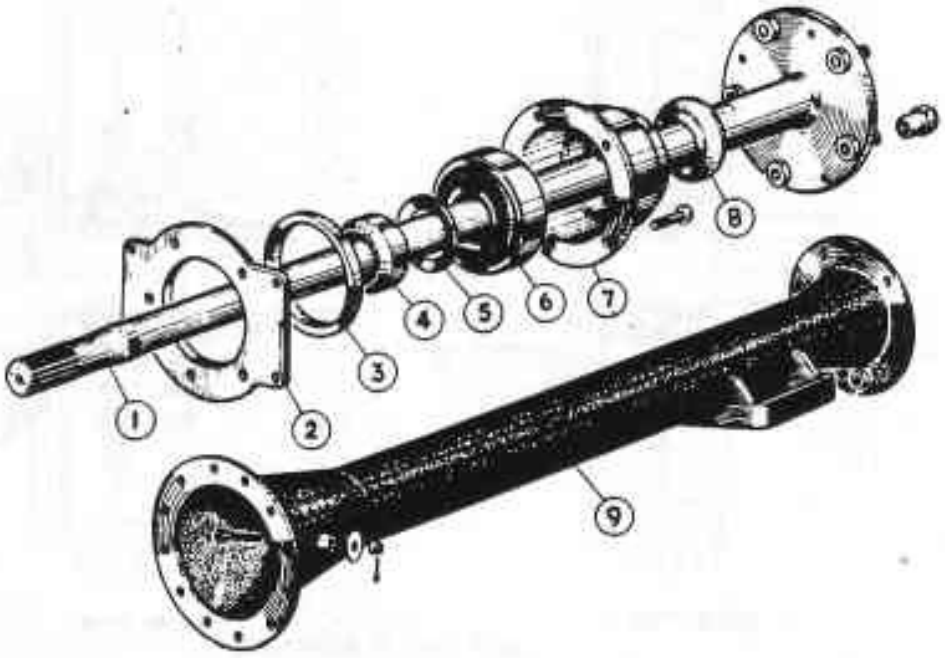


FIG. J2. AXLE ASSEMBLY.

1. Axle shaft.
2. Spigot plate.
3. Adjusting piece.
4. Collar.
5. Spring plate.
6. Ball bearing.
7. Housing.
8. Distance piece.
9. Axle tube.

Data, Half-Shaft Assembly

Bentley - A & B series:

Interference fit, bearing and shaft	.0006" to .0014"
Interference fit, collar and shaft	.003" to .0043"

Bentley - (C series and onwards), Silver Wraith, Silver Dawn:

Interference fit, bearing and shaft	.0006" to .0014"
Interference fit, collar and shaft	.0038" to .0046"

Phantom IV:

Interference fit, collar and shaft	.0010"

Axle bearing end float (All) .010" to .015"

Attention is drawn to the appreciable end float in the above bearings and they should not be renewed unless the end float considerably exceeds this figure or they are rough in operation.

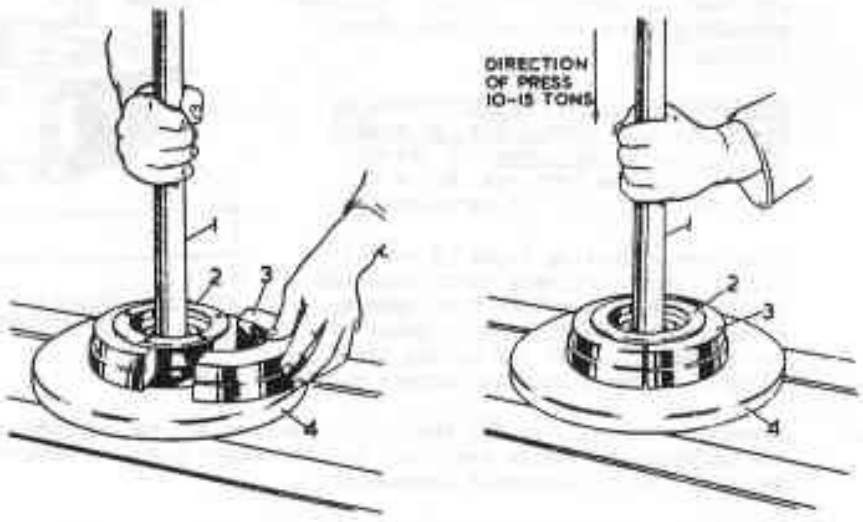


FIG. J3. REMOVING BEARING AND HOUSING.

1. Axle shaft
2. Bearing and housing
3. Split collar
4. Support plate

To Renew Bearings:

A special extractor 733/T1002 is required.

1. Check studs for alignment. With the spigot plate (1 & 12, Fig. J1) removed from the bearing housing, mount assembly in lathe, turn the collar (7) until thin enough to split. Check shaft for bowing, if more than .002", straighten in cold press.

2. Use extractor, or remove bearing as shown in Fig. J3.
NOTE:- If shaft is worn, new diameter 1.7726" - .0003", due to bearing revolving on shaft, a complete new assembly must be fitted. If the oil seal has worn a small groove, blend edges by filing, providing this is not too deep.

3. Measure the width of the outer race of the new and old bearing, the variation should not exceed .002". If the new bearing is wider, a similar amount should be ground off the existing adjusting piece (3 and 14, Fig. J1), but if it is narrower or of the same width, the adjusting piece may be fitted without alteration. A .002" end float of adjusting piece is permissible.

3a. If a new bearing housing and spigot plate are to be fitted, press the new bearing fully home into housing and bolt on spigot plate without fitting adjusting piece.

Place assembly on surface plate and clock top face, as shown in Fig. J4. Fit new adjusting piece and again take clock reading.

An amount equal to the difference in clock readings should then be ground off the adjusting piece, to obtain zero nip on the bearings, but a nip not exceeding .002" is permissible.

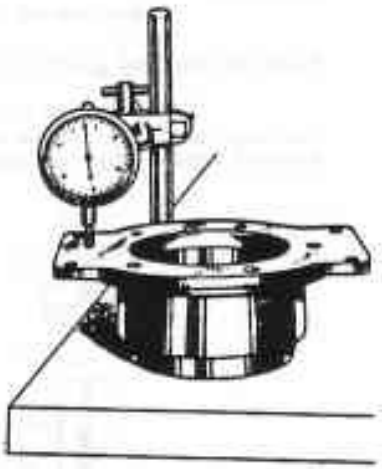


FIG. J4. CLOCKING TOP FACE OF SPIGOT PLATE.

4. Place the adjusting piece (3 or 14) Fig. J1, onto the axle shaft followed by the housing complete with bearing, press bearing fully home (approx: 10 ton pressure). Fit the spring plate (5 or 16) ensure this is correct way round.

5. Press on collar (7 or 18) which will flatten out spring plate, place the adjusting piece in position, attach spigot plate to housing with two bolts to hold correct assembly.

To Remove Rear Axle:

1. Jack up and place blocks under rear shackle brackets. Disconnect chassis lubrication unions.

2. Disconnect propeller shaft at rear end. Disconnect brake rods from equaliser, and equaliser support from axle tube.

3. Jack up rear axle to free shock damper arms, and disconnect forked links from main arms.

4. Disconnect the four U-bolts and remove near-side brake drum. Manoeuvre axle casing out between springs and chassis frame towards the off-side.

To Replace Rear Axle:

Replacement is the approximate reversal of the removal operations.

Renew rubber mounting pads if necessary.

Check rear equaliser support is correctly positioned, see Fig. J5.

DISMANTLING CENTRE CASING:

Before dismantling, suitably mark with co-relation marks axle tubes and centre casing, also relative positions of side plates and centre casing.

Remove axle tubes from centre casing complete with shafts and brake drums.

Remove side plates, place casing under press and remove nuts progressively in opposing pairs to avoid distortion from internal pre-load spring. Remove oil seal and adjusting washer (3 and 5, Fig. J6).

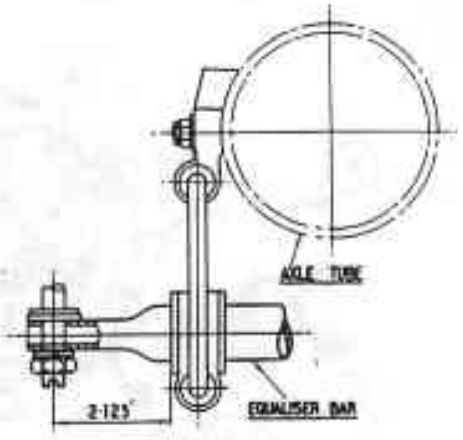


FIG. J5. REAR BRAKE EQUALISER.

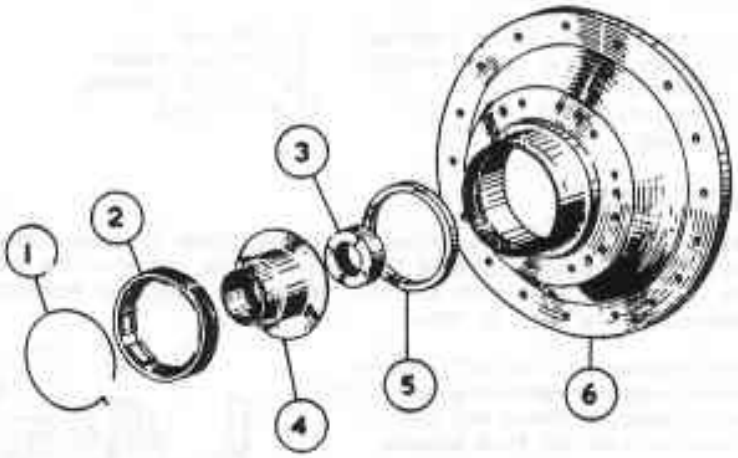


FIG. J6. L.H. SIDE PLATE ASSEMBLY.

1. Locking ring.
2. Internally serrated nut.
3. Oil seal.
4. Oil seal housing.
5. Adjusting ring.
6. Side plate.

Lift out crown wheel assembly from L.H. side.

Remove nuts from pinion retaining plate and withdraw bevel pinion assembly. Remove spring housing (9, Fig. J7) with press or clamp.

BEVEL PINION:

From Bentley chassis B.433.SP (12/41 axle) B.380.SR (11/41 axle), Silver Wraith chassis WVH.77, Silver Dawn chassis SMF.42, taper roller bearings are fitted in place of the multiple bearing for the pinion, see Figs.J8 and J9.

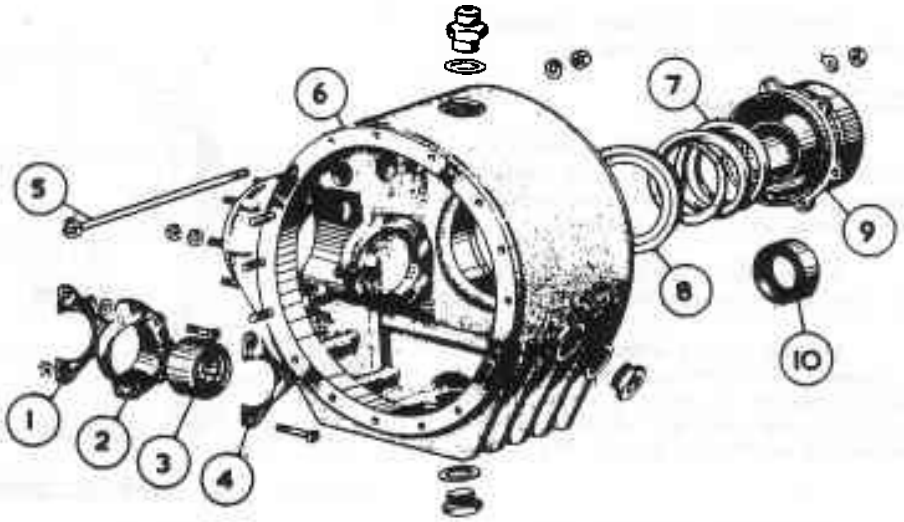


FIG. J7. CENTRE CASING - BENTLEY, SILVER WRAITH, SILVER DAWN.

1 & 4. Bridge plates, nose bearing.
2. Bridge, pinion nose bearing.
3. Bearing.
5. Retaining bolt
6. Casing.
7. Spring.
8. Thrust washer.
9. Spring housing.
10. Oil seal.

To Renew Multiple Bearing:

1. Place nose of pinion in suitable holding block in vice. With Tool No. 1649/T3, remove driving flange retaining nut and lock-washer and withdraw flange with suitable extractor, collect Woodruff Keys. Remove bearing housing cover.

2. With spanner No. 1649/T2, remove pinion bearing retaining nut (left-hand thread). Press out pinion. Press out bearing from housing.

3. Select adjusting washer (4, Fig. J8) to give .003" gap between cover and housing when cover is pressed down firmly by hand.

4. Lubricate and re-assemble. Fit new oil seal felt in bearing housing cover and replace driving flange.

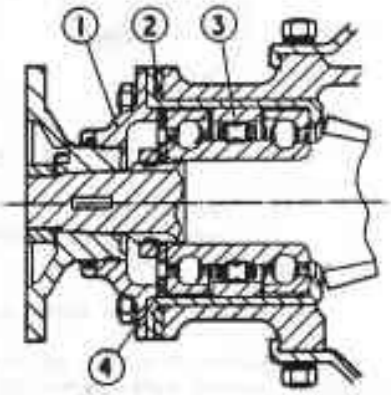


FIG. J8. PINION AND MULTIPLE BEARING.

1. Cover.
2. Pinion adjusting washer.
3. Bearing.
4. Bearing adjusting washer.

1. Oil seal.
2. Flinger.
3. Bearing housing.
4. Outer race.
5. Adjusting washers.
6. Outer race.
7. Pinion depth adjusting washer.
8. Pinion bearing retaining nut.
9. Flange retaining nut.

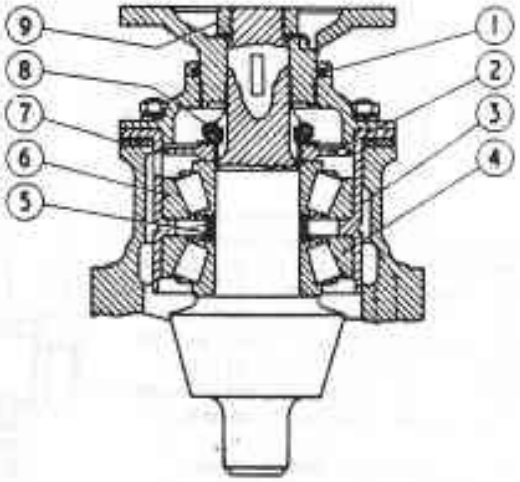


FIG. J9. PINION AND ROLLER BEARING.

To Renew Taper Roller Bearing:

The correct pre-load on these bearings is assessed by the drag torque measured at the holes in the pinion bearing housing flange and is adjusted by selective fitting of adjusting washers between the inner races. The drag torque should be 5-12 in./lbs. with bearings dry.

The London Service Station will undertake the fitting and pre-loading of new taper roller bearings if the bearing housing and old adjusting washers are returned to them.

1. Place nose of pinion in suitable holding block in vice. With Tool No. 1649/T3, remove driving flange retaining nut and lockwasher and withdraw flange with suitable extractor, collect keys. Remove bearing housing cover.

2. With spanner No. 1649/T2 remove pinion bearing retaining nut (left-hand thread). Press out pinion.

3. Collect outer bearing and adjusting washers. Remove inner bearing from pinion shaft with suitable extractor. Tap out outer races from housing.

4. Tap new outer races into bearing housing. Assemble new bearings and housing, dry, on dummy pinion of Gauging Tackle as shown in Fig. J10.

   Tighten knurled nut until drag torque is between 5 and 12 in/lbs.

5. With micrometer, measure overall dimension between outer face of flange of pinion and outer face of knurled nut as shown in Fig. J10. Record dimension.

   Strip assembly and measure overall width of inner race. The total width of the two inner races plus 2.00", deducted from recorded dimension will give width of adjusting washer for correct pre-load.

Select two adjusting washers to give this thickness and re-assemble pinion and housing, 5 to 12 in/lbs., overall thickness .352" to .378".

If special tool STD.717 is not available, pre-loading can be carried out by trial and error, using mandrel as shown in Fig. J11, on which the inner races of the bearing are a sliding fit, and an accurate spring balance clipped to one of the holes in the flange of the pinion bearing housing.

1. Tap new outer races into bearing housing and assemble in dry conditions on mandrel held vertically in vice, using the two original adjusting washers. See Fig. J12.

2. Fit L.H. thread retaining nut and whilst gradually screwing down, turn housing by hand to ensure that no undue load is applied to bearings. Thicker adjusting washers must be fitted if drag, measured by spring balance begins to exceed 6 lbs. Do not crush bearings.

3. Correct pre-load is with nut fully tightened and spring balance shows a drag of between $2\frac{1}{2}$ and 6 lbs.

4. When assembling bearings to actual pinion, increase thickness of adjusting washers by .002" to allow for expansion of inner races when pressed onto pinion. This expansion is allowed for when special tool is used.

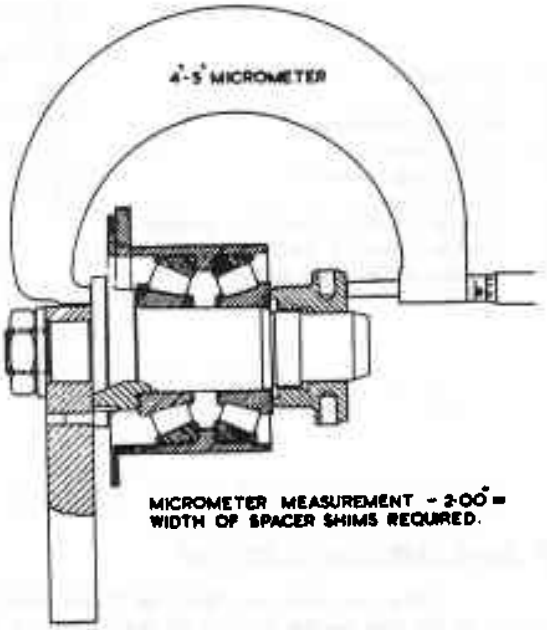


FIG. J10. GAUGING BEARING PRE-LOAD.

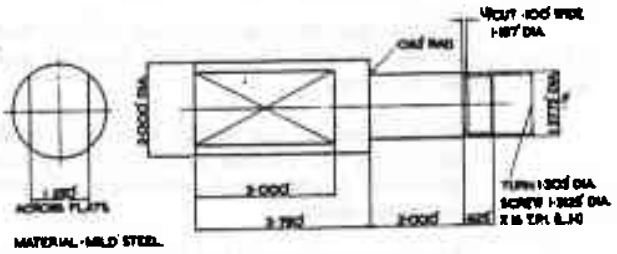


FIG. J11. MANDREL - DETAILS FOR MANUFACTURE.

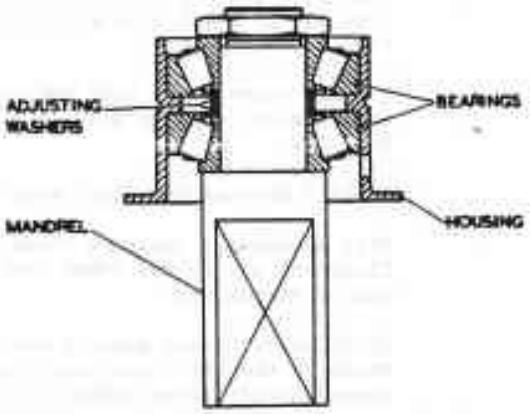


FIG. J12. BEARING ASSEMBLY MOUNTED ON MANDREL.

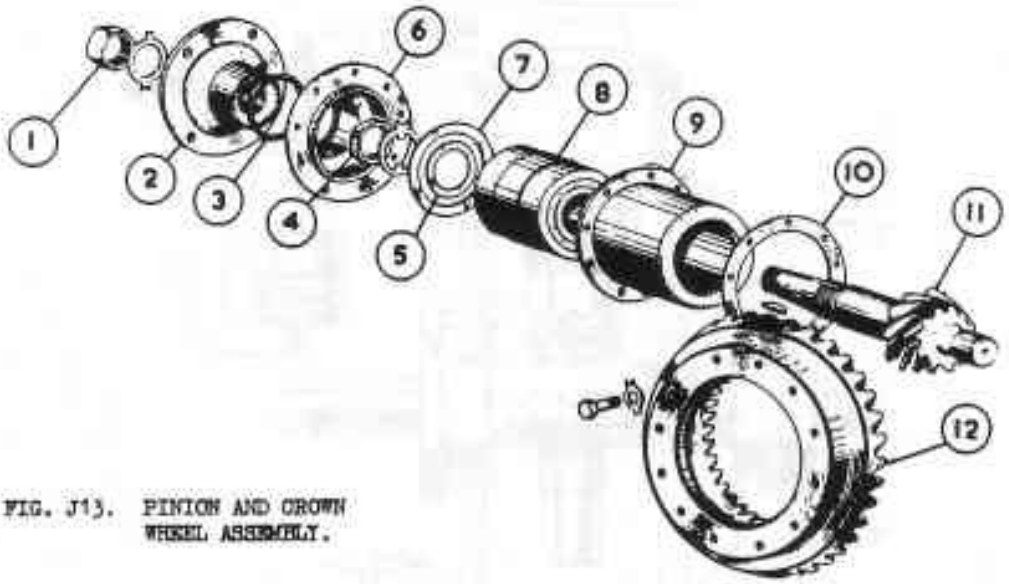


FIG. J13. PINION AND CROWN WHEEL ASSEMBLY.

1. Nut, driving flange.
2. Driving flange.
3. Felt washer.
4. Nut, pinion bearing.
5. Adjusting washer.
6. Cover.
7. Adjusting washer.
8. Bearing.
9. Bearing housing.
10. Adjusting washer.
11. Bevel pinion.
12. Crown wheel.

Re-assemble and refit to axle casing.
Bearings should be light press fit .00025" - .0005" on shaft.

CROWN WHEEL AND PINION:

The crown wheel and pinion are supplied in lapped pairs and must not be used independently.

Crown wheel and pinion may be stoned if necessary, but they must be reset to original figures, etched on parts, by means of new adjusting washers if required.

To Check Crown Wheel:

Place crown wheel complete with roller bearings and outer races under a press with suitable distance pieces "A" and "B" as in Fig. J14.

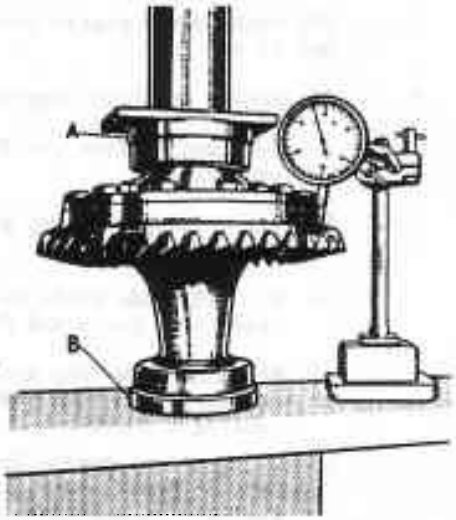


FIG. J14. CHECKING CROWN WHEEL RUN-OUT.

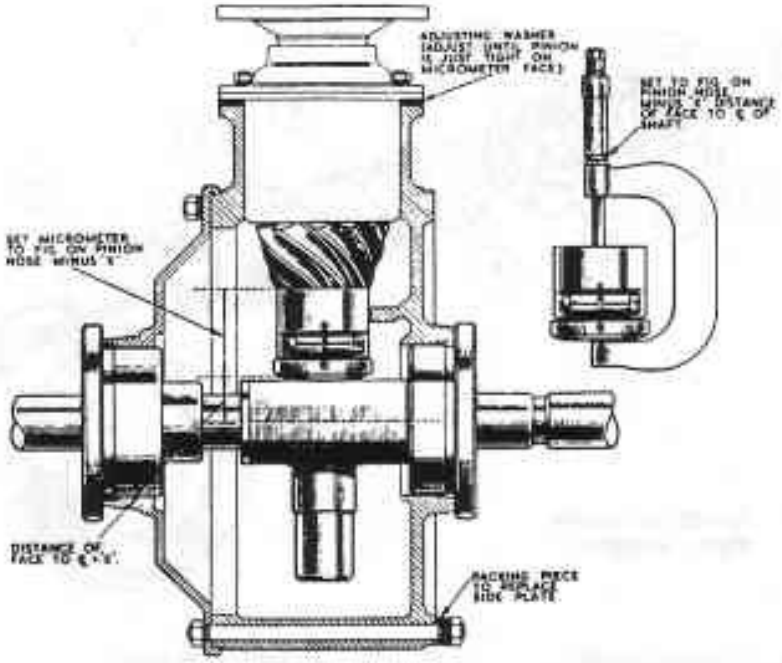


FIG. J15. PINION SETTING TOOL IN POSITION.

Apply light pressure and rotate wheel slowly. The "run-out" should not exceed .002". If over this figure, inspect crown wheel for incorrect seating on differential casing.

To Fit New Crown Wheel and Pinion:

1. Fit replacement pinion into pinion housing, refit driving flange but do not lock.

2. Set pinion depth in relation to crown wheel:-

   a) Subtract 1" from the dimension etched on pinion behind nose bearing.

   b) Set measuring piece, see Fig. J15, to resultant dimension and lock.

   c) Fit L.H. side plate to centre casing with packing pieces under bolt heads and fully tighten.

   d) Fit pinion setting tool into casing, see Fig. J15, using original adjusting washer, chamfer upwards, under pinion housing flange.

   e) Tighten down gradually, using three equally spaced nuts. The correct pinion depth is with no end float at measuring piece and with nuts fully tightened. The pinion will be slightly stiff due to nip on bearing, check actual clearance by moving measuring piece.

If the original spacing washer (2, Fig. J8, or 7, Fig. J9) is not of suitable thickness, select one from range.

Fit remaining nuts, tighten down and re-check. Remove tool.

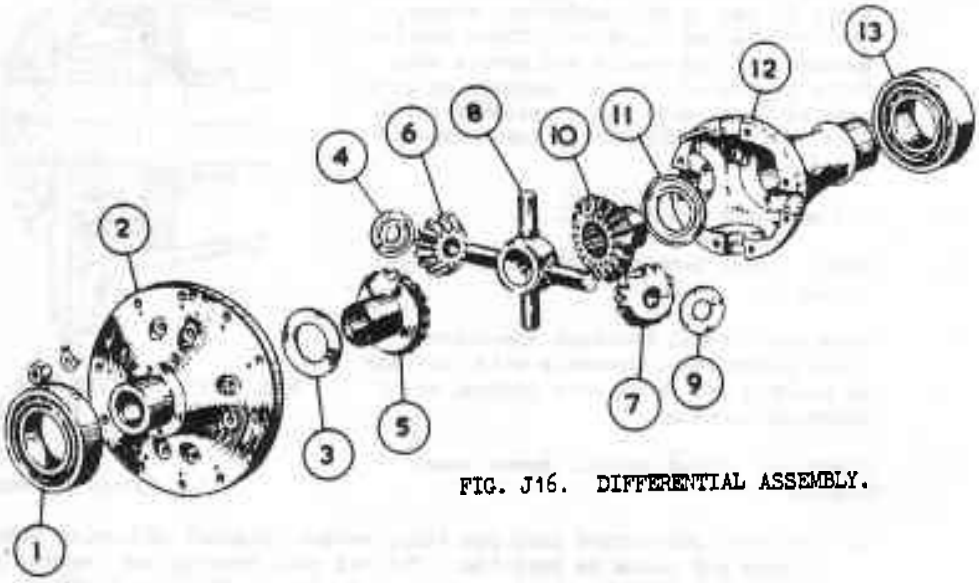


FIG. J16. DIFFERENTIAL ASSEMBLY.

1. Bearing.
2. Differential casing.
3. Bevel adjusting washer.
4. Bevel adjusting washer.
5. Bevel, splined.
6. Bevel, plain.
7. Bevel, plain.
8. Trunnion.
9. Bevel adjusting washer.
10. Bevel, splined.
11. Bevel adjusting washer.
12. Differential casing.
13. Bearing.

NOTE:- The pinion setting tool Fig. J15, is not suitable for Silver Wraith Long Wheelbase or Phantom IV models.

When setting pinion on these models, the suggested method is by trial and error. The pinion teeth should be marked with blueing compound and the pinion and crown wheel assembled in the casing. Turn pinion by hand, dismantle and examine bedding. Adjustment can be made by varying the thickness of the adjusting washer as before.

3. Fit new crown wheel to differential casing, do not lock.

4. Fit the four bevel pinions on respective trunnion bearings and place assembly in R.H. half of differential casing without adjusting washers behind gears. Take Left-hand splined wheel and mesh with the four pinions. Draw the four pinions up so that the mitres at back all match correctly.

Measure gap between back of each bevel and casing and fit suitable washers, see Fig. J17.

Mark relative positions and lift out trunnion assembly. Fit L.H. splined wheel with adjusting washer to give slight backlash. Place opposite splined wheel in casing with adjusting washer, bolt two halves together. Check backlash between splined wheels and bevels when fully tightened. Select washers to give zero backlash with whole assembly still free to turn. Dismantle, lubricate and re-assemble.

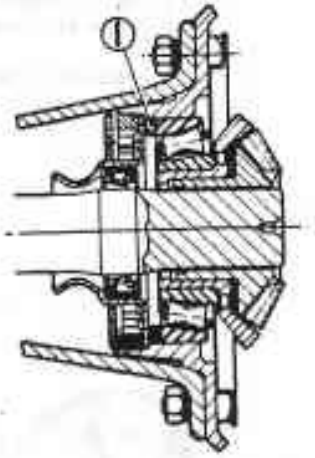


FIG. J17. DIFFERENTIAL BEVEL ADJUSTING WASHER.

1. Adjusting washer.

5. Fit new axle shaft seals.

6. Refit thrust washer, spring and housing to casing.

7. Note crown wheel backlash dimension, place crown wheel assembly with bearings in housing and refit side plates, no jointing compound.

8. Check and adjust pinion, crown wheel backlash:-

a) Tap L.H. outer race into position, select thinnest adjusting washer, grease and place in position. Fit oil seal housing and gradually tighten retaining nut at same time check that there is backlash between crown wheel and pinion.

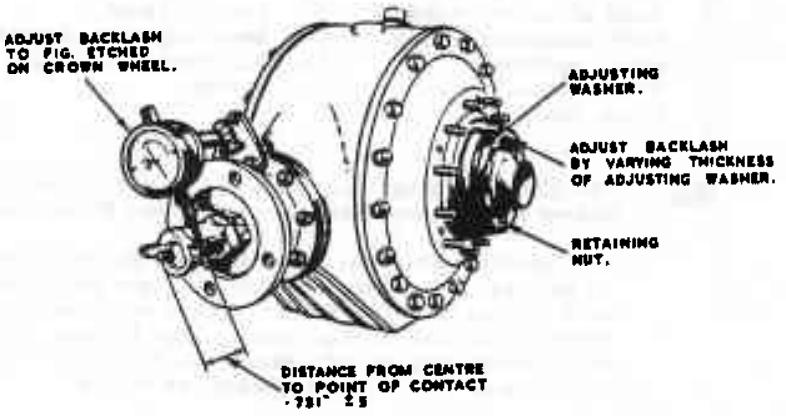


FIG. J18. CHECKING PINION AND CROWN WHEEL BACKLASH.

b) Fit adaptor as shown in Fig. J18, take average figure of twelve readings. Adjust average reading to etched figure by varying adjusting washer above. Ratio of washer thickness to backlash is 1:1.

c) Complete assembly - lock.

9. Apply jointing compound to axle tube faces and refit tubes. Fit pinion driving flange.

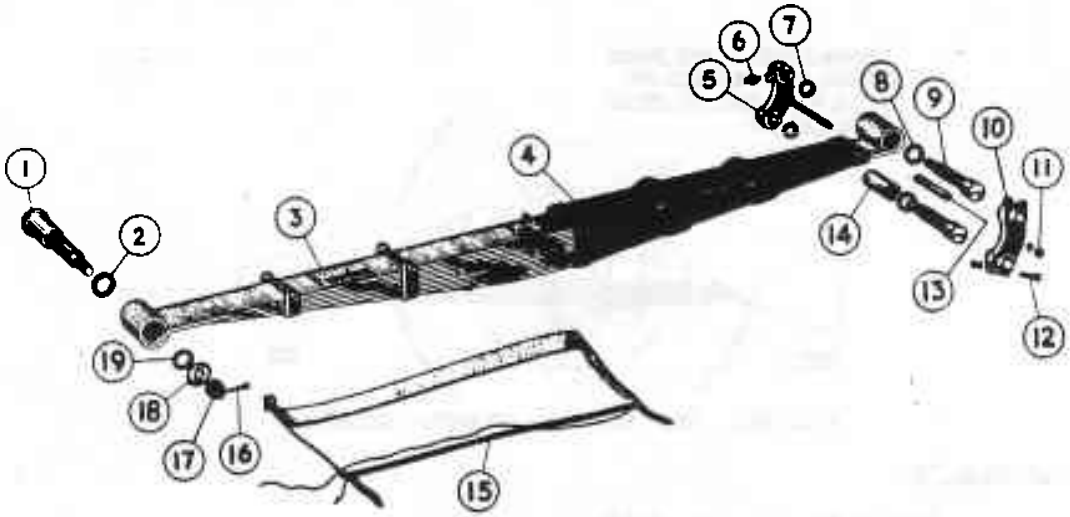


FIG. J19. REAR SPRING AND FITTINGS

1. Shackle pin, front.
2. Oil retaining washer, large.
3. Road spring.
4. Rear gaiter.
5. Inner shackle.
6. Oil connection.
7. Oil retaining washers, small.
8. Oil retaining washers, large.
9. Shackle pins.
10. Outer shackle.
11. Nut, shackle bolt.
12. Shackle bolt.
13. Distance piece.
14. Bush, rear shackle.
15. Front gaiter.
16. Split pin.
17. Nut, front anchor.
18. Washer.
19. Oil retaining washer, small.

Oil Leak from Pinion Seal:

1. Remove propeller shaft, mark before removal.

2. Mark with co-relation marks pinion casing to differential casing, remove nuts and withdraw pinion.

3. Remove nut on pinion, the oil thrower can then be removed to leave flange with felt oil seal.
Fit new felt washers, refit flange using grease on felt and ensuring washer is not trapped.

REAR SPRINGS:

The rear springs are of normal leaf type, adapted and strengthened according to the terrain on which the car is to operate.

The forward ends of the rear springs are pivoted to the frame by means of steel bushes. The shackle pins at the forward and rear ends are of the threaded type, and both shackle pins and bushes are lubricated from the centralised chassis system.

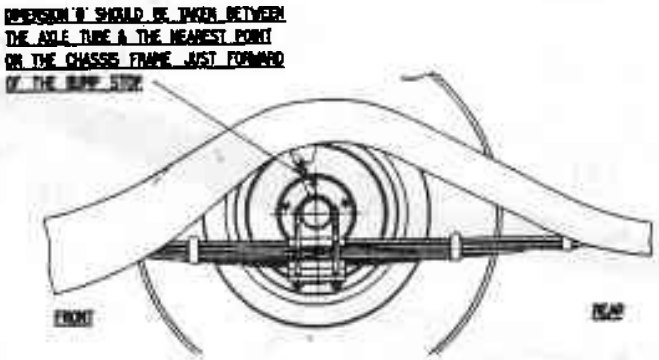


FIG. J20. REAR SPRINGS - STANDING HEIGHT.

Dimension "B":

Bentley Mk. VI	-	5.625
Silver Dawn	-	5.625
Silver Wraith	-	5.765
Phantom IV	-	5.765

To Remove Rear Spring:

1. Jack up and place support under chassis extremities.

2. Remove U-bolt. Disconnect lubricator pipe to shackle pin.

3. Withdraw shackle pin. Remove gaiters.

Spring Selection:

Spring selection should reproduce a figure for dimension "B", Fig. J20, to give a nominal dimension as quoted, plus or minus .300", with car at normal curb weight but free of passengers and driver.

If the petrol tank contains less than 5 gallons of petrol, .400" should be added to this dimension.

On individual cars, the two dimensions on opposite sides of the car should be within .378" of each other.

REAR SHOCK DAMPERS:

The shock dampers are of the double acting hydraulic type. A piston assembly operating in a cylinder maintained full of oil which is displaced from one end of the cylinder to the other past a spring-loaded valve. The loading of this valve, hence degress of damping is controllable though the "ride" control lever on the steering wheel.

The "Control" operates through a small gear type pump attached to and driven from the gearbox to maintain a pressure of oil through piping to each damper. The pressure is variable, controlled by a spring loaded ball valve, and is exerted on the valve in each damper through bellows.

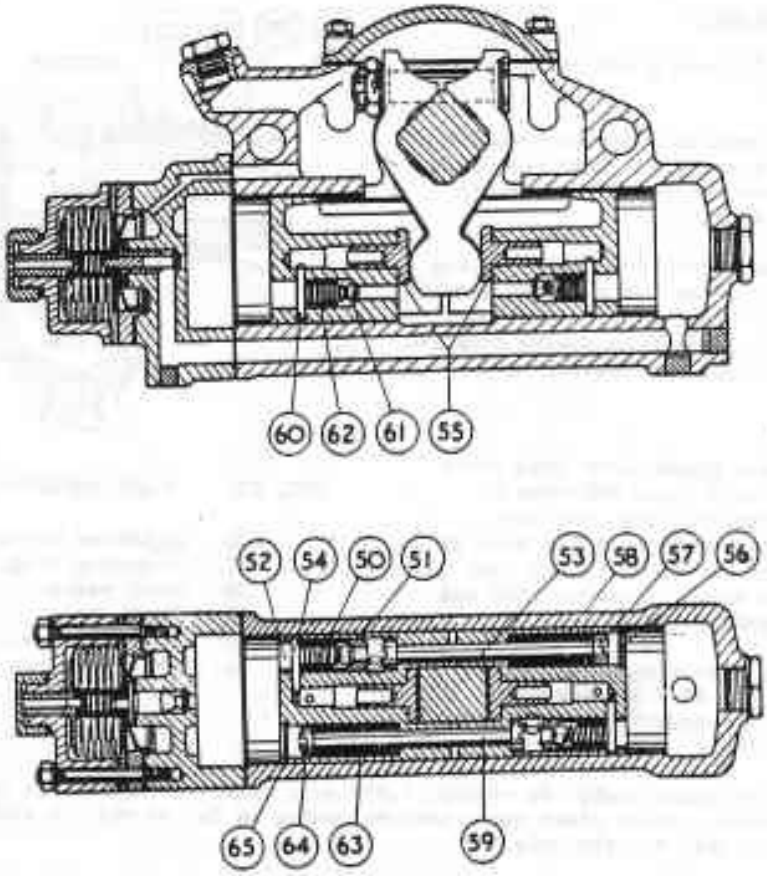


FIG. J21. SECTION - REAR SHOCK DAMPER

50. Spring - Replenishing valve.
51. Replenishing valve.
52. Housing - Replenishing valve.
53. Bolt - Piston.
54. Taper pin.
55. Wearing pad.
56. Expanding disc - Piston.
57. Nut - Piston bolt.
58. Spring - Piston bolt.
59. Bolt - Piston.
60. Taper pin.
61. Replenishing valve.
62. Spring - Replenishing valve.
63. Spring - Piston bolt.
64. Nut - Piston bolt.
65. Expanding disc - Piston.

The pump draws its oil supply from the gearbox though this oil is not actually pumped into dampers. Check there is no wastage from this line.

A filter is provided in the gearbox for this oil, adjacent to oil level dipstick, and is removable for cleaning.

Dismantling Damper:

To fit new gland packing due to oil leak:-

1. Disconnect and remove damper from chassis. Bolt onto flat plate. Do not hold directly in vice.

2. Remove bolt from intermediate lever, the two nuts and washers from gland cover and withdraw main lever from casing complete with gland assembly.

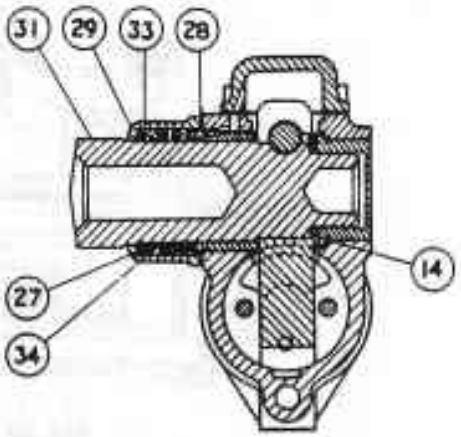


FIG. J22. GLAND ASSEMBLY.

14. Adjusting washer.
27. Retaining ring.
28. Joint washer.
29. Gland cover.
33. Gland packing.
34. Pressure ring.

To Replace:

1. Place gland cover onto shaft of main lever followed by retaining ring, the new gland packing, which must be very carefully fitted over the shaft, pressure ring and gland spring.

Gland packing - approximately 2½ ft. of 2 ply asbestos string prepared with Russian Tallow.

Place joint washer on casing, refit main lever, do not damage adjusting washer. Press gland cover towards casing as far it will go and tighten nuts with fingers only.

2. The gland must only be tightened up when it has been warmed sufficiently to soften tallow impregnating packing. Heat end of shaft and the end of gland cover gently with blow lamp or gas flame. The temperature is approximately correct when it is just possible to bear the hand on end of shaft.

Progressively tighten gland cover nuts. Excess tallow will be exuded and all space in gland filled.

3. Refit bolt to intermediate lever. Fill damper with oil, expel air and refit to chassis.
Refit bearing bolt to top of connecting link and main lever of damper. (The nut must only be tightened when the rear springs are taking full weight of body). This instruction also applies to nut of bearing bolt at lower end of connecting link and also nut securing Silentbloc bracket to rear spring plate.

4. Reconnect oil pressure pipe to damper and expel air:-

Start engine and run slowly in top gear approximately 10 miles per hour, move ride control lever to "Hard", remove air release plug on damper end cover, continue running until continous flow of oil from release plug.

Replace plug and repeat for opposite side damper. Top up gearbox.

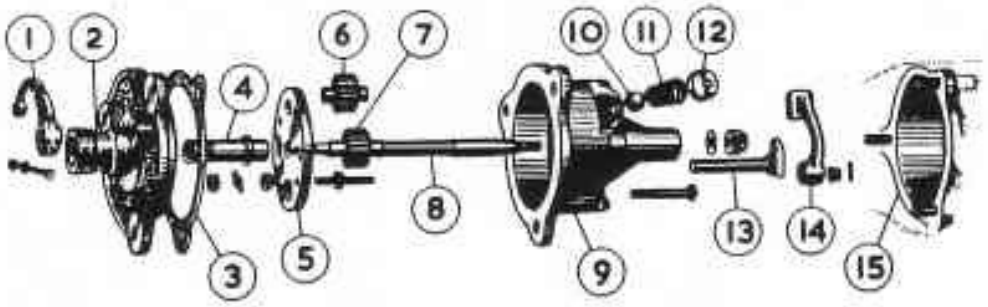


FIG. J23. DAMPER CONTROL PUMP.

1. External operating lever.
2. Cover.
3. Vellumoid washer.
4. Bush.
5. Disc.
6. Driven gear.
7. Driving gear.
8. Gear shaft.
9. Housing.
10. Valve ball.
11. Valve spring.
12. Valve spring cover.
13. Operating pin.
14. Internal operating lever.
15. Gearbox.

Testing "Ride Control":

Jack up rear wheel, engage top gear and run engine at approximate speed of 10 - 15 miles per hour.

Connect oil pressure gauge to plug on 4 way connection in the frame cruciform, just behind gearbox.

With hand lever in "Hard" position, adjust control rod so that oil pressure of 29 - 31 lbs/sq.in. is obtained. Check with hand lever at "Normal" position that pressure is not less than 2½ lbs/sq.in.