Service Instruction Manual

Fourth Issue

STANDARD VANGUARD

SERIES I AND II

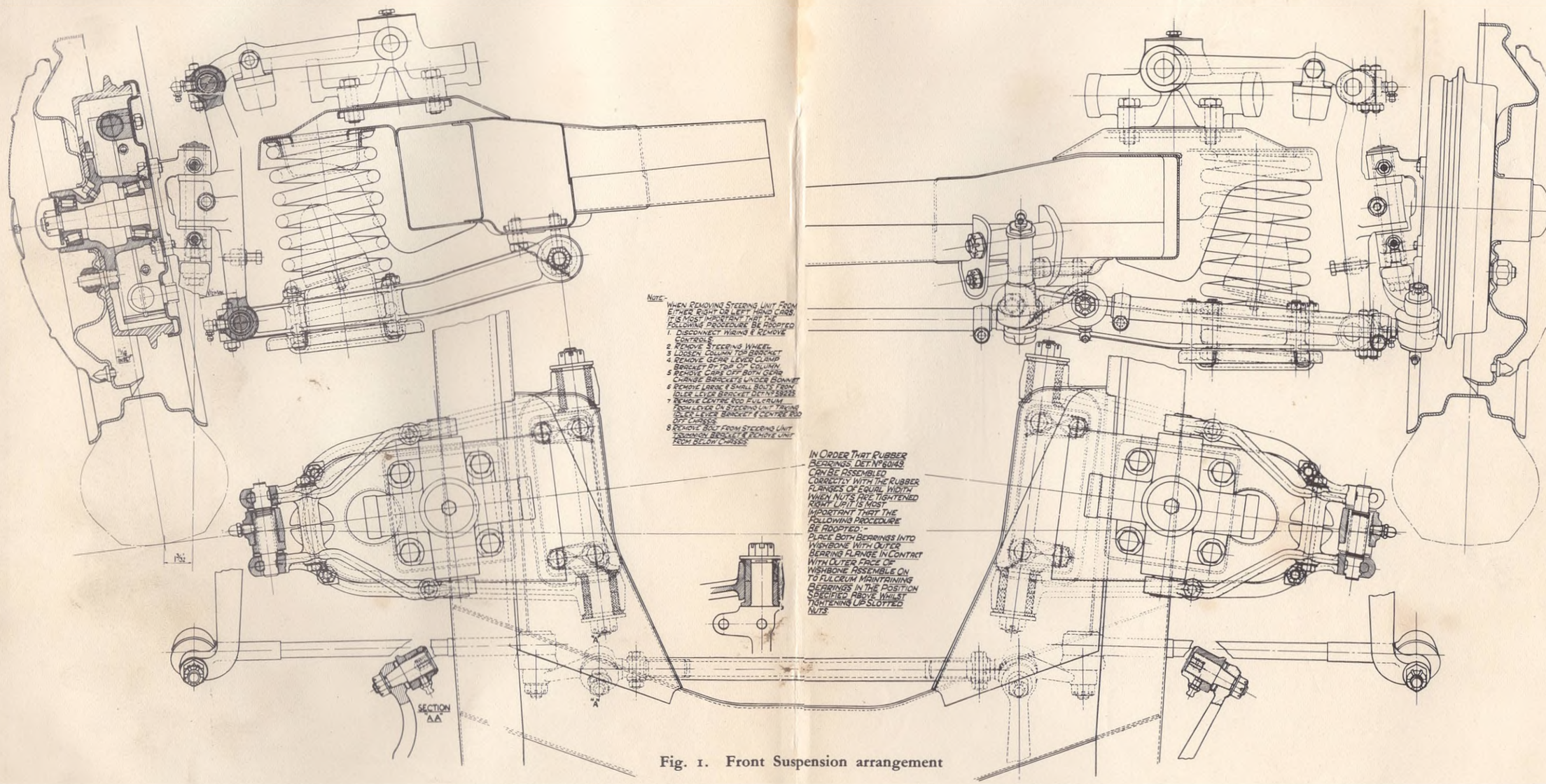
and

TRIUMPH "RENOWN" MODELS

FRONT SUSPENSION AND STEERING

SECTION G

THE STANDARD MOTOR COMPANY LTD., COVENTRY



NOTE-
WHEN REMOVING STEERING UNIT FROM EITHER RIGHT OR LEFT HAND CARS, IT IS MOST IMPORTANT THAT THE FOLLOWING PROCEDURE BE ADOPTED
1. DISCONNECT WIRING & REMOVE CONTROLS.
2. REMOVE STEERING WHEEL.
3. LOOSEN COLUMN TOP BRACKET.
4. REMOVE GEAR LEVER CLAMP BRACKET AT TOP OF COLUMN.
5. REMOVE CLIPS OFF BOTH GEAR CHANGE BRACKETS UNDER BONNET.
6. REMOVE LARGE & SMALL BOLTS FROM IDLER LEVER BRACKET DET. NO 532235.
7. REMOVE CENTRE ROD FULCRUM FROM LEVER ON STEERING UNIT TAKING IDLER LEVER BRACKET & CENTRE ROD OUT CARRIER.
8. REMOVE BOLT FROM STEERING UNIT TRUNNION BRACKET & REMOVE UNIT FROM BELOW CHASSIS.

IN ORDER THAT RUBBER BEARINGS, DET. Nº 60149 CAN BE ASSEMBLED CORRECTLY WITH THE RUBBER FLANGES OF EQUAL WIDTH WHEN NUTS ARE TIGHTENED RIGHT UP IT IS MOST IMPORTANT THAT THE FOLLOWING PROCEDURE BE ADOPTED :-
PLACE BOTH BEARINGS INTO WISHBONE WITH OUTER BEARING FLANGE IN CONTACT WITH OUTER FACE OF WISHBONE ASSEMBLE ON TO FULCRUM MAINTAINING BEARINGS IN THE POSITION SPECIFIED ABOVE WHILST TIGHTENING UP SLOTTED NUTS.

Fig. 1. Front Suspension arrangement

ILLUSTRATIONS

Series II Supplement

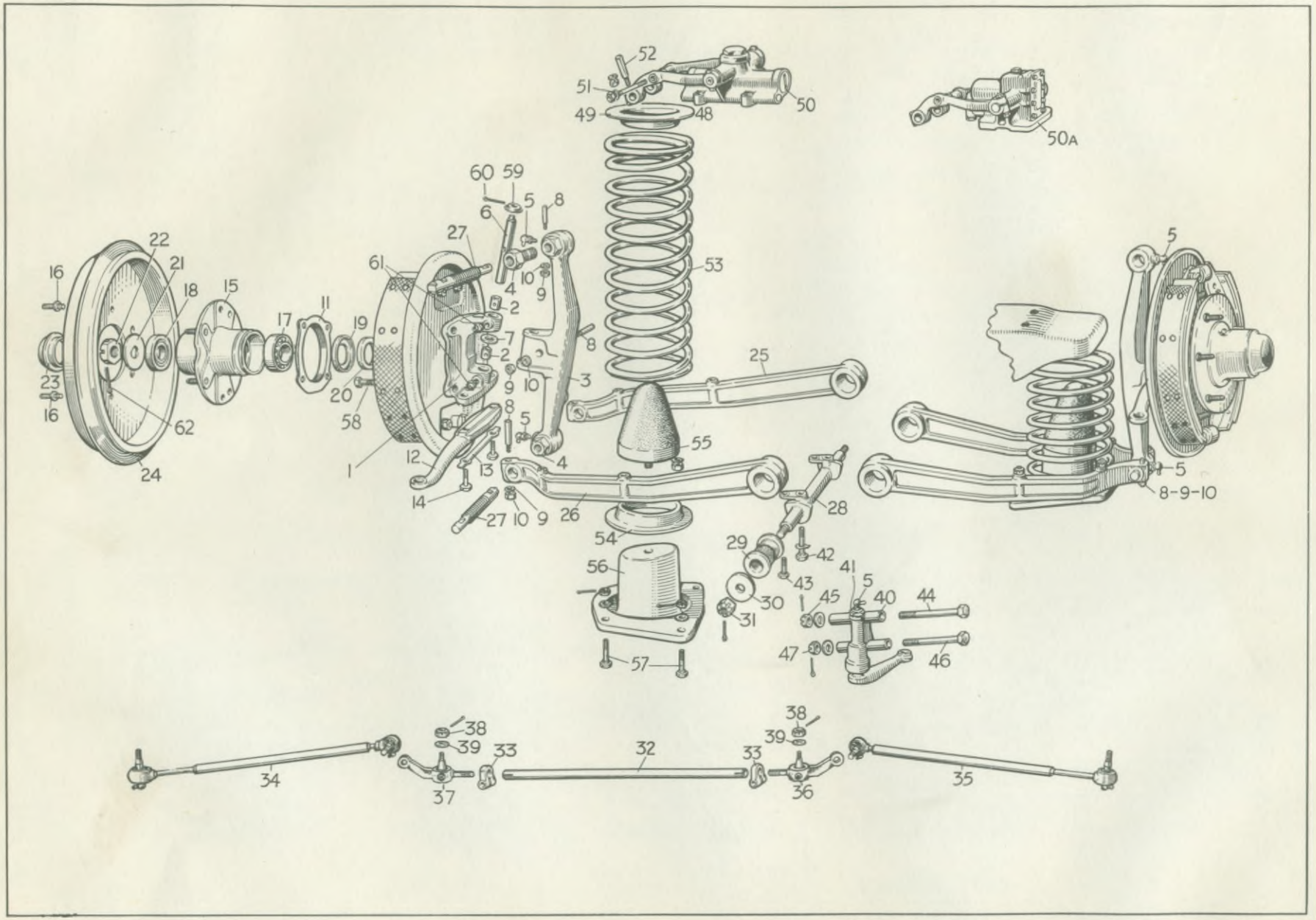


Fig. 2. Exploded view of front suspension

FRONT SUSPENSION AND STEERING

DIMENSIONS AND DETAILS

King Pin inclination to Stub Axle	99½°
(2° Wheel Camber and 7½° King Pin Inclination)	
Caster Angle	1° Positive
Wheel Camber	2° Positive
Steering—Back Lock	32°
Steering—Front Lock	29½°
Centre Tie Rod Centres	16¼" ± 1/32"
Outer Tie Rod Centres	13⅛" ± 1/32"
Swivel Pin Diameter	11/16" − .0001" − .0005"
Steering Box Ratio	14 : 1

NOTATION FOR FIG. 2

No.	*Detail*	*Item*
1	56032/3	Stub Axle (R.H. & L.H.)
2	58290	Bush to Swivel Pin.
3	56030/1	R.H. & L.H. Stub Axle Bracket.
4	57832	Bush for Stub Axle Bracket.
5	56934	Grease Nipple.
6	101451S	Swivel Pin.
7	48206	Thrust Washer.
8	101146	Cotter-King Pin (5/16" N.F.).
9	NH.2008	Nut for Cotter Pin—5/16" N.F.
10	WQ.0308	Washer Lock.
11	56035	Oil Trap.
12	56055/6	Tie Rod Lever R.H. and L.H.
13	56702	Tab Washer.
14	BH.0911	Bolt 3/8" × 24NF × 1⅜".
15	59186	Front Hub with Studs and Greaser.
16	57304	Studs for Front Hub.
17	58616	Roller Bearings (Inner).
18	59181	Roller Bearings (Outer).
19	58272	Cover for Felt Washer.
20	58271	Felt Washer for Hub.
21	61265	" D " Washer for Stub Axle.
22	NL.2212	Slotted Nut 9/16" × 18 N.F.
23	59177	Cap for Front Hub.
24	58679	Brake Drum (9" Diameter).
25	60145	R.H. Rear and L.H. Front Lower Wishbone.
26	60146	R.H. Front and L.H Rear Lower Wishbone.
27	56059	Fulcrum Bolt—Top and Bottom Outer.
28	300052	Bottom Inner Fulcrum.
29	61062	Rubber Bearing.
30	60148	Washer.
31	61302	Slotted Nut 9/16" × 18 N.F.
32	56695	Centre Tie Rod.
33	60307	Clamp for Tie Rod.
34	201478	R.H. Outer Tie Rod Assembly.
35	201479	L.H. Outer Tie Rod Assembly.
36	61900	Centre Tie Rod End Assembly L.H.
37	61899	Centre Tie Rod End Assembly R.H.
38	NL.2210	Nut Slotted 7/16" × 20N.F.
39	WP.0010	Washer Plain.
	PC.0010	Split Pin for NL.2210.
	58261	Rubber Gaiter.
40	59225	Steering Lever & Bracket Assembly.
41	59223	Plug for Bracket.
42	BH.1017	Bolt for Fulcrum—Long 7/16" N.F. × 2⅛".
	61505	Tabwasher.
43	BH.1009	Bolt for Fulcrum Short 7/16" N.F. × 1⅛".
44	56080	Bolt ½" × 20 N.F. for Steering Lever Bracket.
45	NL.2211	Slotted Nut ½" × 20 N.F.
	WP.0047	Washer Plain.
	PC.0020	Pin Cotter.
46	56703	Bolt 3/8" × 24 N.F. for Steering Lever Bracket.
47	NL.2209	Slotted Nut 3/8" × 24 N.F.
	WP.0009	Washer Plain.
	PC.0009	Pin Cotter.
48	100175	Rubber Rebound Buffer.
49		As for 54
50*	300433	Shock Absorber (Girling).
50A*	300434	Shock Absorber (Armstrong). (See important Note below).
51	BH.0929	Bolt with NH.2009 and WL.0209.
52	101146	Cotter Fulcrum Bolt 5/16" N.F.
	NH.2008	Nut for Cotter.
	WQ.0308	Washer Lock.
53	59179	Road Spring.
54	56042	Washer for Road Spring.
55	56052	Rubber Buffer Assembly.
56	59166	Spring Abutment Plate.
57	59071	Bolts 3/8" × 24 N.F. × 2 1/32".
	WP.009	Plain Washer.
	NL.2209	Slotted Nut 3/8" × 24 N.F.
58	UH.0905	Setscrews 3/8" × 24 N.F. × 5/8".
	WQ.0309	Spring Washer Square Section.
59	32061	Cover Plate for Swivel Pin.
60	PC.0007	Cotter-Pin.
61	56935	Grease Nipples.
62	PC.0012	Split Pin.

*These Absorbers must not be used to replace earlier types of Dampers, without first modifying Spring Abutment Brackets. Cast iron Armstrong dampers and also alternative makes to be fitted in pairs.

DESCRIPTION

The front suspension consists of a pair of low periodicity coil springs, one on each side of the chassis, the lower end of each spring being carried on an abutment plate which is bolted to a long pair of shackle arms, the upper end being accommodated in a cupped recess under a bracket on each chassis side member. On the upper side of this latter bracket is mounted the double-armed piston type shock absorber to which reference is made later.

The inner ends of each pair of lower shackle arms, to which is attached the coil spring pan, are rubber bushed to the widely separated ends of a fulcrum bracket. This fulcrum bracket is bolted to a tapped plate, which is welded into position inside the box sectioned rearward extension of a chassis cross member.

Each of the two independent suspension units is completed by the linking of the outer extremities of the lower shackle arms mentioned above to the outer ends of the double arms of a piston-type shock absorber. This linkage is made by means of the stub axle bracket and a case-hardened screwed shackle pin fitted in a similarly threaded accommodating sleeve, at either end of the bracket. Each of these shackle pins are located in the shackle and shock absorber arms respectively by means of cotter pins which engage with flats on the case-hardened shackle pins, there being opposed pairs of flats, to allow for end-wise adjustment. Each threaded sleeve is provided with a hexagon head and a cyanide-hardened external thread which, when the sleeve is screwed into the stub axle bracket, is sufficiently hard to cut its own thread.

A photograph of the arrangement drawing for the front suspension and stub axle assembly is shown in Fig. 1. An exploded view of the front suspension unit is also given in Fig. 2.

The shock absorbers used in the front suspension are described in the special section dealing with these components and road springs.

TO REMOVE AND REPLACE FRONT SPRING

1. Jack up front of car on the side of chassis concerned at a convenient point and remove road wheel and two diagonally opposed spring pan bolts.
2. Fit approved front spring compressor, as shown in Fig. 3, and compress spring sufficiently to take load off the remaining two bolts securing abutment plate to shackle arms.
3. Remove abutment plate bolts and apply guide pin, as shown in illustration Having fitted guide pin, which is required to keep

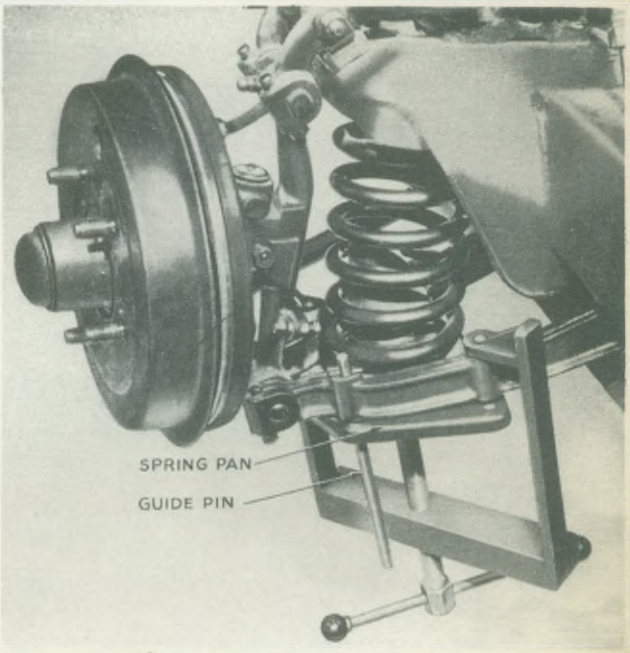


Fig. 3. Employment of compressor for L.H. front spring removal—Tool No. 20S.50.

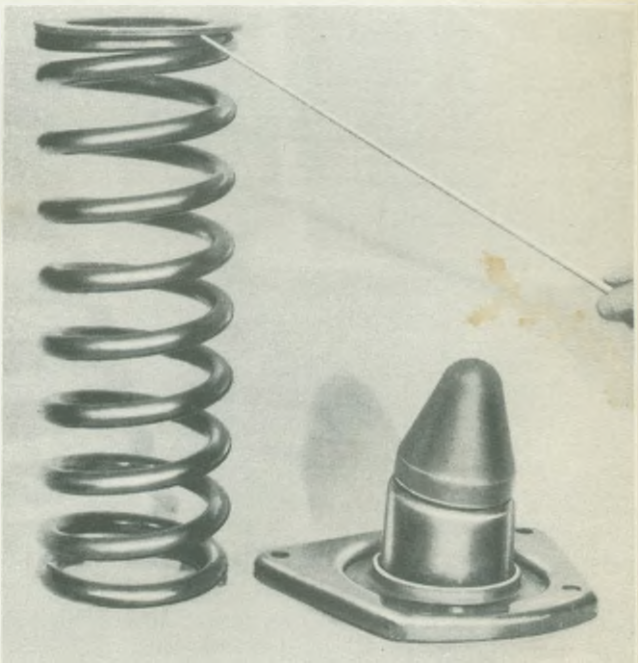


Fig. 4. Locating front spring rubber cup washers prior to removing

plate in position, slacken off spring compressor. Remove coil spring.

4. Replace coil spring, solutioning cupped shaped rubber washer to upper end of spring and in abutment plate to locate whilst fitting, as shown in Fig. 4. The use of solution on these washers prevents the possibility of misplacement during fitting.

5. Reassembly is the reverse procedure, applying guide pins to abutment bracket before commencing to compress the spring as shown in Fig. 5.

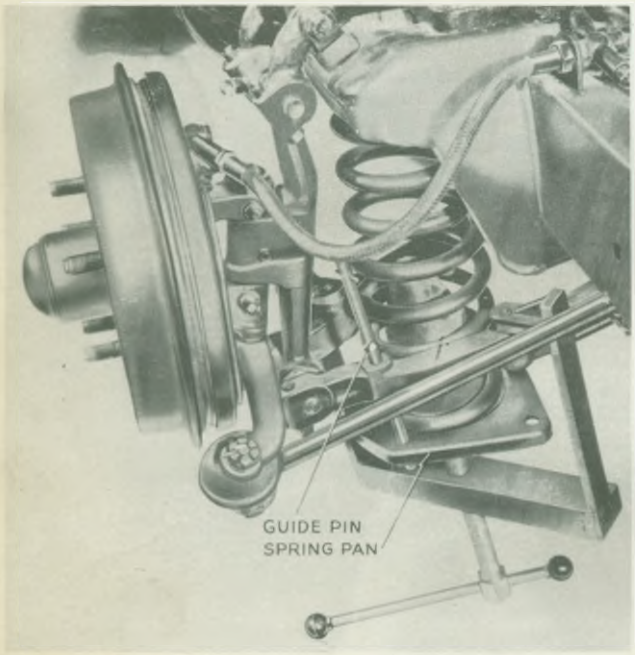


Fig. 5. Employment of compressor when fitting R.H. front spring—Tool No. 20S.50.

TO REMOVE AND REPLACE FRONT SUSPENSION UNIT

Proceed as directed in Operations 1-3 above for the "Removal of Front Spring," and after having removed the coil spring continue as directed below :—

1. Disconnect the flexible hydraulic pipe line at the point indicated in Fig. 6. Do not attempt to remove this pipe line from the backing plate until after the pipe has been disconnected as indicated above or it will be damaged beyond repair.

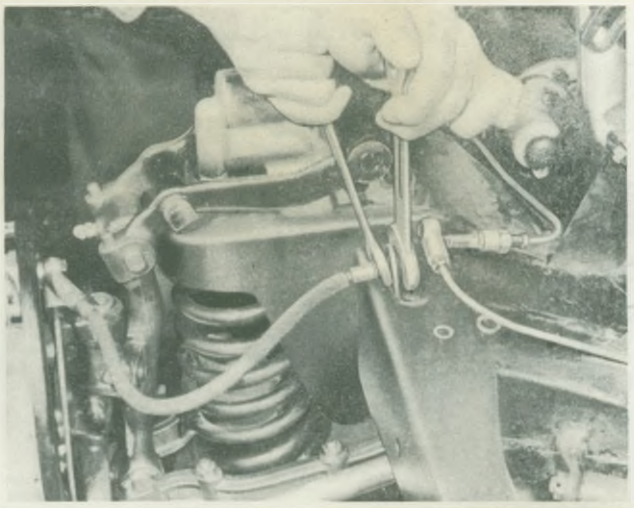


Fig. 6. Showing the method for detachment of flexible brake pipe line from bracket on chassis

2. Remove the castellated nut, which secures the steering tie rod to the tie rod lever, and drive out ball pin, whilst supporting the lever from below with a jack, or other suitable fixture to prevent damage to this lever.

3. Release the tab washers fitted to the four bolts which secure the fulcrum axis bracket to the underside of the chassis and remove these four bolts. This will leave the bottom shackle arms hanging loose as shown in Fig. 7.

4. After the removal of the four bolts which secure the shock absorber to the upper side of the spring abutment bracket, the complete assembly can be removed from the chassis.

5. To fit a new assembly is the reverse procedure to that indicated above with the additional necessity for "bleeding" the brakes as directed in the appropriate section of this manual.

N.B.—The necessity for "bleeding" the brakes can be avoided where the brake backing plate is left attached to the pipe line, but this will render necessary the extraction of the hub bearings etc. as indicated under the dismantling of front suspension unit below.

TO DISMANTLE FRONT SUSPENSION UNIT

When it is necessary to dismantle the front suspension unit, proceed as follows :—

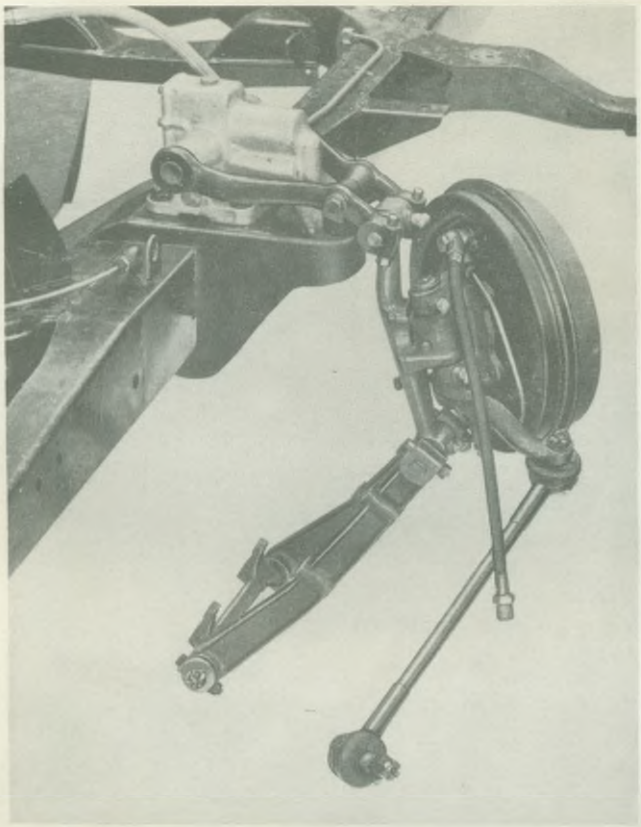


Fig. 7. Front suspension unit partially detached

1. Having jacked up the appropriate side of the chassis, remove road wheel and withdraw brake drum after removal of two securing screws.
2. Remove dust cap, stub axle castellated nut and plain washer.
3. Extract front hub employing special extractor, manufactured by Messrs. V. L. Churchill, as shown in Fig. 8. This extractor will probably leave the inner ring of the inner bearing on the stub axle together with the felt washer and cover plate. The outer rings will have to be driven out of the hub.
4. Remove oil collector plate from stub axle after withdrawal of four setscrews ($\frac{9}{16}$" A/F spanner) and spring washers. Withdraw grease retainer felt and brake back plate and shoe assembly.
5. Remove coil spring and front suspension unit as indicated above.
6. Detach the stub axle bracket from the top and bottom shackles by screwing out the two shackle pins with a $\frac{1}{2}$" A/F spanner, after first driving out the cotters. The removal of the shackle pin will release the two synthetic rubber oil seals.
7. If it is necessary, after a very considerable mileage, to replace the screwed shackle bolts and bushes, the latter can be screwed out of the stub axle bracket. Although these bushes are provided with a cyanide-hardened external thread, with a view to cutting their own thread in the stub axle bracket, no difficulty will be found in screwing a new bush into the existing bracket.
8. Remove the tie rod lever by withdrawal of two $\frac{9}{16}$" A/F headed $\frac{3}{8}$" bolts and locking plate.
9. Remove the two right-angled greasers on the stub axle bracket and also the two straight ones for the swivel pin bushes.

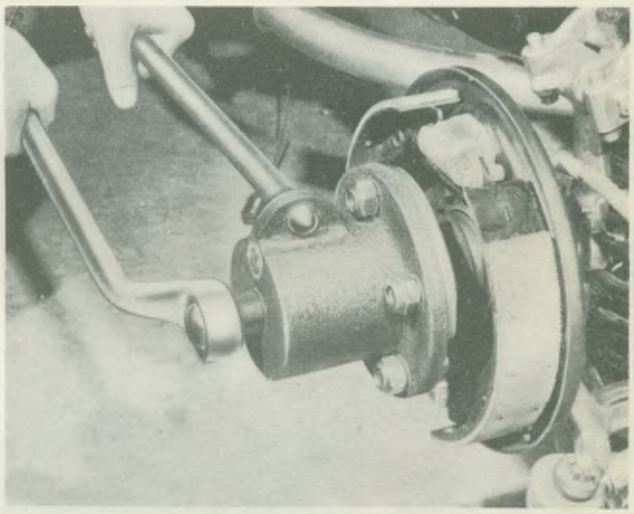


Fig. 8. Removing front hub with approved extractor —Tool No. 20S.86.

10. Extract swivel pin as shown in Fig. 9. The bottom of the swivel pin is drilled and tapped to allow for the use of this extractor.
11. The swivel pin bushes may be driven out as shown in Fig. 10.
12. The lower shackle arms are, as previously indicated, rubber bushed to the inner fulcrum bracket. To remove these arms from this bracket, the castellated nut at each end of the fulcrum bracket should be removed with the plain washer against which each abuts. The arms and bushes can then be removed from the fulcrum bracket.

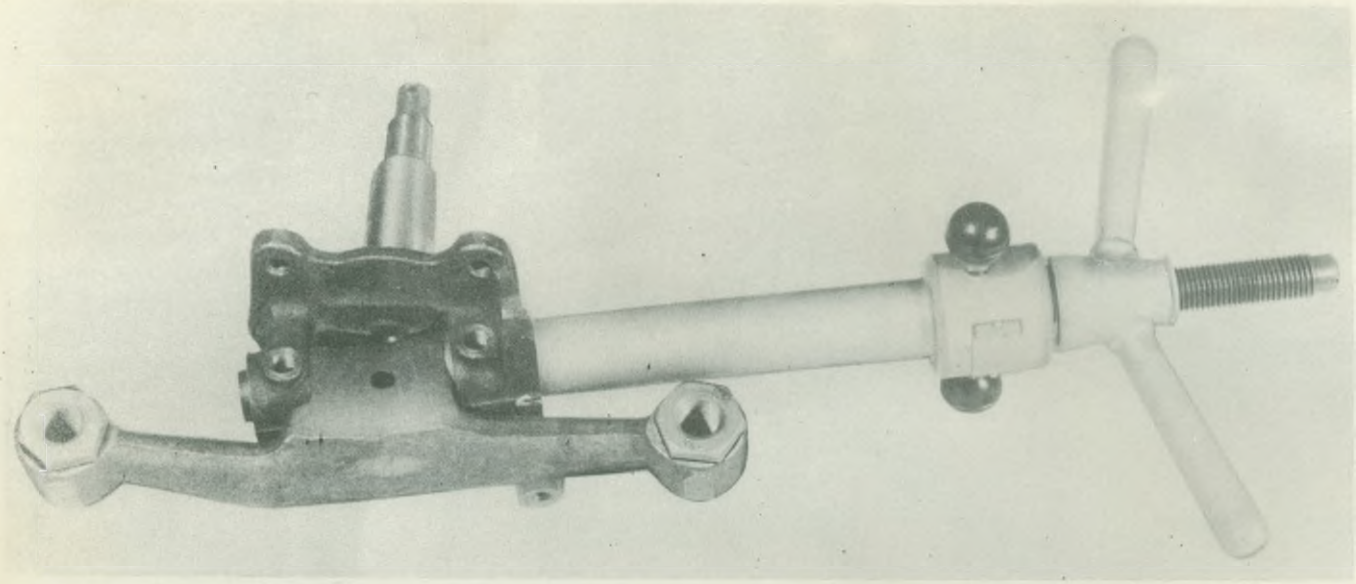


Fig. 9. Extracting front swivel pin with approved extractor—Tool No. 20S.97.

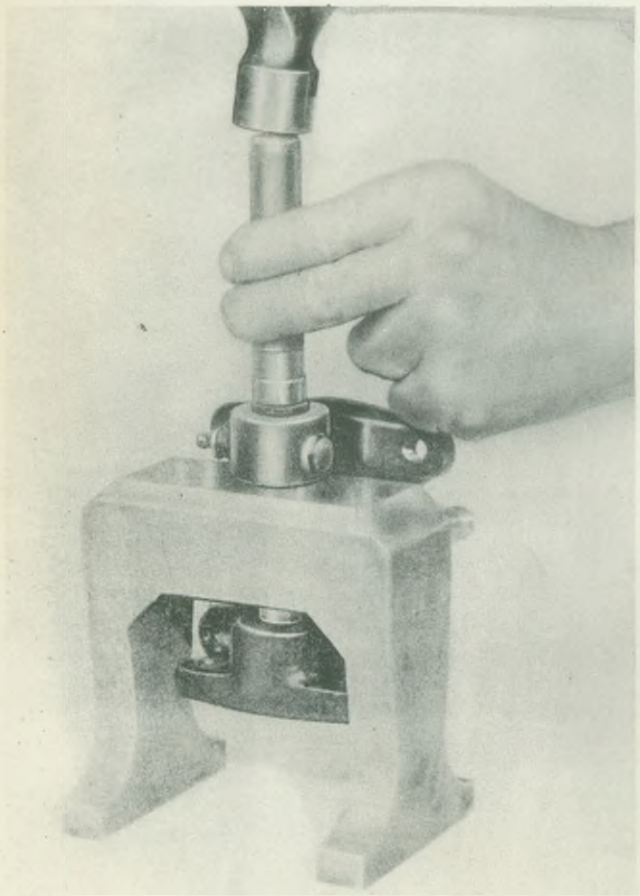


Fig. 10. Driving out old swivel pin bushes with Churchill driver and in conjunction with special anvil

Fig. 11. Driving in swivel pin bushes with approved driver and locator

TO REASSEMBLE FRONT SUSPENSION UNIT

Reassembly of the front suspension unit is the reverse procedure to that given above for dismantling with the following additional attentions required :—

1. Worn screwed shackle pins and their accommodating threaded bushes should be replaced. These replacements are not likely to be required until after a considerable mileage has been covered.
2. When fitting synthetic rubber oil seals on shackle pins, centralize the stub axle bracket by 180° movements of the screwed pins permitted by two flats on either end of these.
3. It is important when fitting rubber bushes, that the instructions with regard to the installation of these bushings given in the arrangement drawing, illustrated in Fig. 1, are regarded where the necessity for such replacement arises. **Do not allow rubber bushes to become contaminated by oil or grease.**
4. Worn swivel pins, and bushes should be replaced. The approved anvil and driver should be employed for the installation of these bushes as shown in Fig. 11 and subsequently they should be reamed with the special reamer illustrated in Fig. 12.

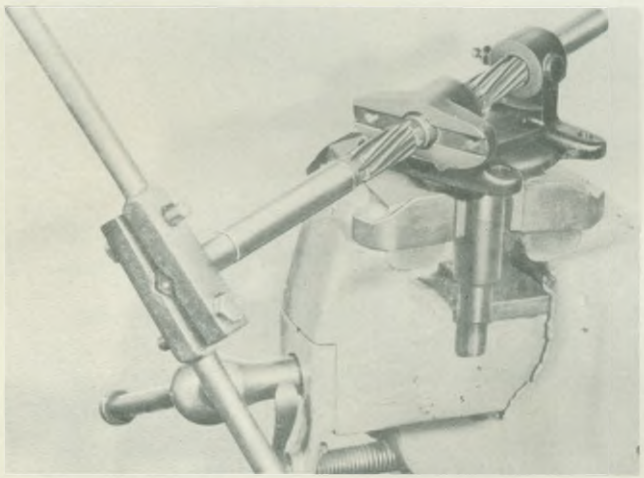


Fig. 12. Reaming swivel pin bushes with approved reamer—Tool No. 20S.—S.18A.

5. Worn thrust washers should be replaced. Where vertical lift in excess of .005" exists after fitting new thrust washers or where the existing washers are not worn; pen steel packing shims should be fitted under the upper jaw of the stub axle and not between the washer and the stub axle, or between the washer and the vertical link, as such an application would lead to early destruction of such shims. (The alternative to the employment of such shims is the self manufacture of an oversize thrust washer).
6. The operation of the shock absorber should be checked in accordance with the maker's instructions and it should further be ensured that the fluid level is at the correct height. Replenishments should not be required unless the shock absorber has developed a leak. The proper condition of these shock absorbers is of considerable importance to the front suspension.
7. It is a wise precaution to solution the coil spring rubber washer on to the top of the spring and the lower one into its recess in the abutment plate before assembling into the unit.
8. When fitting the spring into the unit, enter guide pin shown in Fig. 5 into abutment *before* commencing to compress the spring, with the special tool shown in this illustration.
9. The hub bearings, oil seal felt, cover and oil trap should now be assembled with the hub itself on to the stub axle. The hub bearings, stub axle and parts shown in Fig. 13.

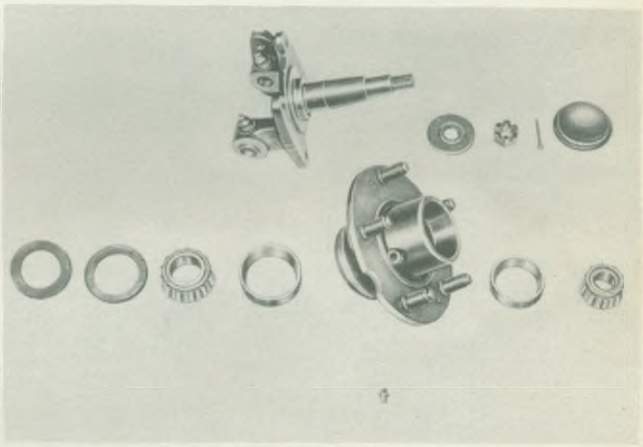


Fig. 13. Exploded view of stub axle assembly

10. When tightening stub axle nut, tighten this up and then slacken back—approximately three slots. It may seem after this procedure that the bearing appears to be preloaded, but this slight tightness should disappear after a short initial running period, when the thrust of the taper roller bearing has forced the outer bearing hard against the " D " washer.

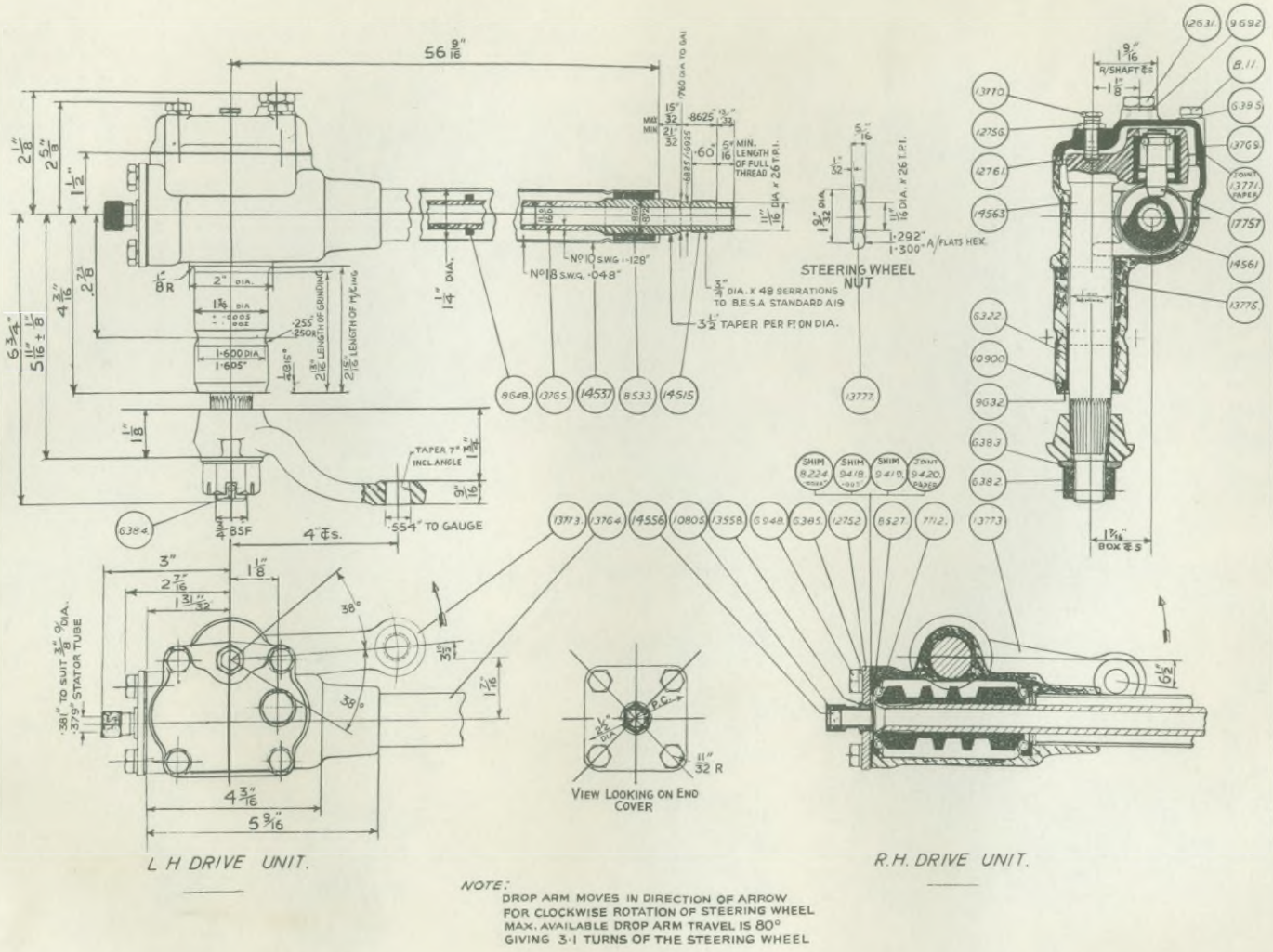


Fig. 14. Drawing of Bishops cam steering unit

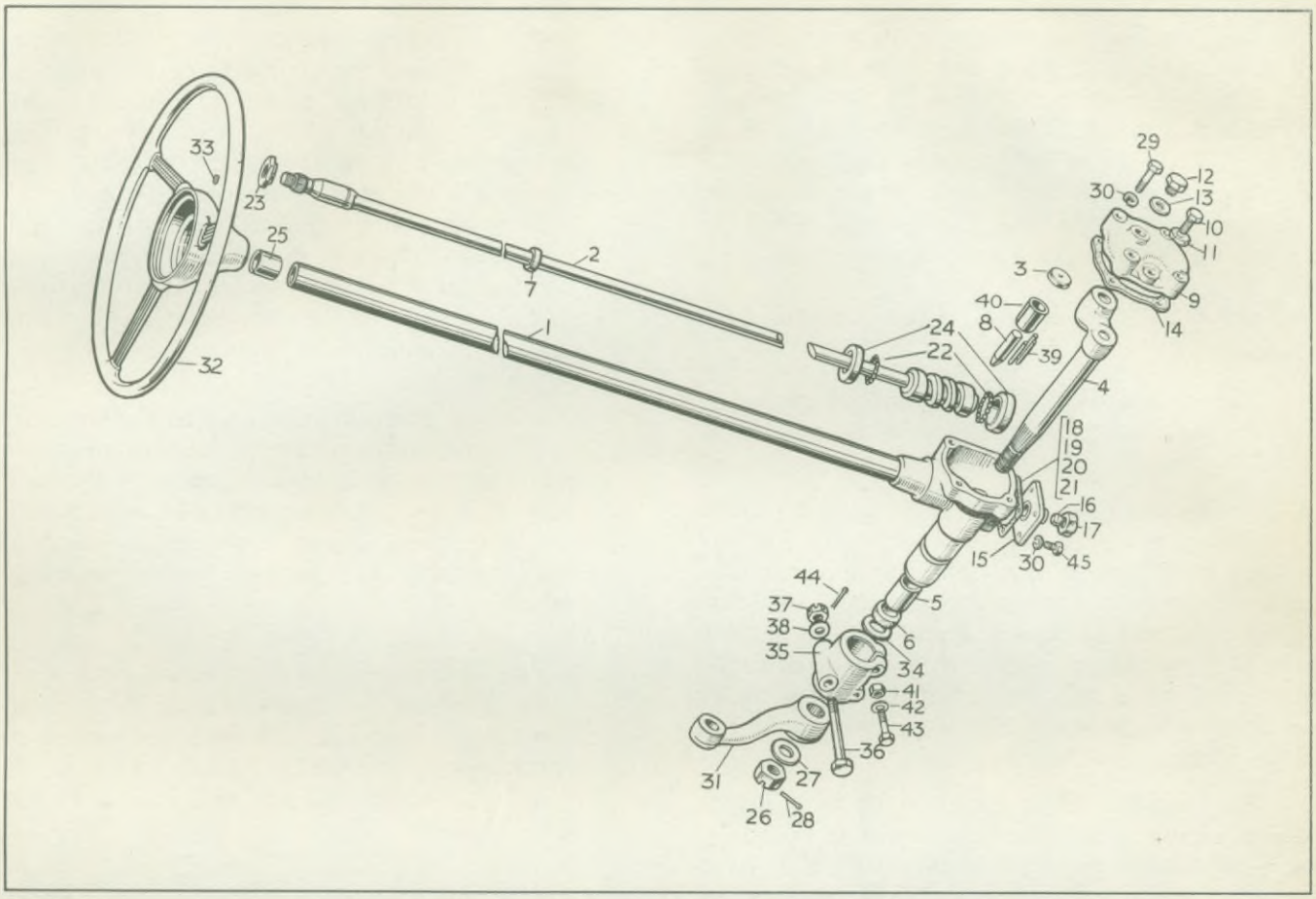


Fig. 15. Exploded view of Bishops cam steering gear

NOTATION FOR FIG. 15

Fig.	*Detail*	*Item*
1	60355	Steering Tube and Box Assembly.
2	300613	Inner Column and Cam Assembly.
3	300619	Thrust Disc.
4	300615	Rocker Shaft (Base) Assembly 300614.
5	60584	Bush for Rocker Shaft.
6	60585	Cork for Rocker Shaft.
7	60586	Rubber Ring (2 off).
8	300618	Peg.
9	60358	Cover.
10	60359	Thrust Screw.
11	60360	Lock Nut.
12	SP.68B.	Oil Plug.
13	SP.54V.	Washer.
14	60363	Joint.
15	60364	Bottom End Cover Assembly.
16	60365	Olive.
17	60366	Nut.
18	60367	Shim .0024".
19	60368	Shim .005".
20	60369	Shim .010".
21	60370	Joint.
22	60371	Ball Cage Assemblies.
23	60372	Nut, Steering Wheel.
24	60373	Ball Cup.
25	43314	Felt Bush.
26	SP.21K.	Slotted Nut—$\frac{3}{4}$" B.S.F.
27	SP.44S.	Plain Washer.
28	SP.550	Split Pin—$\frac{5}{32}$" × $\frac{1}{2}$".
29	SP.3G.	Bolt $\frac{5}{16}$" B.S.F.
30	SP.48E.	Spring Washer.
31	56029	Drop Arm Lever.
32	62002 62003	Steering Wheel (Alternative).
33	59107	Grub Screw No. 10F.
34	43332	Retaining Disc Rocker Shaft.
35	59224	Trunnion Bracket.
36	56080	Bolt for Trunnion Bracket.
37	NL.2211	Nut Slotted $\frac{1}{2}$" × 20 N.F.
38	WP.0047	Washer—Plain.
39	300620	Needle Rollers.
40	300617	Outer Housing.
41	NH.2008	Nut $\frac{5}{16}$" × 24 N.F.
42	WL.0208	Washer Lock.
43	BH.0815	Bolt $\frac{5}{16}$" × 24 N.F. × $1\frac{7}{8}$".
44	PC.0020	Pin Cotter.
45	SP.3A.	Bolt for End Cover.

Two types of steering gear are scheduled to be used on our "Vanguard" model, namely, the Bishops Cam Gear Type PL.1588 and the Burman L.3, manufactured by Messrs. Burman & Sons Ltd. It is proposed to deal with each of these units separately as they are both used on this chassis. In the case of the Triumph "Renown" model, the Burman gear alone is used.

BISHOPS CAM GEAR (Figs. 14 and 15)

Description.

This gear provides a 14 : 1 ratio, there being only two moving parts, there being practically metal-to-metal contact throughout its movement.

The gear is illustrated in Fig. 14, an exploded view being given in Fig. 15 from which it will be observed that it is a self-contained unit of extreme simplicity consisting essentially of a cam 14561 mounted on the bottom of the steering tube 13765 which engages with rocker shaft 14563 through a spiral groove cut in the periphery of the cam and a roller bearing mounted in the top of the integral lever rocker shaft.

The whole unit is enclosed in an oil-tight casing 13775 which carries two ball bearings 8527 on which the cam runs and which have been designed to carry both radial and thrust loads. The lever 13773 is fitted to the lower end of the vertical rocker shaft and the central control is locked by the gland nut (10805) attached to the bottom cover plate (12752). When the cam is rotated the peg moves over a predetermined arc and thus imparts the desired motion to the rocker shaft.

TESTS DIAGNOSIS AND ADJUSTMENTS (Steering Unit)

Means for adjustment to take up wear are provided and the following points should be noted as important :—

1. There should be no end motion of the steering tube and cam in any position.
2. There should be no lost motion of the rocker shaft in the *straight ahead* position.
3. Lost movement in either of these two points mentioned above will result in unsteady steering, knocks and backlash on the steering wheel.
4. The cam is designed to give no play in the straight ahead position and a gradually increasing amount of play towards either lock. This play is never felt on the steering wheel, because the geometry of the steering mechanism always causes pressure on the cam through the rocker shaft towards the centre, tending to return the steering gear to the straight ahead position. Thus, as the gear rocker shaft moves towards its mid position for straight ahead steering, the backlash is gradually eliminated, so that for normal steering in the straight ahead position, maximum stability is obtained.
5. The notes given below apply to the steering unit alone and separate provisions must be made to deal with any looseness in the ball pin joints and other connections, which will in themselves cause "wandering" or a knock which will be felt on the steering wheel.
6. To locate a trouble in the steering gear, deal with it alone by disconnecting drop arm lever 13773, also auxiliary drop arm assembly from cross member. LEAVE DROP ARM LEVERS ATTACHED TO FULCRUM PINS.

It should be very carefully noted that under no circumstances must the lever be removed from the rocker shaft by hammer blows. A proper extractor tool must be used as shown in Fig. 16 to extract this lever as hammer blows cause the taper roller to hammer the cam track and ball bearings, etc., resulting in damage often serious to one or more of these parts.

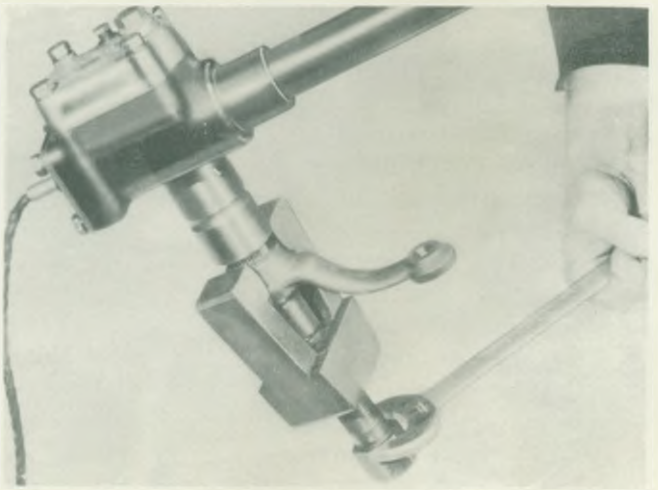


Fig. 16. Extracting drop arm from steering unit with approved extractor

Stiff steering gear.

Try the feel of the steering gear. If it is stiff, it is possible that the steering column is pulled out of line. Loosen the top support clip for the top support for the outer column (under the instrument board) and let the column find its own unrestricted position. If still stiff, see if this tightness exists in all positions. If so, the explanation may be one or more of the following :—

(a) Frame bracket clamp bolts too tight.
(b) Tight felt washers at the top of the steering column.
(c) Rocker shaft too tight in its bearing.
(d) The cam too tight in its bearing.
(e) Bent steering tube.
(f) Central control tube fouling the inside of the steering column.
(g) Trafficator head binding.

DIAGNOSIS

If the steering is stiff in the centre position only, the adjusting screw 13770 (see Fig. 14) is probably tightened up too much. If the steering assembly is properly fitted and there is no question therefore of the steering column being pulled out of line, or of the frame bracket clamp bolts being too tight, one of the other points enumerated must be to blame.

To investigate the possibility of point (f) being responsible, loosen off the brass gland nut 10805 holding the trafficator tube at the bottom end of the steering and three grub screws in the steering wheel, and partly withdraw the tube.

If the steering is still stiff when the stator tube is free, investigate the possibility of point (d) above being responsible by slightly loosening the four setscrews (about half to three-quarter of a turn is sufficient) which hold the bottom end plate (12752) in position. This eases the ball bearings.

If the procedure indicated in the previous paragraph fails to ease the steering, retighten the four setscrews and remove the steering wheel and trafficator and ascertain whether the felt bush (8533) at the top of column is tight and if so ease it.

If the felt washer is not responsible for the trouble and the gear is still found to be stiff, the next step is to investigate the possibility of a bent steering tube. To explore this possibility, withdraw the felt bush and see if the inner column pulls heavily to one side of the outer column.

REMEDIES

Bent steering inner column.

The inner column is fairly flexible and *slightly* pulling to one side has little or no effect on the feel of the gear, but a badly bent column which is causing stiffness should either be rectified, where this is possible, or alternatively replaced.

Tight cam bearings.

If the cam bearings (8527, Fig. 14) are too tight. Do not remove the steering wheel and the procedure given below should be adopted :—

1. Disconnect the electric cables at the push-in connection.
2. Remove the brass union nut (10805, Fig. 14) and olive, arranging a receptacle to catch escaping oil.
3. Partly withdraw the three grub screws, which locate the trafficator in the steering wheel, as shown in Fig. 17 and raise the trafficator slightly.
4. Remove the four setscrews (6948) which secure the base plate (12752) and insert an additional shim, or shims, of sufficient thickness to give an easy fit for the bearings without end play. Be careful if, when removing the base plate, the ball cup comes away, that it is properly replaced when refitting the end cover. Take care also to renew the paper washer if it is damaged and to keep the shims scrupulously clean, otherwise oil leakage may develop. The steering wheel should never be removed when this bottom end shimming is done, as it prevents the inner column and cam with top ball cage from sliding down and becoming displaced.
5. Refit the trafficator olive and brass union nut (10805) and retighten the three grub screws securing the trafficator control.

N.B.—Where it is necessary for any reason to remove the trafficator control lever, the small spring clip should be released with such a tool as is shown in Fig. 18, after which it is an easy matter to lift out this lever.

Knock or backlash in straight ahead position.

It is quite possible, with a stiffly operating gear, to have a knock or backlash in the straight ahead position. This is due to play of the taper roller in the cam groove, and is eliminated by re-adjusting the screw (13770, Fig. 14) until a slight binding can be felt when turning the steering wheel to and fro with the gear in the STRAIGHT AHEAD POSITION.

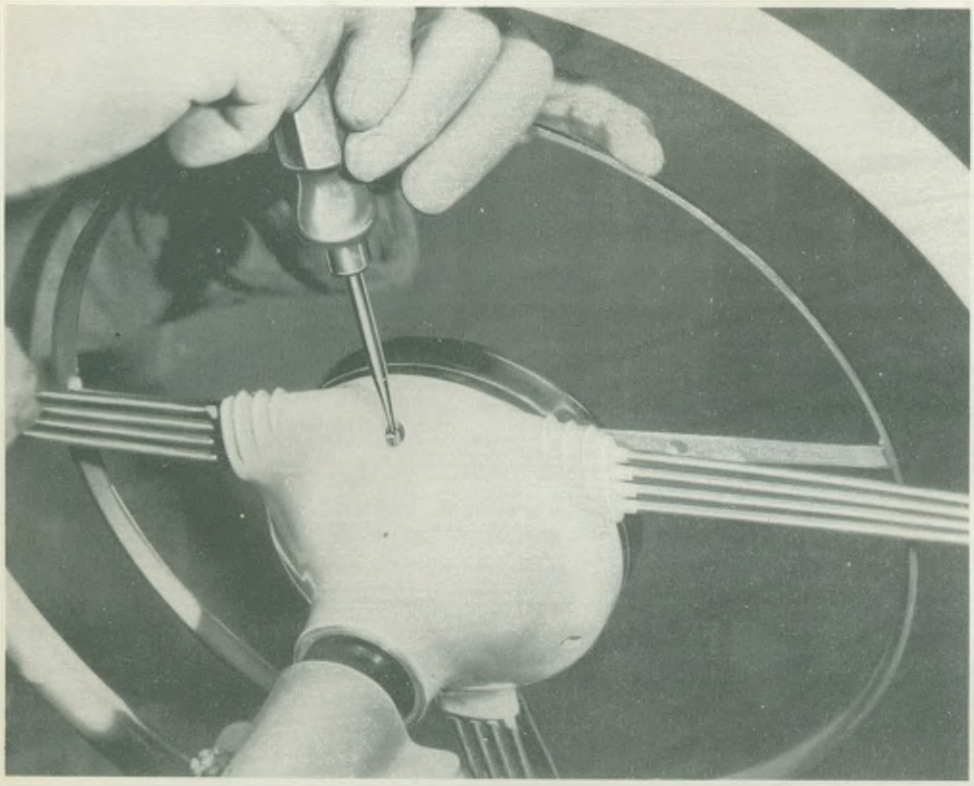


Fig. 17. Removal of one of the three grub-screws which secure trafficator ring in steering wheel hub

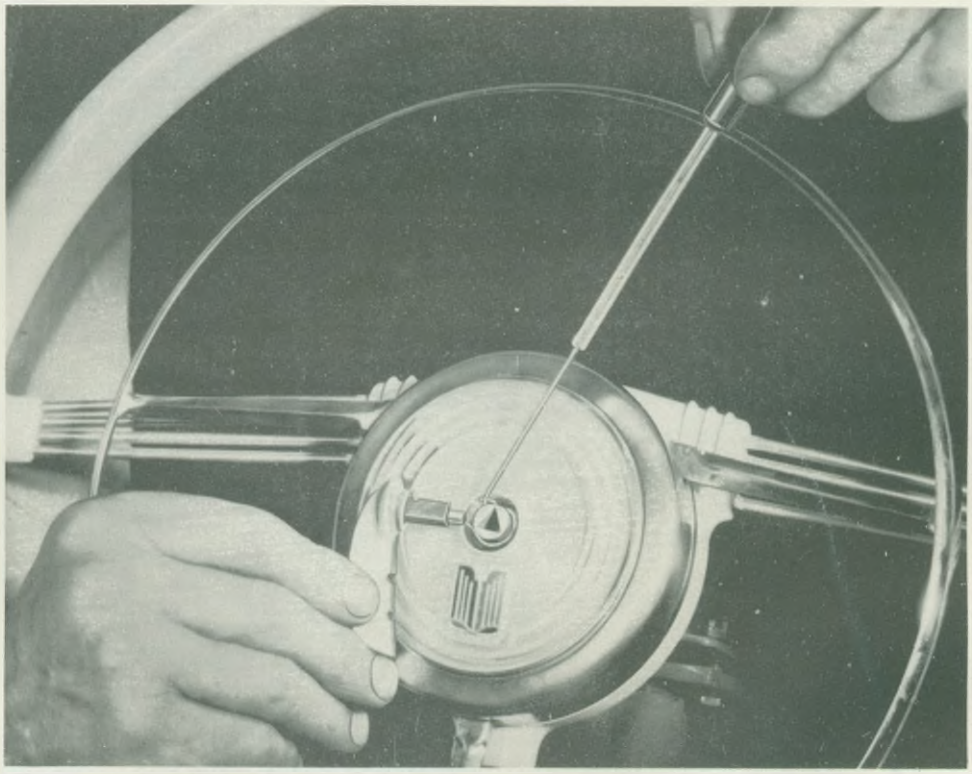


Fig. 18. Showing release of circlip to enable withdrawal of trafficator lever

Lost motion can be easily detected by lightly shaking the lever (13773, Fig. 14) in a forward and rearward direction and moving the steering wheel to and fro near the straight ahead position, until the least amount of play is found (this fixing the deepest point of engagement between the rocker shaft lever and cam), keeping the gear in this position and then adjust the setting of the screw (13770, Fig. 14). Be careful not to adjust this screw too far in so that the feel in the straight position is too heavy ; just a slight binding is all that is required, otherwise the side plate will be damaged and oil lost, quite apart from the fact that the steering will be rendered stiff in the straight ahead position.

Easy gears with backlash or knock.

1. Disconnect the rod from the lever (13773, Fig. 14). Set the steering partly towards right- or left-hand lock. (Full lock position should not be used.) Grip the lever firmly and try to move it forwards and backwards (holding the wheel from turning) and see if the steering wheel shows any lift. If such play exists, this is due to end play of the cam in the ball bearings. The remedy for this lift is to remove one or more shims adopting a similar procedure to that described above for the addition of shims when dealing with a tight bearing.
2. Place the steering in the straight ahead position and then shake the lever backwards and forwards to see if there is any play of the taper roller in the rocker shaft. If play exists, adjust the side screw until all slackness is eliminated.

Before attending the adjustment mentioned in the previous paragraph, the shim thickness under the end plate must be corrected to eliminate end play where this exists. Correct rocker shaft adjustment is only practicable when there is no end play in the column and cam.

Never use a wedge or other crude method to remove the lever from the rocker shaft of a steering gear. This method inevitably damages the peg, cam, cork sealing gland and disc at the end of the trunnion bracket through which the rocker shaft projects. The correct method for the removal of this lever is shown in Fig. 16.

Removal of steering drop arm lever.

If, for any reason, the lever has been removed from the gear, it is essential that it goes back on the correct spline. A line is scribed on the bottom of the rocker shaft and two on the rocker shaft, one for the right-hand steering models and the other for left-hand models, as shown in Fig. 19, and these must coincide as appropriate to the model concerned.

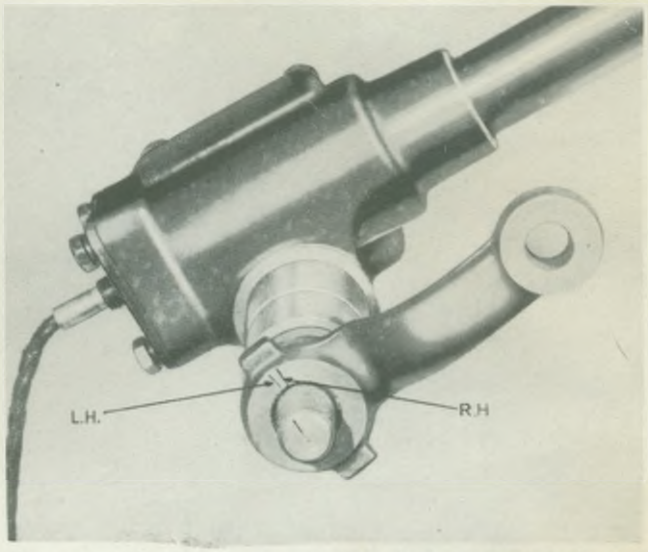


Fig. 19. Markings on steering box rocker shaft and drop arm

LUBRICANTS

The oil recommended for this steering gear is of the extreme pressure type and the necessary recommendations are included in the summary given in the General Data Section.

REMOVAL OF STEERING UNIT (Bishops Cam and Burman L.3 steering units)

This should be done from the bottom of the car, adopting the procedure outlined below :—

1. Disconnect a lead from the accumulator to break the electrical circuit.
2. Place the car over a pit or on a hoist, making provision for the removal of the front wheels, which will be necessary if the steering box trunnion bolt and/or the larger auxiliary box bolt are difficult to remove, as explained in operation 5.
3. Disconnect control tube electrical leads from the push-in connector.
4. Withdraw central control assembly into the interior of the car, after removal of the nut and olive at the base of the stator tube and the withdrawal of the three locating grub screws from the steering wheel boss. The withdrawal of control assembly will allow the oil to escape from the steering box.
5. Detach auxiliary drop arm assembly from its bracket by drifting out the securing bolts, utilizing the hole provided in the chassis

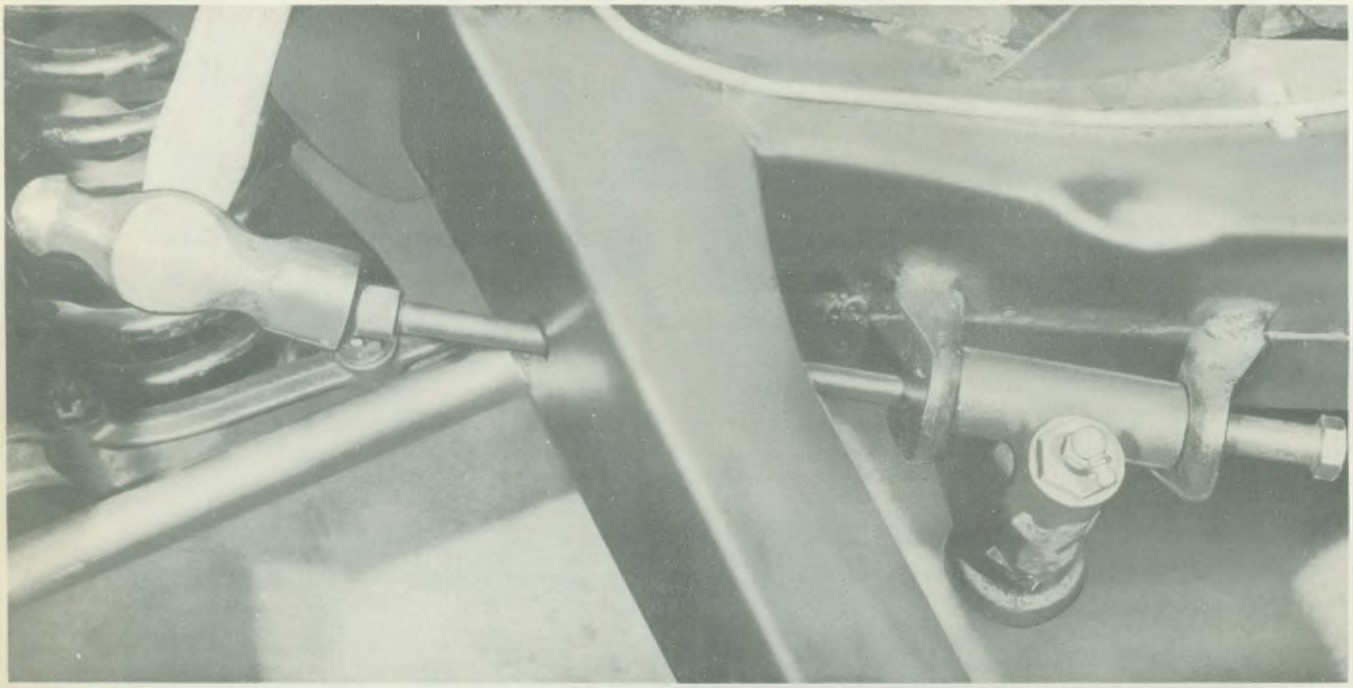


Fig. 20. Drifting out auxiliary drop-arm bracket bolt. The same method may be employed for removal of steering box bolt.

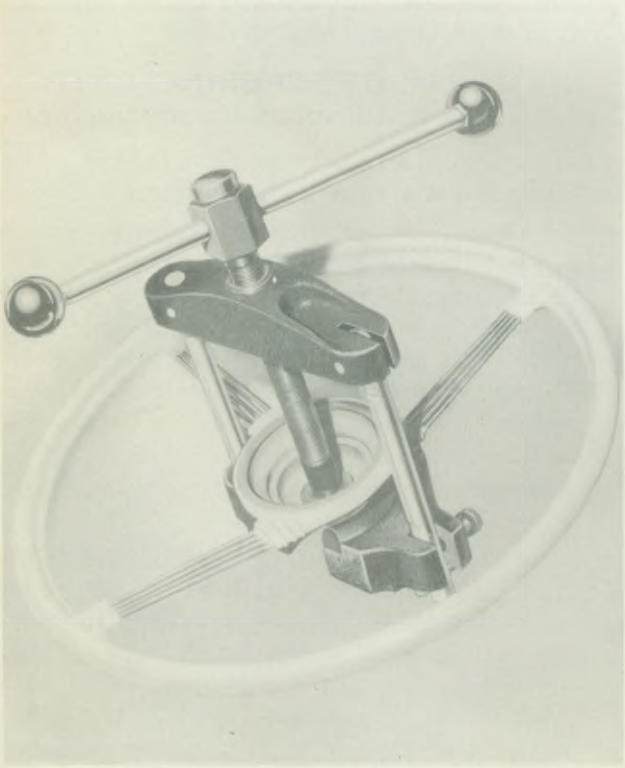


Fig. 21. Removing steering wheel with special puller

side member for the drifting out of the upper or larger bolt of the two, as shown in Fig. 20 if this proves difficult to remove.

6. Extract steering box drop arm with the approved extractor as shown in Fig. 16. It is now possible to swing the tie rods and drop arms clear for the passage of the steering assembly.
7. Remove the bottom half of the bottom gear lever control rod bracket with the support rod by removal of two $\frac{1}{2}$" A/F headed bolts and withdraw the clip securing the reversing light leads to steering column. Similarly, withdraw the bottom half of the second control rod bracket. Where the same assembly is to be refitted, it will same time when re-installing if the position of the control rod brackets are marked for reassembly.
8. Remove the upper control rod clamping bracket, adjacent to the steering wheel, by the removal of a single bolt.
9. Extract steering wheel after removal of securing nut employing special wheel puller as shown in Fig. 21. Mark the splines for reassembly if the same steering unit is to be re-installed.
10. Remove the nut securing steering box trunnion to bracket on cross members and drift out bolt, utilizing the hole in the chassis frame as shown in Fig. 20, for the entry of drift.

11. Remove the bottom bolt from dash-board support bracket. This will free the steering column and leave the control rods supported.
12. Withdraw the steering assembly, turning the rocker shaft housing into a horizontal position, from below.

REFITTING STEERING ASSEMBLY
(Bishops Cam and Burman L.3)

Re-installation of the steering assembly is the reverse procedure to that outlined above for its removal if the same assembly is to be installed. (See separate instructions with regard to the fitting of a replacement assembly.)

It is considered desirable, however, to give some instructions with regard to the re-engagement of the drop arm which is naturally of considerable importance.

In spite of the markings shown in Fig. 19, a little difficulty will be experienced in matching these up in the appropriate manner. The procedure set out hereafter should, therefore, be followed.

Refit the steering wheel in its original position after the steering unit has been re-installed (separate instructions are given for this operation where a replacement assembly is being fitted). The engagement of the correct spline is important as a single spline's error will affect the correct position for " straight ahead " steering and also the operation of the trafficators.

The refitting of the control rod brackets can be effected by referring to the marks made on the column when dismantling where the same assembly is being refitted. Reference should be made to the instructions given later when fitting a new assembly.

When refitting the steering box drop arm, the markings shown in Fig. 19 should be used with the road wheel in the " straight ahead " position and the steering wheel assuming the position shown in Fig. 22. A single spline's error in the engagement of the drop arm will have a considerable effect on the appropriate position of the steering wheel (a 14 : 1 ratio being used), and a check should be made after fitting drop arm before proceeding further to obviate extra adjustments after completion of work.

Where interference has been required to the steering tie rod lengths, they should be reset to the dimensions specified in Fig. 24 or 25 as appropriate. Front wheel tracking should be checked and reset as explained under " Front Wheel Alignment."

N.B.—When refitting steering box trunnion to bracket, make sure that the single securing bolt is dead tight.

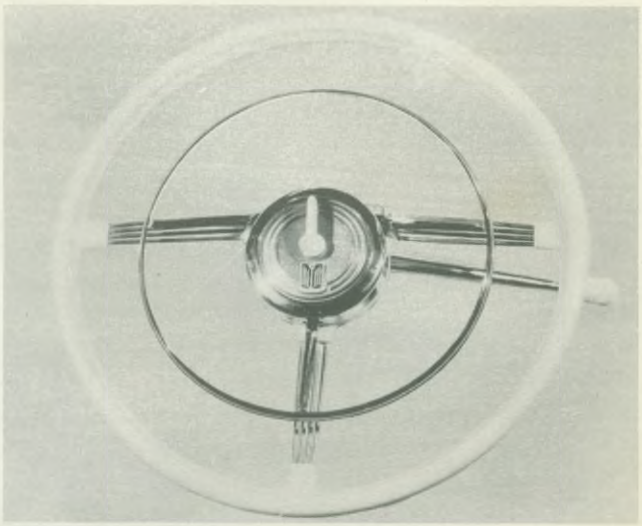


Fig. 22. Straight ahead position of steering wheel, horn rim and trafficator lever

SELECTING SPLINE ON CENTRE COLUMN FOR STEERING WHEEL ENGAGEMENT
(Bishops Cam and Burman L.3)

Before fitting the drop arm to the rocker shaft, fit the steering wheel on any spline and rotate until an extreme lock position is obtained.

Next mark the periphery of the steering wheel with a pencil in the T.D.C. position and rotate the wheel in the opposite direction until the other lock position is reached.

The number of wheel revolutions from lock to lock should be halved and the steering gear turned back correspondingly to its mid position and the wheel splines re-engaged, so that the spokes of the wheel assume the position shown in Fig. 22. The spokes of the horn rim should be aligned with those on the steering wheel and the trafficator lever set before tightening up the nut at the base of the stator tube.

When the assembly has been refitted, the steering lock stops in the stub axle brackets must be so set that they come into operation before the stops in the steering box itself come into action.

To adjust the lock stop setscrews, turn the steering until one of the box stops are reached with that lock stop setscrew slackened back. The stop setscrew should then be adjusted until it just contacts the inner end of the tie rod lever concerned, with the steering held against the box stop. The setscrew

should then be screwed in approximately a further quarter of a turn, thus ensuring that this stop is reached before that in the steering box.

Repeat the procedure indicated in the previous paragraph for the other lock.

In general, the procedure indicated above will provide a turn and a quarter of the steering wheel from rather less than backlock to the " straight ahead " position and without any difficulty with tyre rub. In cases where tyre rub is encountered, suitable adjustment will necessarily be required.

FITTING GEAR CHANGE OPERATING RODS TO STEERING COLUMN
(Bishops Cam and Burman L.3)
(Comm. No. V.1—V.51,000)

Where it is necessary to fit change speed controls to the steering column, the underside of the bottom bracket should be set to the dimension shown in Fig. 23. The position of the top control rod bracket should then be adjusted so that the distance from the top of this to the top of the steering column is $2\frac{7}{16}$"—$2\frac{5}{8}$", which should provide a clearance between the change speed lever knob and the underside of the steering wheel, in its spring-loaded position, of $1\frac{1}{2}$" approximately.

The position of the intermediate change speed control bracket should now be adjusted so as to provide a clearance for the dogs, thus permitting the independent operation of the two pairs of gear positions.

The adjustment of the lengths of the two rods connecting the levers at the bottom of the steering column with the gearbox is of some importance if proper operation of the gears is to be permitted. These two rods should be so adjusted that the dogs are in perfect alignment when the gear lever is in the neutral position.

It is important that the three control rod brackets should be properly aligned with one another and that there is no possibility, therefore, of the rods being in a state of twist.

The dimensions for fitting of gear change control rod brackets to steering column are given in Fig. 23.

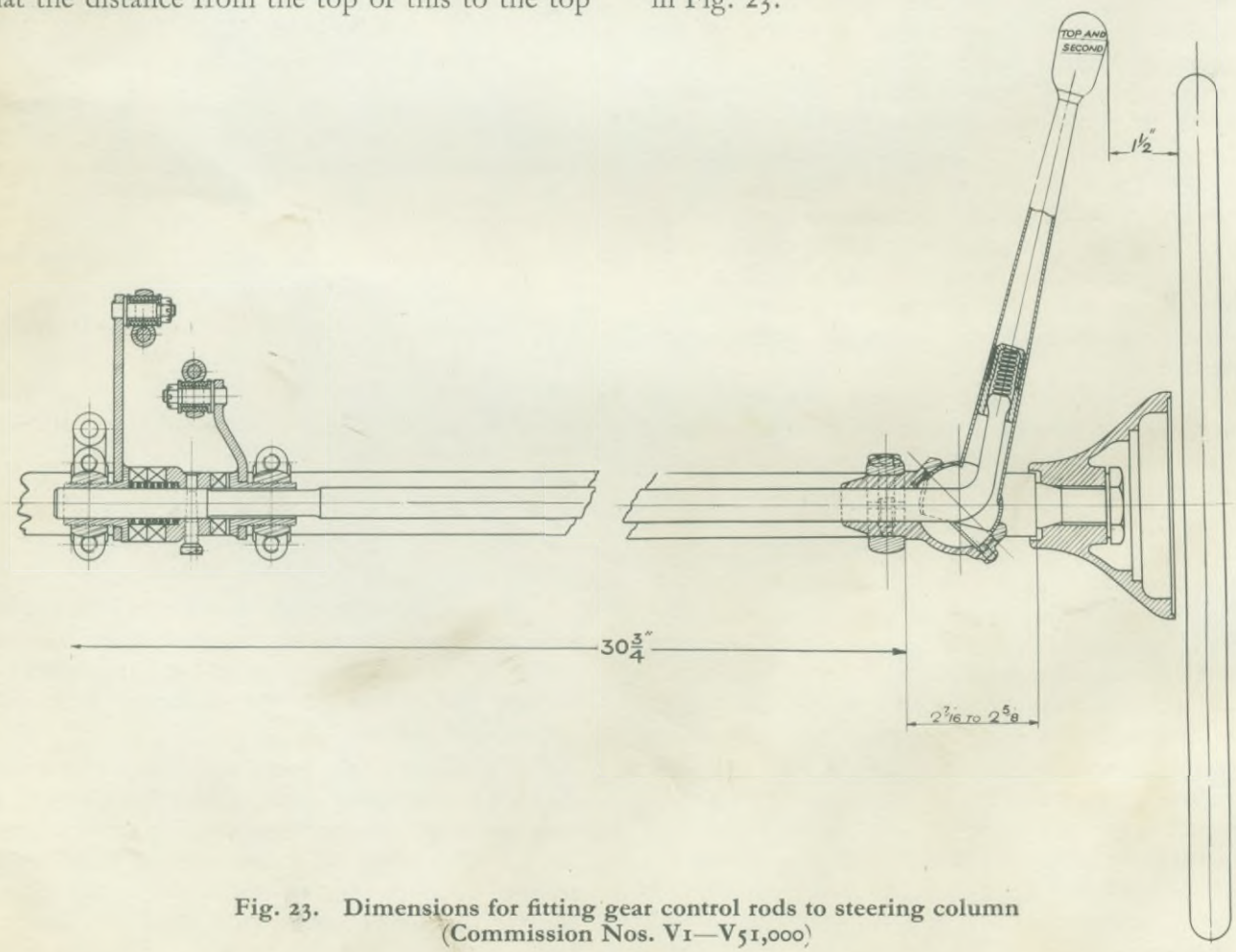


Fig. 23. Dimensions for fitting gear control rods to steering column (Commission Nos. V1—V51,000)

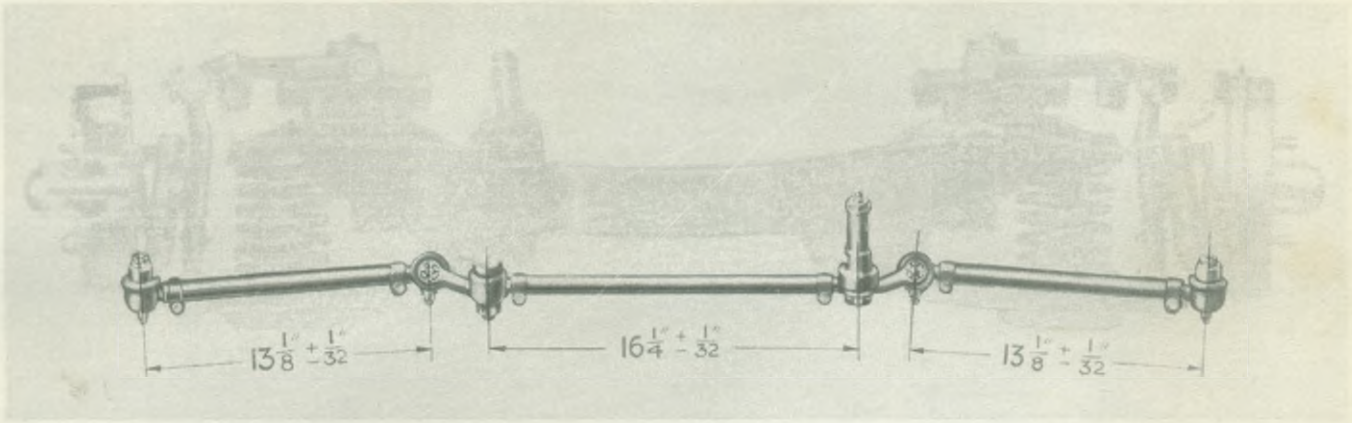


Fig. 24. Dimensions of steering tie rods. The centre tie rod dimension must never be altered, when equipped with adjustable outer tie rods (Com. No. V1-V97995 Vanguard. TDB1-TDB2662 on Triumph Renown)

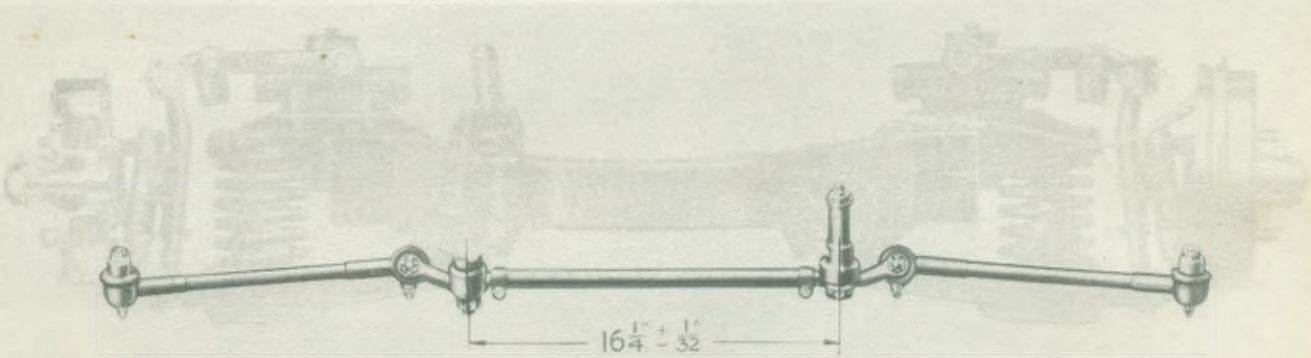


Fig. 25. Dimensions for steering tie rods. The centre tie rod must be altered where non-adjustable outer tie rods are fitted. (Com. No. V97996 & future and TDB2663 & future)

To fit new steering tie rods.

Early Vanguards were fitted with adjustable outer tie rods as shown in Fig. 24. With current productions, non-adjustable outer tie rods are fitted, which are shown in Fig. 25. The lengths of the tie rods shown in Figs. 24 and 25 are of considerable importance and must be regarded when fitting replacements. In order to fit these replacements, it is necessary to detach the auxiliary drop arm and bracket and also the steering box drop arm noting the markings shown in Fig. 19 for reassembly of the latter drop arm.

Proceed, therefore, as follows :—

1. Remove the two auxiliary bracket securing bolts and extract the steering box drop arm with approved extractor as shown in Fig. 16. Where tie rods are at present fitted, the outer ends of the outer rods will have to be detached from the stub axle tie rod levers and the tie rods will be removed with the auxiliary drop arm assembly and steering box drop arm as one unit.
2. Adjust the lengths of the tie rods to agree with those in Fig. 24 or 25 as appropriate to the Model (a further check will have to be made during a later operation) and assemble together leaving the clamping bolts on the rods slack at this juncture.
3. Turn the auxiliary drop arm out from its bracket three turns (this is an average setting) and screw out the fulcrum pin where fitted at each end of the centre tie rod just over a quarter of a turn (20 minutes on the clock face is recommended). With cars now leaving the production lines, the screwed fulcrum pin, at each end of the centre tie rod, is replaced by a normal ball and socket joint, and the necessity for screwing out these pins does not, therefore, arise. The ball and socket joints were introduced at Com. No. V.48045 on the R.H.S. models and at V.48122 with the L.H.S. cars. **The oil seal in this bracket should be fitted with the lip downwards not inwards as is normally the case with this type of retainer.**
4. Next assemble the centre tie rod on to the two drop arms in the appropriate fitted relation, engaging the slot in each of the screwed fulcrum pins with a screwdriver

whilst its securing nut is tightened, where the screwed type of fulcrum is fitted, to prevent altering the correct relation of these pins with their respective screwed socket as provided for in previous operation. Having tightened fulcrum nuts, split pins can be fitted. The proper tightening of the fulcrum pin nuts is important.

Where the ball and socket ended type of centre tie rod is used, as on the current productions, having set the rod centres to $16\frac{1}{4}''$, the clamp bolts should be left slack, until after assembly of the ball joints onto their respective levers, thus ensuring proper alignment with these levers. Where adjustable outer tie rods are fitted, the centre tie rod clamp bolts should now be finally tightened and further adjustments required, made on the outer tie rod remote from the steering side of the Car. Where the non-adjustable type of outer rods are fitted, as on present day productions, adjustment of front wheel alignment is necessarily made on the centre tie rod. Actually, if the dimensions shown in Figs. 24 and 25, as appropriate to the Model, are used, very little further adjustment should be required.

Fig. 26. Adjusting positing of auxiliary bracket to align centre tie rod with drop arm

5. Fit auxiliary drop arm assembly and steering drop arm with tie rods to chassis, leaving the auxiliary bracket bolts slack and matching up the markings on the steering box rocker shaft and its drop arm as appropriate for L.H. and R.H. steering. Refer to Fig. 19. and previous remarks on Page 15 concerning the fitting of the latter drop arm.

6. To ensure that the centre tie rod and drop arms, with screwed fulcrum pins, or ball joints as fitted operate in the same horizontal plane, the auxiliary drop arm should be screwed into or out of its bracket until this tie rod is approximately (complete revolutions of the drop arm only are possible) parallel to either the base of the sump or the

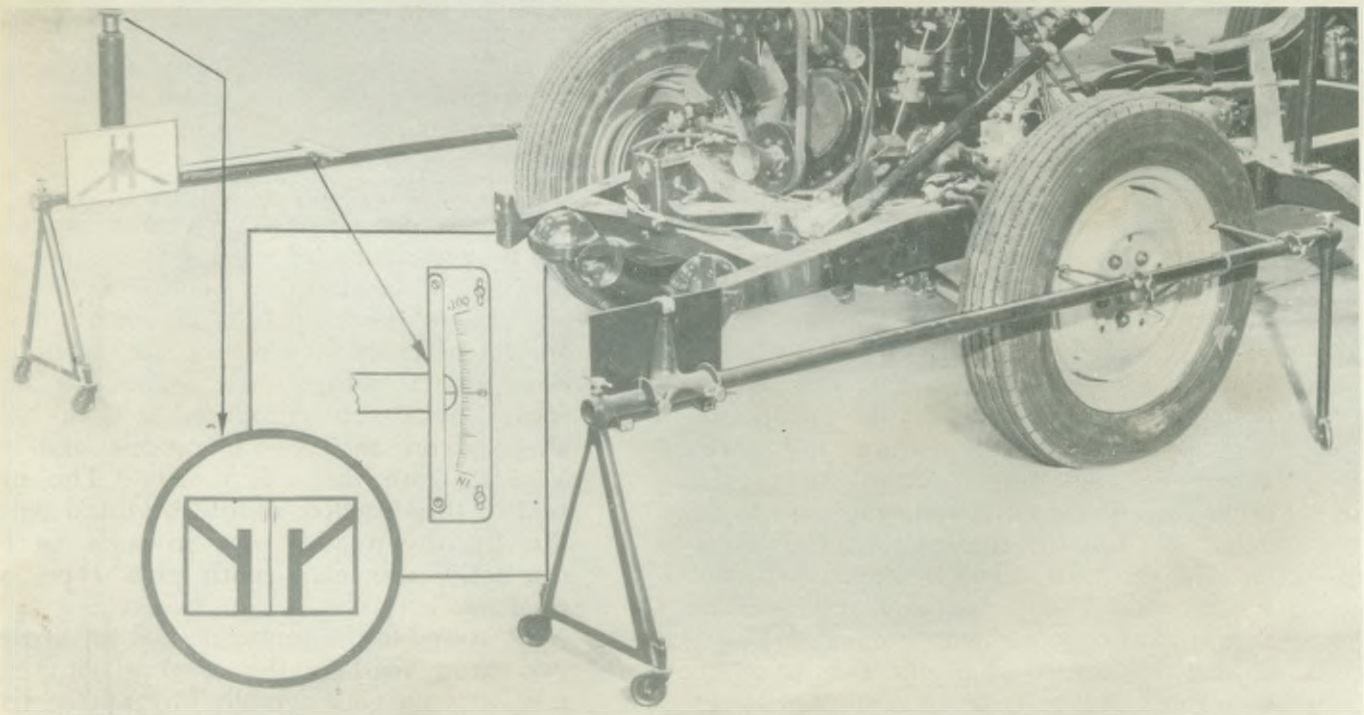


Fig. 27. Checking front wheel alignment with Dunlop optical alignment gauge

chassis cross member. The method for this adjustment is to withdraw the two auxiliary bracket bolts (which should be still loose) and to rotate the bracket as shown in Fig. 26 as, or where, necessary. Three turns out should usually provide the correct setting and under no circumstances should more than five be required.

7. Having aligned the centre tie rod as described in the previous paragraph, check the dimensions of the rod with those given in Figs. 24 and 25. A convenient method for measuring these centres is the employment of a trammel, which can be easily manufactured in your repair shop. To lengthen the tie rods it is necessary to make anti-clockwise rotations viewing from the L.H. side of the car and vice versa. With the earlier batches of Cars, where adjustable outer tie rods are used, the clamp bolts on the centre rod can now be secured. Where present day Models, which have non-adjustable outer tie rods, are being serviced, and with which the front wheel alignment is necessarily adjusted by alterations in length of the centre rod, the clamp bolts can be left loose until after the front wheel alignment has been finalized.

8. Where adjustable outer tie rods are fitted the length of these should be compared with the dimensions given in Fig. 24 or 25 a trammel can be used for this purpose. Having made the necessary adjustments by *anti-clockwise or clockwise* rotations as recommended in previous paragraph, further slight adjustments to these rods may be necessary and the clamp bolts should be only partially tightened, after placing the ball pins in the mid position of their angular travel.

9. Tighten up auxiliary bracket bolts and make certain that the single bolt securing the steering box trunnion to the chassis bracket is dead tight, or alternatively take steps to tighten it. *The tightness of this bolt is of importance and when split-pinning the castle nut always tighten to the next slot rather than slacken back to the previous one.*

FRONT WHEEL ALIGNMENT

The correct front wheel alignment is provided by a " Parallel " to $\frac{1}{8}$" " Toe-in." setting of the front road wheels.

WHERE NON-ADJUSTABLE OUTER TIE RODS ARE FITTED.

When assembling this type of Steering Gear in the Factory, the centre tie rod is set to $16\frac{1}{4}$", before the steering unit, less steering wheel, is fitted with the rods assembled to the main and auxiliary drop arms.

The front alignment is set to $\frac{1}{8}$" " Toe-in " (this limits being specified as Parallel to $\frac{1}{8}$" Toe-in), by slight adjustments of the Centre Tie Rod.

Having obtained the correct front Wheel alignment, the front and rear wheels on the steering unit side of the Car are set parallel to one another, by movements of the front road wheel, and then the steering wheel is fitted on to the splined centre column so that the spokes, horn ring and trafficator control are positioned, as shown in Fig. 22 for Straight Ahead Steering.

This type of rod lay-out is the one employed at the present time, with these Models.

WHERE ADJUSTABLE OUTER TIE RODS ARE FITTED.

When assembling this car in the factory, the front and rear road wheels on the **Steering unit** side of the chassis (as appropriate for L.H. or R.H. steering) are set parallel to one another, with the steering wheel in its " straight ahead " position as shown in Fig. 22, the respective tie rods set to dimensions detailed above, adjustments to achieve this alignment being made on the outer tie rod adjacent to the steering unit. Subsequently the front wheels are set parallel to one another by adjusting the length of the other outer tie rod, the ball joints **on the two outer tie rods placed in the mid position of their angular travel and the clamp bolts finally secured.**

N.B. The employment of the tie rod dimensions given above will be found to require little, if any, further adjustment to provide the correct front wheel alignment.

Adjusting front wheel track (Vanguard Models).

From the factory procedure outlined above it will be appreciated that to correct slight inaccuracies in front wheel tracking, found in cars, fitted with adjustable type of outer tie rod, adjustments should be made on the outer tie rod remote from the steering unit, taking steps to

ensure that the ball pins are in the mid position of their angular travel for " straight ahead " steering. The proper positioning of these ball pins is of particular importance if proper lock-to-lock movements are to be permitted under all possible conditions of front suspension " bump " and " rebound."

Where the non-adjustable type of outer tie rod is used, the front wheel alignment is adjusted by altering the length of the Centre Tie Rod. The nominal centres of $16\frac{1}{4}$" for this tie rod, should require little alteration to provide correct alignment.

Where serious discrepancies in front wheel tracking are found, however, which indicate the possibility of tie rod damage or maladjustment, the tie rod lengths should be reset to the dimensions given in Fig. 24 or 25 as appropriate. Having set the tie rods to the correct dimensions the steering wheel's position for " straight ahead " steering should be checked by reference to Fig. 22 and alterations made if necessary by the engagement of fresh steering wheel splines. Any appreciable alterations in the length of the steering rods will inevitably affect the position of the steering wheel.

In our Service Department we use the Dunlop optical gauge for measuring front wheel tracking, but the employment of any accurate fixture for the purpose will be satisfactory providing that allowances are made for the possibility of wheel rim and/or tyre " run-out."

With a view to compensating for possible wheel rim, or tyre " run-out," the distance measured between points on the tyre, or rim, of the respective wheels, at the same height, at the rear of the wheels should be compared with a similar measurement made at the front of the car and an average of several readings used.

When using the optical gauge illustrated in Fig. 27, several checks should be made using either the wheel rim or tyre wall, adjusting the outer rod so that the average of the readings at different points on wheel rim or tyre provides the adjustment nearest to the correct one. **Set front wheels parallel to $\frac{1}{8}$" " Toe-in."**

ADJUSTING FRONT WHEEL ALIGNMENT. (Renown Models).

The adjustment of front wheel alignment with these Models, differs somewhat to that used for the Vanguard Cars, inasmuch as with the " Renown " an additional tie rod is incorporated. This additional rod consists of a fore and aft pull and push rod, which connects the drop arm on the steering unit to one arm of a bell crank lever assembly and bracket, see Fig. 28, which is bolted to the chassis frame. To the other arm of the bell crank lever is attached one of the centre tie rod ball pins, the other ball pin on this tie rod being assembled to the steering lever of the auxiliary drop arm. The centre and outer tie rods are interchangeable with those used on the " Vanguard."

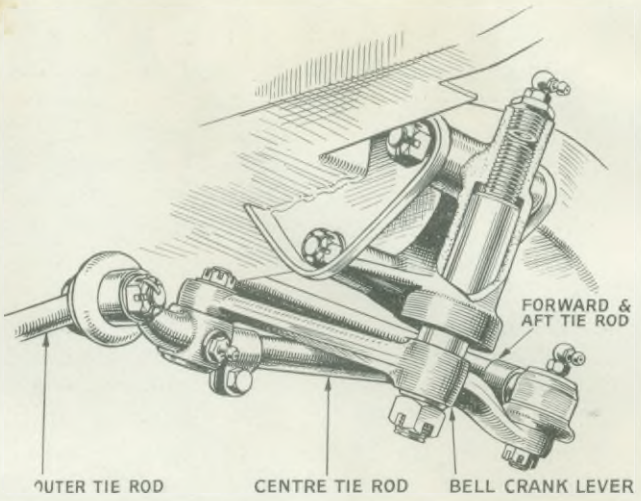


Fig. 28. Bell crank lever and bracket assembly fitted to " Renown " models

The method which is used when setting the front wheels for this Model is as follows :—

The Steering Wheel is assembled on to its splines, on the centre shaft, in the mid position of this shaft's travel, so that the spokes of this Steering Wheel, assume the position shown in Fig. 29.

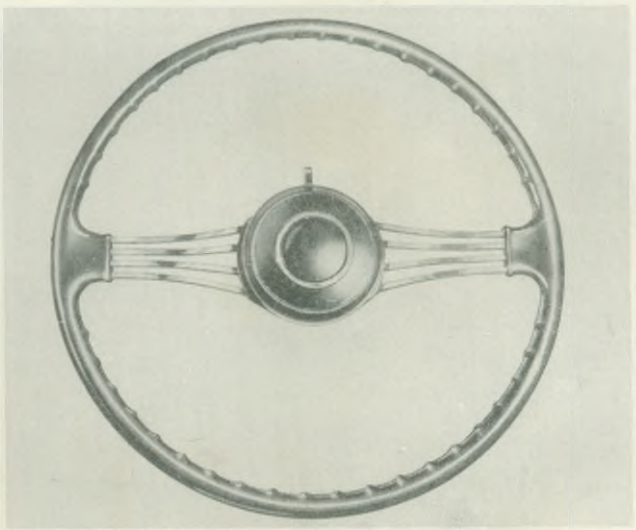


Fig. 29. Position of steering wheel for " straight ahead " steering. (Triumph " Renown ")

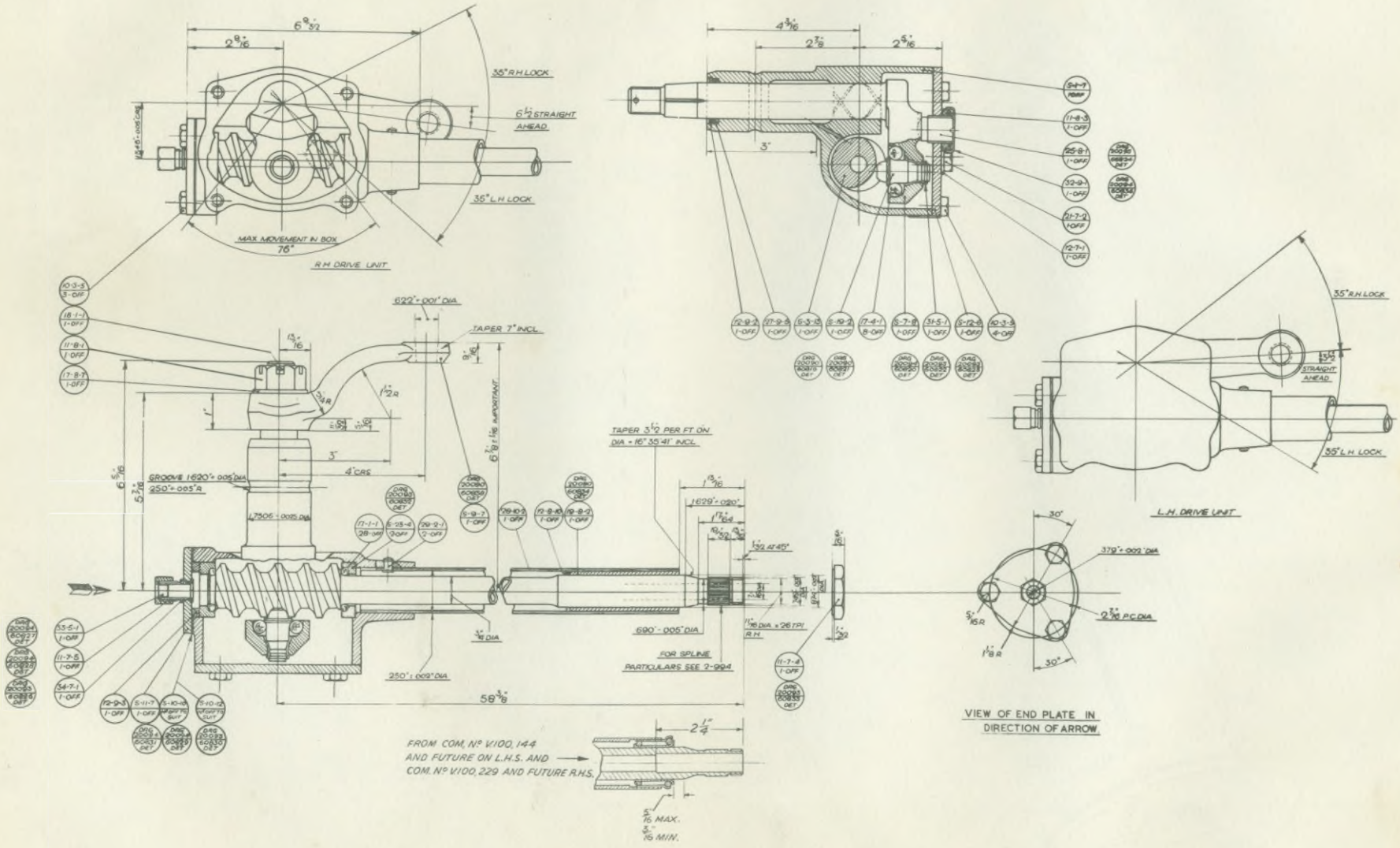


Fig. 30. Arrangement of Burman L.3 steering unit

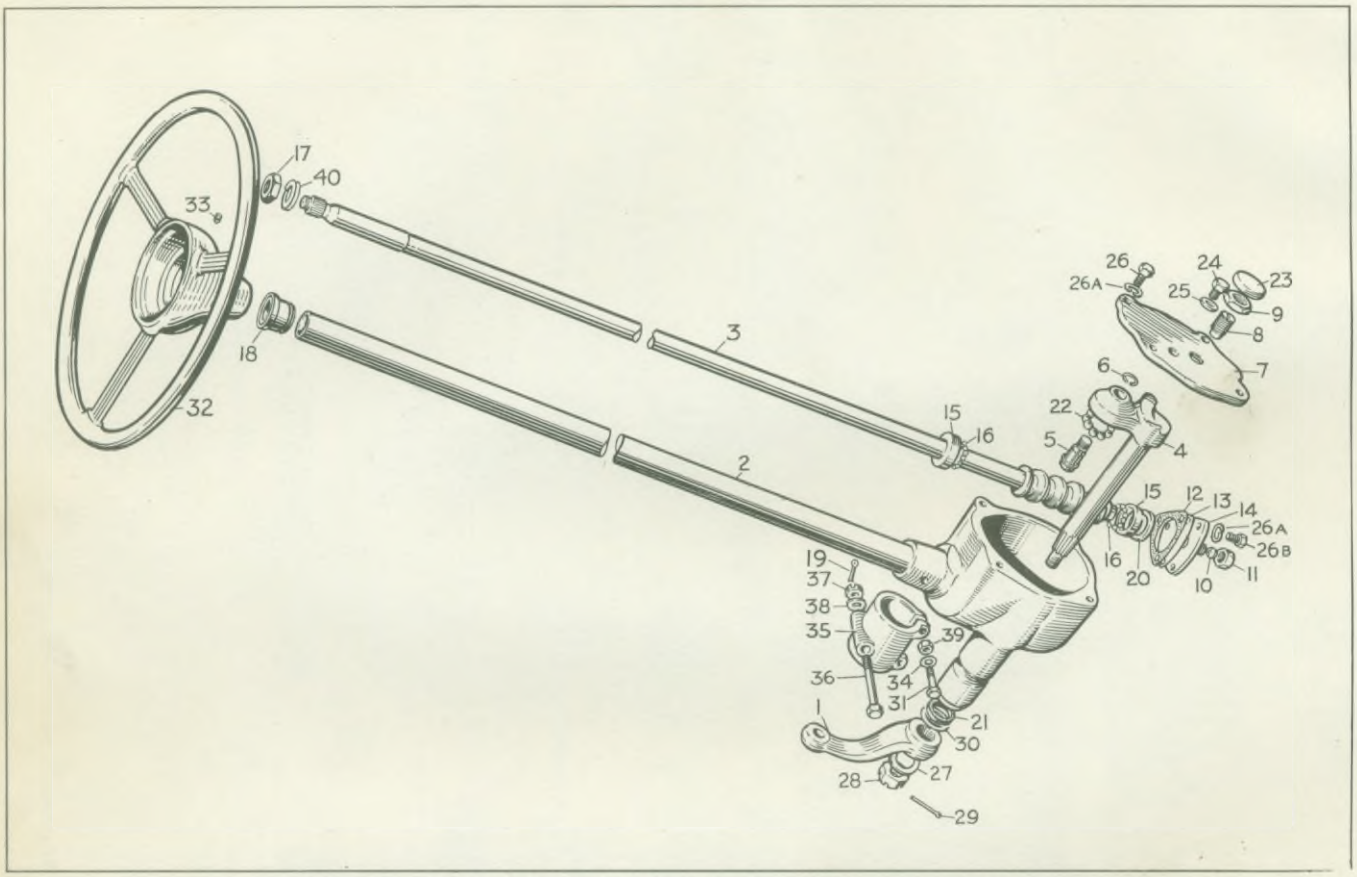


Fig. 31. Exploded view of Burman L.3 steering gear details

NOTATION FOR FIG. 31.

Fig.	*Detail*	*Item*
1	60838	Drop Arm.
2	500206	Steering Tube and Box Assembly
3	60819	Inner Column and Cam Assembly
4	60820	Rocker Shaft.
5	60821	Ball Peg.
6	60822	Circlip.
7	60823	Cover Plate.
8	60824	Adjusting Screw.
9	60825	Locknut.
10		Olive.
11		Nut.
12	60829	Paper Washer.
13	60830	Washer-Steel.
14	60831	End Plate Assembly.
15	60832	Cup for Balls.
16	BL.0014	Balls $\frac{7}{32}$" Dia.
17	60833	Nut—Steering Wheel.
18	101529	Top Bearing Assembly.
19	PC.0020	Pin Cotter.
20	60980	Washer—Packing.
21	500104	Dished Washer Rocker Shaft.
22	BL.0024	Ball $\frac{3}{8}$" Dia.
23	60836	Cap for Adjuster Screw.
24	60837	Plug—Oil Filler.
25	WF.0531	Washer—Filler Plug.
26	SP.3D.	Bolt $\frac{5}{16}$" B.S.F. × $\frac{7}{8}$".
26A.	WL.0208	Washer Lock.
27	WM.0077	Washer.
28	SP.21K.	Slotted Nut $\frac{3}{4}$" B.S.F.
29	PC.0013	Split Pin.
30	500105	Dished Washer Retaining Ring.
31	BH.0815	Bolt Clamp.
32	58078	Steering Wheel.
33	59107	Grub Screw No. 10F.
34	WL.0208	Washer Lock.
35	59224	Trunnion Bracket.
36	56080	Bolt for Trunnion Bracket.
37	NL.2211	Nut Slotted, $\frac{1}{2}$" × 20 N.F.
38	WP.0047	Washer—Plain.
39	NH.2008	Nut $\frac{5}{16}$" × 24 N.F.
40	24287	Spring Washer.

heavy oil or grease. The ball bearings, fitted at the top of the column with later Models, using this type of gear, should be assembled on grease, and are unlikely to require any subsequent treatment during the Car's life.

The upper ball bearings for the inner column should be positioned in thick grease on the upper side of the worm.

Having inserted the inner column, the outer bearing balls can be located by the use of thick grease as with the inner bearings, and the race fitted. Adjusting shims should be fitted between the two paper packings, (which packings should be renewed) so that there is no end play, nor, on the other hand, should there be pre-loading of the bearings, which might cause damage to these.

Having replaced the follower peg, again by positioning the balls in thick grease and inserting the split ring, the rocker shaft may be installed. The fit of the rocker shaft in its housing should be ensured as also should the oil retaining properties of the oil seal, in the end of the steering box trunnion.

The adjuster in the cover plate should be slackened off, after the removal of the pressed steel cap and releasing the lock nut. The cover plate can now be fitted, making sure that this provides an oil-tight joint. Having fitted the cover plate, and with the steering in the **" straight ahead "** position, screw down the adjuster just sufficiently to eliminate all backlash, but without exerting pressure on the rocker shaft.

It should be noted that the wear which occurs in use is normally greater in the " straight ahead " position than on lock, provision is made for this in the design of the cam, and it will be found that there will be slight end play towards each lock.

It will be appreciated, therefore, from the previous paragraph, that adjustment between the follower peg and the cam on the upper extremity of the rocker shaft should be made in the " straight ahead " position, otherwise tightness will occur when the steering gear is in this mid-position. When the adjuster has been finally locked in position by the lock nut, the steel cap should be replaced and the drop arm refitted in such a way that the appropriate line (the one for L.H. or R.H. steering as applicable) on the drop arm coincides with the marking on the rocker shaft as shown in Fig. 19.

After replacing the stator tube assembly, the steering gear should be finally filled with one of the oils recommended in the Summary of Lubricants given in the " General Data " Section. A final test should then be carried out, to ensure that the movement is free from lock to lock with no tight spots, before reassembling the unit into the car.

Refitting Burman L.3 steering unit to car.

Having reassembled and adjusted this steering gear as already indicated, instructions as for the Bishops Cam may be employed.

The instruction for the fitting of the gear change control rods given on pages 18 or 32 should be employed as appropriate to the Car concerned.

Diagnosis and treatment of complaints.

Owing to the similarity in the design of the two types of steering gear used with the " Vanguard," the methods of diagnosing and treatment of complaints already given for the Bishops Cam apply equally to the Burman Steering Unit.

It is considered desirable, however, to stress the importance, with the Burman gear, of not overtightening the rocker shaft adjuster screw, as, owing to the design of this steering unit, excessive tightness due to maladjustment renders the steering gear particularly harsh in operation.

TIE ROD LEVERS

Description (Fig. 32).

The steering tie rod levers are of manganese molybdenum steel and handed for the right-hand or left-hand side of the car. The same levers are used with the two types of steering gear employed.

The dimensions for these levers are given in Fig. 32.

To remove and refit.

If it becomes necessary to withdraw a tie rod lever for any reason, the nut securing the ball pin to the lever extremity should be screwed back until it is flush with the end of the thread, after first extracting the split pin.

Having screwed back the nut, support the lever from beneath with a jack or heavy object to provide the necessary reaction, and give the shank of the ball pin a sharp blow with a hammer to free the ball pin.

To remove the tie rod levers now entails the release of the locking plate from the securing setscrews and their withdrawal.

Do not use a hammer when refitting the ball pin's tapered shank, but rely on tightening the nut to draw the mating parts together.

The centre Tie Rod having been set, before assembly to the bell crank lever and auxiliary drop arm, to 16¼" centres, is adjusted as necessary to provide the correct front wheel alignment of parallel to ⅛" "Toe-in."

Having obtained the correct alignment of the front road wheels, these are left in this position for "straight ahead" steering. The fore and aft tie rod is then suitably adjusted in length so as to allow the steering wheel to remain in the mid position of its travel, for "straight ahead" steering, with the spokes aligned as shown in Fig. 29. The road wheels must remain in their position for "straight ahead" steering during the adjustment of this rod.

THE BURMAN L.3 STEERING GEAR

Description (see Figs. 30 and 31).

This type of steering gear, which is used on our "Vanguard" model (also Triumph "Renown") as well as the Bishops Cam Gear, which has been already described, consists of a single start worm which is attached to the bottom of the centre steering column.

The single start worm is supported on two ball races in the steering box, the top end of the column, to which it is attached, being carried in an oil impregnated felt bush.

Engaging the worm is a spherical-ended peg, again mounted on ball bearings in the rocker shaft. In operation, turning of the steering column produces semi-rotary motion of the follower peg and consequently arcuate movement of the rocker shaft. As the follower peg moves out of the plane of the worm, the rocker shaft is forced downwards by the hardened lower extremity of the adjuster screw in the top cover, bearing on a special shaped cam on the upper extremity of the shaft, the cam being an integral part of the shaft itself.

Where slackness develops due to wear between the worm and follower, it can be eliminated by screwing in the adjuster screw. *N.B.*—At the time of going to press, a modification has been advised, which is scheduled to take place almost immediately. This alteration consists in the deletion of the adjuster screw and the introduction of packing shim under the cover plate for adjustment purposes.

Where end float develops on the centre column, it may be removed by removing one or more of the shims fitted between the end plate paper packing and that on the bottom of the steering box.

Removal of Burman L.3 steering unit from car.

The same method for the removal of this unit should be employed as for the Bishops Cam Gear. Details for this latter's removal are given on Page 15.

To dismantle steering gear.

In order to dismantle the steering gear, it is necessary first to remove the drop arm which is secured to a taper splined portion of the rocker shaft by a castellated nut and split pin. The removal of the drop arm should be carried out by the employment of a proper extractor, as shown in Fig. 16 and under no circumstances should an attempt be made to drive this off with a hammer, as such a procedure will inevitably result in damage to the steering gear.

If for any reason a proper drop arm extractor is not available, and the steering unit has been removed from the chassis, the drop arm can be withdrawn as explained below.

To remove the drop arm, in the absence of an extractor, detach the cover plate after withdrawal of the four securing setscrews, thus exposing the interior of the box. Next turn the steering gear over and whilst suitably supporting the cover plate face, leaving the rocker shaft free, the latter shaft can be driven through the drop arm with a soft metal hammer.

The follower peg and its ⅜" ball bearings can be removed from the rocker shaft by withdrawal of a split ring.

To remove the inner column, it is first necessary to withdraw the stator tube assembly by unscrewing the nut at the base of the tube, removing the olive and drawing out the assembly from above, after removing the three grub screws as shown in Fig. 17. Subsequently, after the removal of the three securing setscrews, the end plate can be withdrawn, providing access to the lower ball race and 7/32" dia. balls.

The inner column can now be withdrawn through the bottom of the steering box, with the 7/32" dia. balls, the inner race for these balls being an integral part of the shaft.

To reassemble steering unit.

Reassembly of the steering unit is the reverse of that given for dismantling above with the additional necessity for attention to certain points which are outlined below.

The felt bush, which was fitted at the top of the steering column, with this type of unit, on early Models, should be lightly smeared with

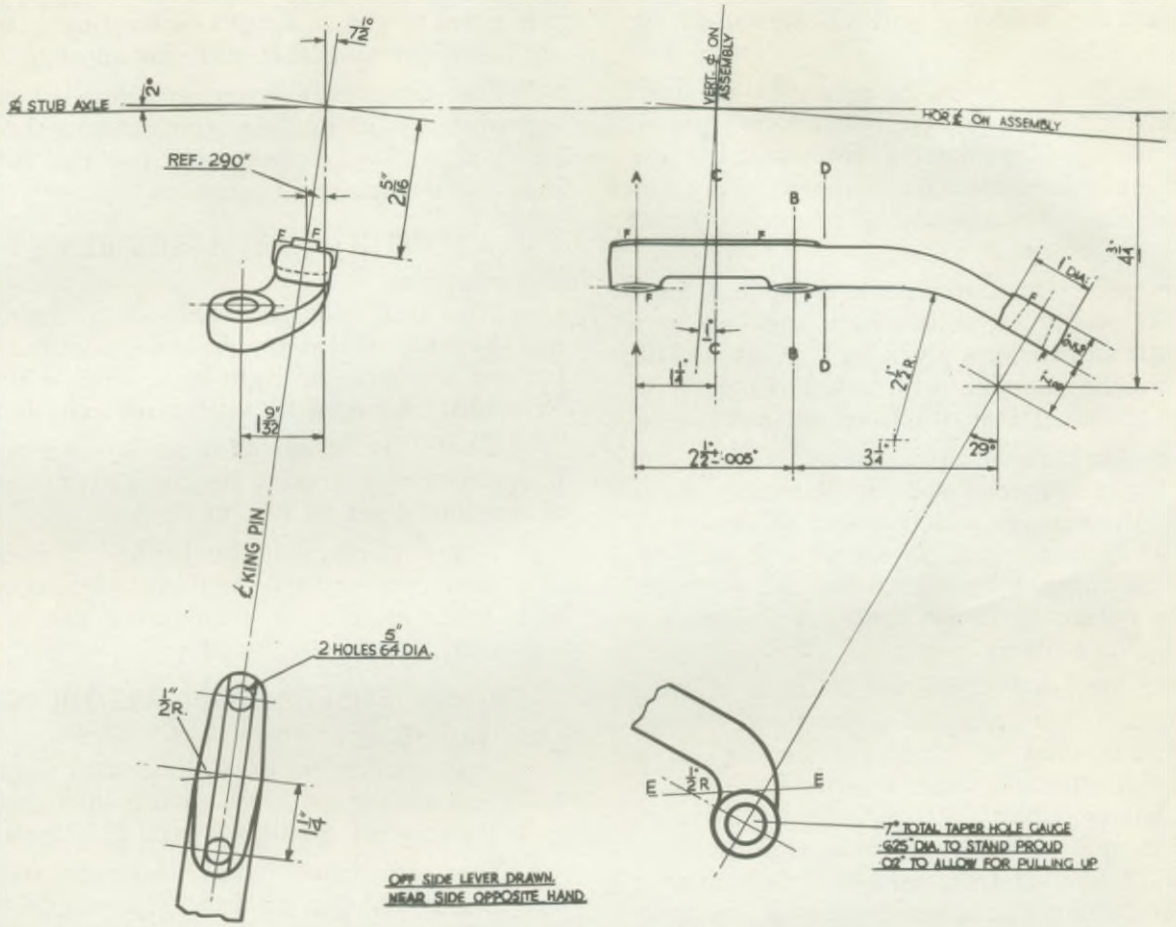


Fig. 32. Steering tie rod levers

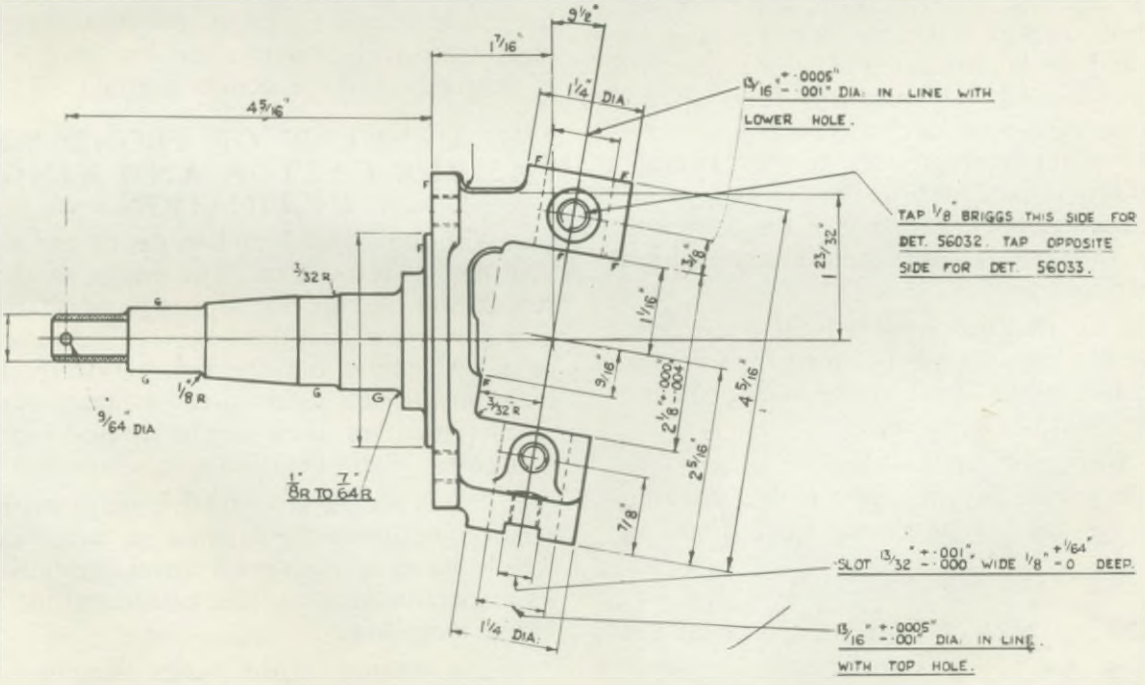


Fig. 33. Stub axle for front suspension unit

Procedure for dealing with a damaged tie rod lever.

Where tie rod levers are seriously damaged due to an accident they should always be replaced by new parts. The material from which these parts are manufactured require special heat treatment and the work cannot be properly carried out by a blacksmith.

The correct procedure, where tie rod lever damage is suspected, is to check such an item against the dimensions given in Fig. 32 and to deal with any damage which has occurred in accordance with the instructions set out above.

As stated earlier in this section, a drop arm should never be removed by hammer blows owing to the damage which would be caused by such a procedure. Fig. 16 shows the employment of an approved extractor for this purpose. Note the markings on the drop arm, illustrated in Fig. 19 for refitting.

If it is required to remove the drop arm for any reason, without removal of the steering gear, it will be necessary to release the auxiliary drop arm bracket from the chassis cross members to prevent any possibility of bending the centre tie rod. The removal of drop arm lever and release of auxiliary bracket from chassis cross member should be carried out as recommended in operations 5 and 6 on Page 15 of this section.

Refitting drop arm lever.

When refitting the drop arm, the markings on the drop arm and steering lever should be regarded and the lever refitted as appropriate for left-hand or right-hand steering. It is always advisable to carry out a check for the correct positioning of the steering wheel in the " straight ahead " position as shown in Fig. 22 as a single spline's error in the engagement of the drop arm will make an appreciable difference to the position of the steering wheel.

Procedure for dealing with a bent drop arm.

When dealing with a bent drop arm lever the same precautions as those outlined for the tie rod levers should be regarded.

The drop arm can be checked against the dimensions given in the appropriate steering gear drawing for the unit concerned (Figs. 14 or 32).

STEERING UNIT DROP ARM LEVER

Description (see Figs. 14 and 32).

The steering drop arm lever is manufactured of molybdenum manganese steel, and the drop arm fitted to the two types of steering gear used are not interchangeable with one another.

The drop arm levers are detailed on the appropriate steering unit arrangements shown in Figs. 14 and 32 respectively for the Bishop's cam and Burman steering gears.

STUB AXLE ASSEMBLY

Description.

The stub axle assembly is a manganese molybdenum steel stamping and naturally handed for the left-hand or right-hand side of the car.

Procedure for dealing with stub axle damage.

Where accidental damage is suspected the item concerned should be checked against the dimensions given in Fig. 33.

Where damage is established the correct procedure is to replace the item in question by a new part, as this steel requires special heat treatment.

FRONT SUSPENSION WISHBONES

Description.

These wishbones are carbon steel stampings and there are two pairs for each front suspension unit. This steel requires special heat treatment.

The right-hand front wishbone is interchangeable with the left-hand rear wishbone and that fitted at right-hand rear with the one used for the left-hand front.

Suspected accidental damage can be checked by reference to Figs. 34 & 35 as applicable, and where such is confirmed, the proper course is the renewal of the item concerned.

MEASUREMENT OF FRONT WHEEL CAMBER CASTOR AND KING PIN INCLINATION

Although wheel camber, castor and king pin inclination are built into the design of the front suspension, and are not adjustable, it is frequently desirable to measure these angles after an accident, or when damage is suspected. With the type of front suspension used on the 2-litre models, the measurement of these angles is not a perfectly straightforward operation.

It is possible to establish mathematically a relation between the change in wheel camber, which occurs as each road wheel is rotated about its respective axis, and the castor and inclination of the king pins.

The **castor angle** varies directly—as the difference between the wheel camber angles when steering an equal amount left and right of the

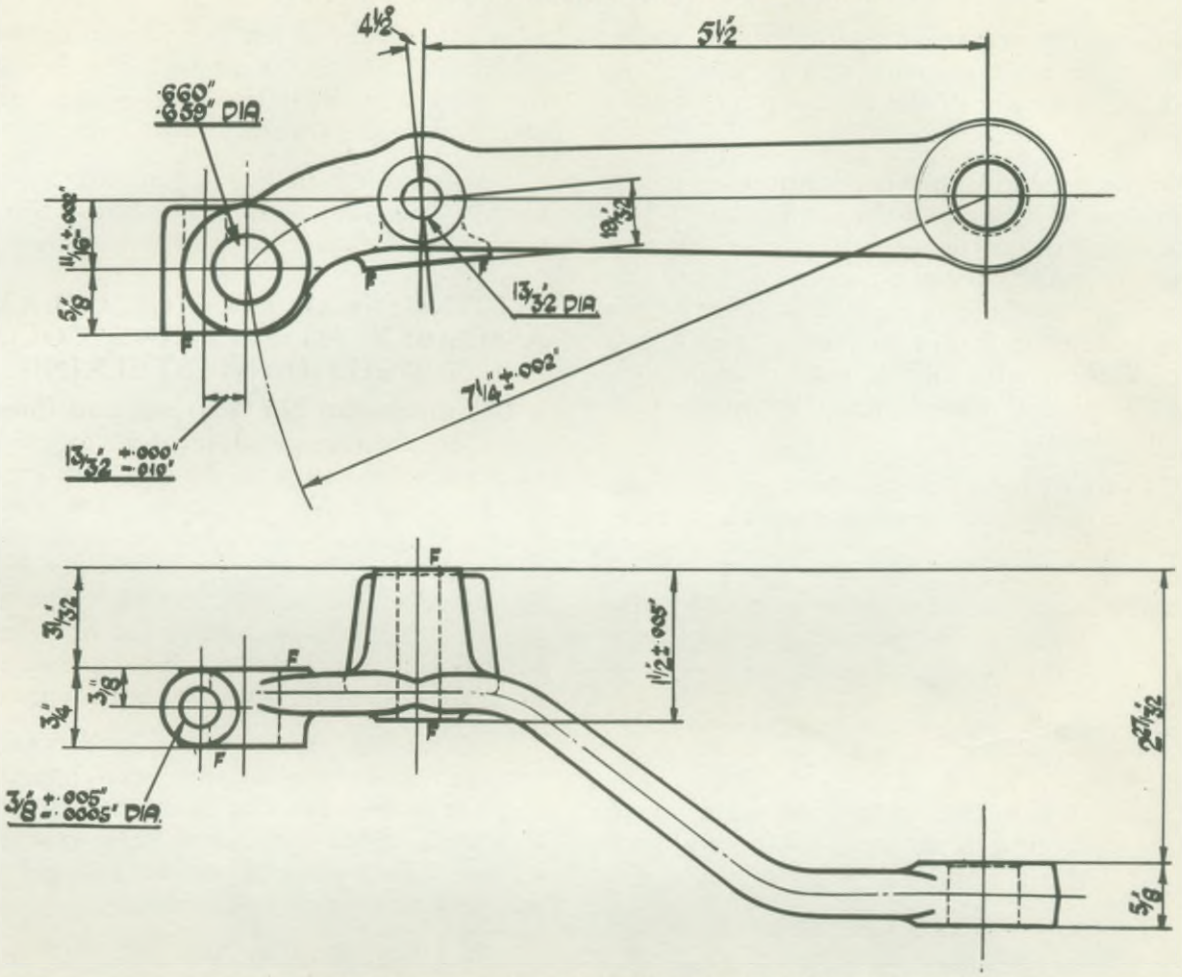


Fig. 34. Shock absorber arm right hand front, and left hand rear shown

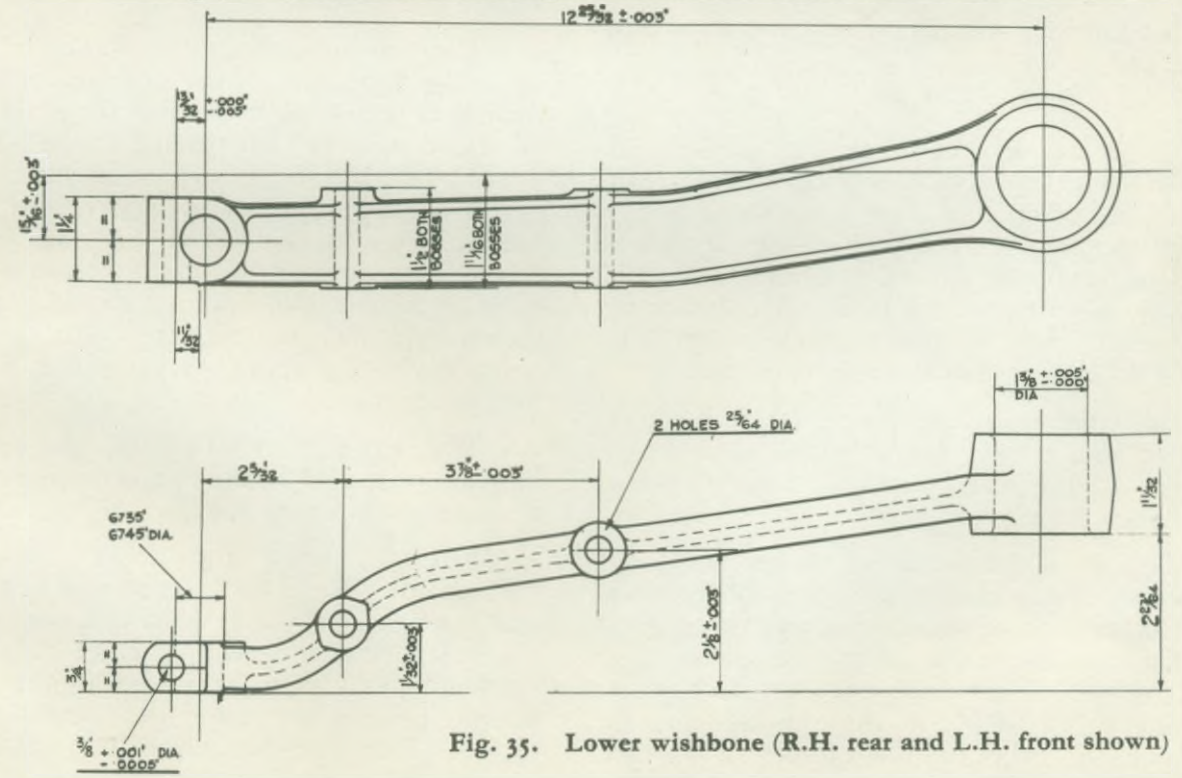


Fig. 35. Lower wishbone (R.H. rear and L.H. front shown)

straight-ahead position, and indirectly as twice the sine of the angle through which the wheel is steered left and right of the central position (see equation 1 below).

Similarly the **king pin inclination** is directly proportional to the sum of the camber angles for equal steering of one of the road wheels, left and right of the straight-ahead position, less twice the camber angle for the latter neutral position of the steering and inversely proportional to twice unity, less twice the **cosine** of the steered angle, left and right of the straight-ahead position (see equation 2 below).

The following example will clarify the method of applying these mathematical relations :—

LET A = The camber angle in degrees for the wheel when steered X degrees to the left of straight ahead.

B = The camber in degrees for the straight-ahead position.

C = The camber in degrees for a wheel steered X degrees to the right of straight ahead.

Using the symbols given above the castor angle $= (A\text{-}C)$ multiplied by $\frac{1}{2 \text{ Sin } X}$ *Equation* 1

The king pin inclination $= (A + C - 2B)$ multiplied by $\frac{1}{2 (1 - \text{Cos. } X)}$ *Equation* 2

There are on the market a number of proprietary makes of camber gauges, which can be used in conjunction with a protractor and a suitable rectangular straight edge—or alternative means of measuring steered movements of each road wheel—to enable the necessary calculations to be made from equations 1 and 2 with the further aid of a table of sines and cosines.

The Dunlop camber gauge, which today is supplied with a metal frame having cross members at $19\frac{1}{2}°$, has been specially designed to make use of these principles.

With the Dunlop camber, castor and king pin gauge, these constants have been looked after in the calibration of the quadrant. As straightforward instructions are issued with each gauge which is sold, it is unnecessary to describe its operation. Fig. 36 shows the camber gauge in operation for checking the camber of a road wheel in a steered left position, preparatory to calculating the castor angle. The estimation of the king pin inclination with this gauge is equally straightforward.

It is important that when carrying out the camber measurements, the tyres should be correctly inflated.

FITTING GEAR CHANGE OPERATING ASSEMBLY TO STEERING COLUMN—RIGHT-HAND STEERING

(Commission No. V.51,001 and Future).

The change speed mechanism, at present in use on our Vanguard Models, was introduced at Commission No. V.51,001. The mechanism used with these Models, before the introduction of the present day arrangement is described and illustrated earlier in this Section. The mechanism, at present in use, differs for right-hand and left-hand steering models and separate instructions are, therefore, given for both types of gear.

If, for any reason, it is found necessary to remove the steering column gear change assembly, the position of the two brackets should be indicated, before withdrawal, by marking with a scriber. This marking of the steering column will save time when reassembling.

If a new steering unit has, during a car's life, to be fitted, the instructions given below should be regarded.

The gear change assembly should be offered up to the upper side of the steering column and the top of the casing containing the gears should be placed in a position parallel to the lid of the steering box and the lower face of this casing be $24\frac{1}{8}$" from the centre of the rocker shaft in the steering box as shown in Fig. 38. Having correctly positioned the casing containing the gears on the steering column it should be secured thereto by fitting and tightening up the two clamp bolts, leaving the upper bracket loosely fitted for further adjustment.

The next step in fitting the gear operating mechanism should be the final adjustment of the position of the upper bracket.

Before securing the upper bracket the " First " or " Reverse " gear should be engaged and the operating lever held upwards towards the underside of the steering wheel. The upper bracket should then be so positioned on the steering column as to allow the operating rod to project $\frac{1}{4}$" beyond the bottom face of the gear

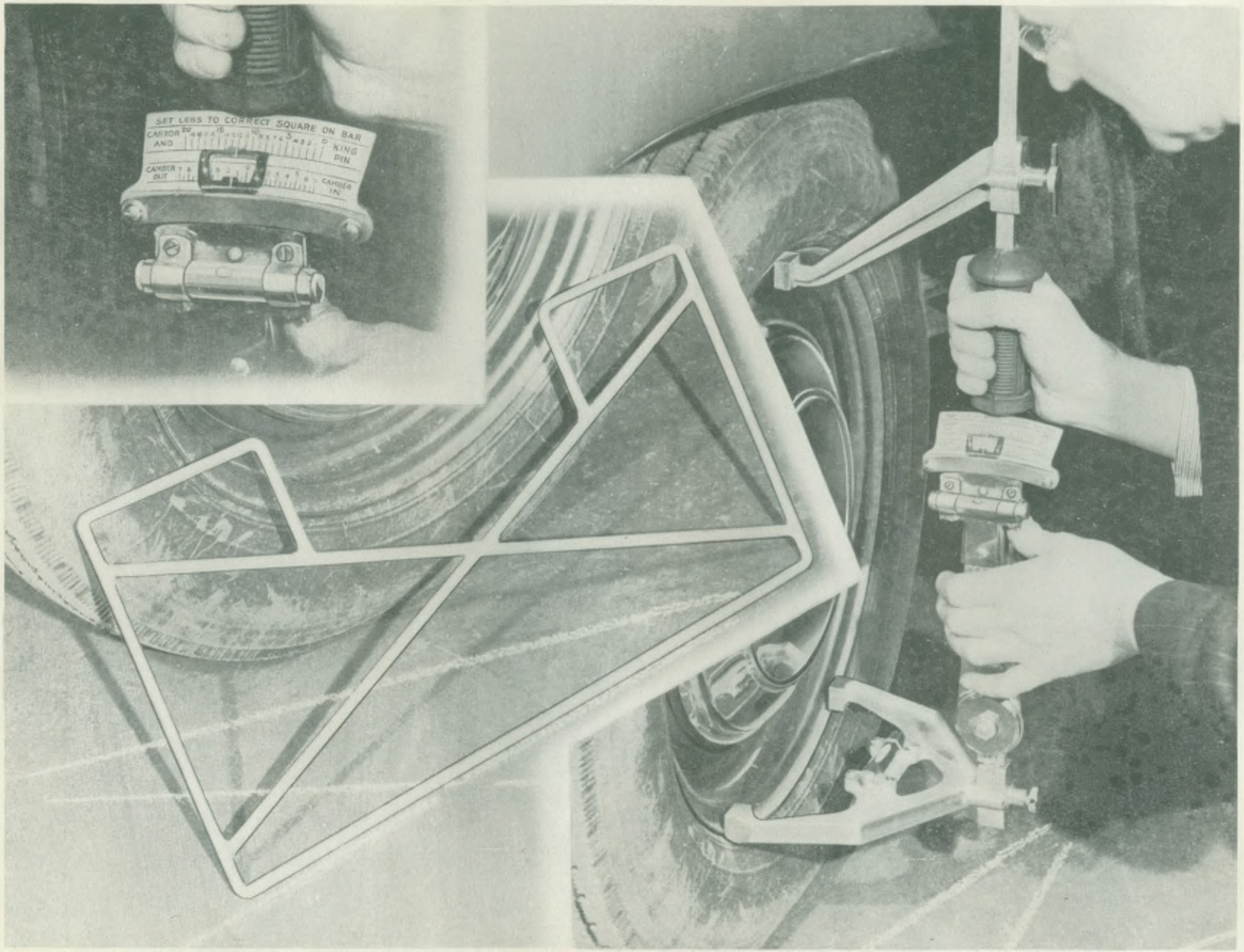


Fig. 36. Illustrating the measurement of wheel camber with Dunlop gauge, in the steered-left position, and the use of template for setting road wheels. Inset is an enlarged view showing the graduation of the quadrant

casing shown in Fig. 37 and to allow a minimum clearance on the underside of the steering wheel of $1\frac{1}{8}$"—$1\frac{3}{8}$". Before finally securing the upper bracket, this should be tapped round the steering column, as necessary, to align it perfectly with the lower bracket, and thus to permit free up and down movement of the operating rod.

The lengths of the two connecting rods are next provisionally adjusted, with the hand lever held in an approximately horizontal position so that free upward and downward movement of the hand lever in " Neutral " is possible. In this position, the gear on the vertical shaft and its integral baulk plate, and the gear attached to each lever will assume the position shown in Fig. 37 " Inset," with the cut-away in the Baulk Plate allowing free up and down movement of the control rod.

The connecting rod for the " Second " and " Top " Gears is now finally adjusted in " Neutral," so that the backlash in the gear mechanism on the steering coincides with that in the cross shaft for the " Second " and " Top " Gear. It will be appreciated that if these two backlashes overlap, there will be a possibility, under certain conditions, of drag on the interlock plunger in the gearbox, thus preventing the free engagement of the other pair of gears.

The length of the " First " and " Reverse " Connecting Rod is next adjusted in " Neutral " with levers " B " and " C," Fig. 37, held circumferentially, lightly towards each other, until the teeth of the gears on these are exactly aligned with one another. This method of adjustment eliminates unnecessary backlash in the operation of " First Gear " but if the hand pressure on levers " B " and " C " is excessive there is a danger, after adjustment, of interference between the baulk plate and gears. Checks should be carried out in " Neutral " for free up and down movement and any slight further adjustments, which may be required, made.

When adjusting the nuts on each side of the trunnion, fitted at the upper end of each of the connecting rods, it is important that the tension of nut tightening should be such as to provide the correct degree of compression of the rubber washers.

The correct tension of the nuts should compress these rubber washers, so that the outer faces are $\frac{7}{8}$" apart. Over and under compression must be avoided.

FITTING GEAR CHANGE OPERATING MECHANISM TO STEERING COLUMN—LEFT-HAND STEERING

(Commission Nos. V.51,001 and future)

With this type of gear change mechanism, no gears are employed in the operating mechanism.

The respective pairs of gears are engaged by the operation of two levers, both of which are provided with externally threaded bosses which are accommodated in similarly internally screwed portions of the bottom fixing bracket.

The operating rod is provided with rollers which engage with a suitably placed keyway on each of the two lever bosses. By the design in this mechanism, the neutral position is obtained when the rollers in the operating rod are aligned with the recess in each of the two lever bosses.

The assembly of the operating mechanism on the steering column is carried out in a manner somewhat similar to that employed with the R.H.S. Model, but the bottom bracket is fitted $24\frac{1}{2}$" above the centre line of the rocker shaft as shown in Fig. 38.

The upper and lower brackets should be fitted so as to be in perfect alignment with one another and so that the gear lever is approx-

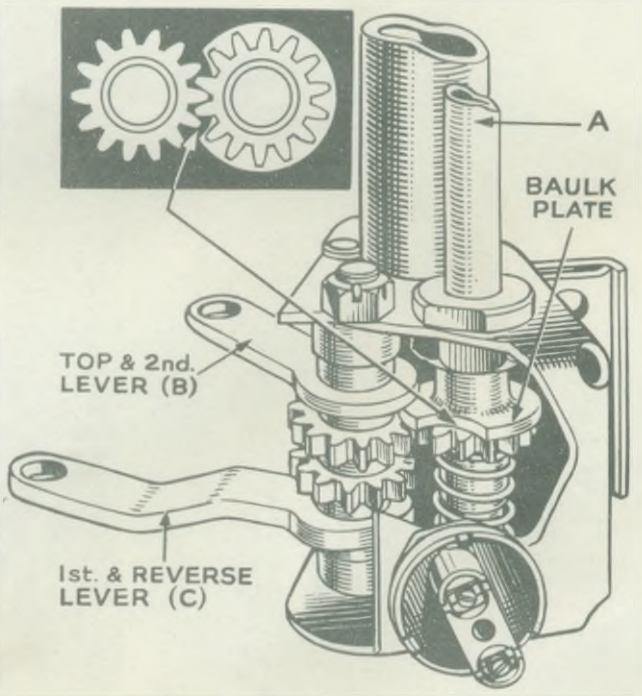


Fig. 37. Cut away view of change gear mechanism showing top gear engaged position. Inset shows neutral position of gear

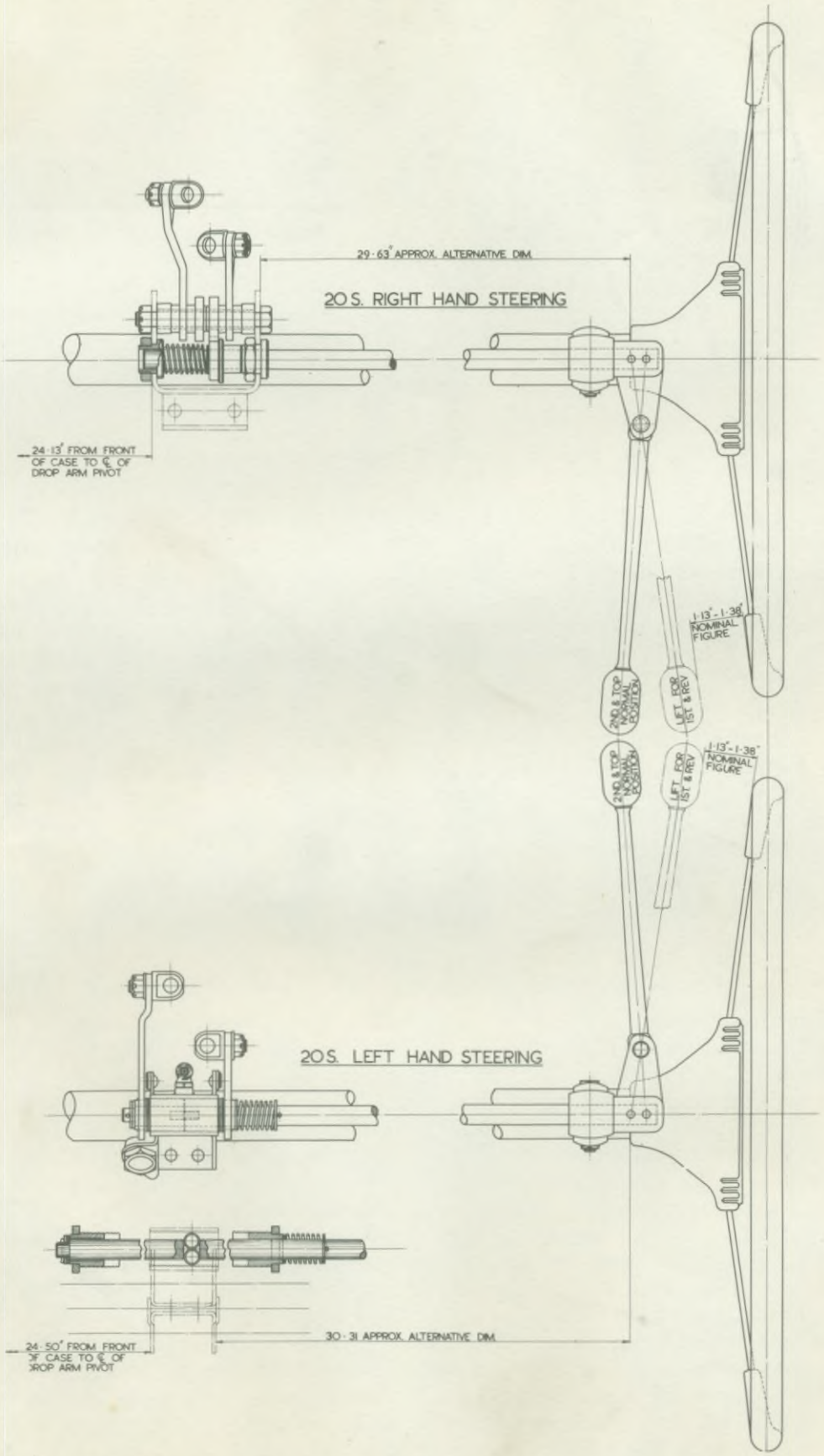


Fig. 38. Arrangement of gear shift mechanism on steering column

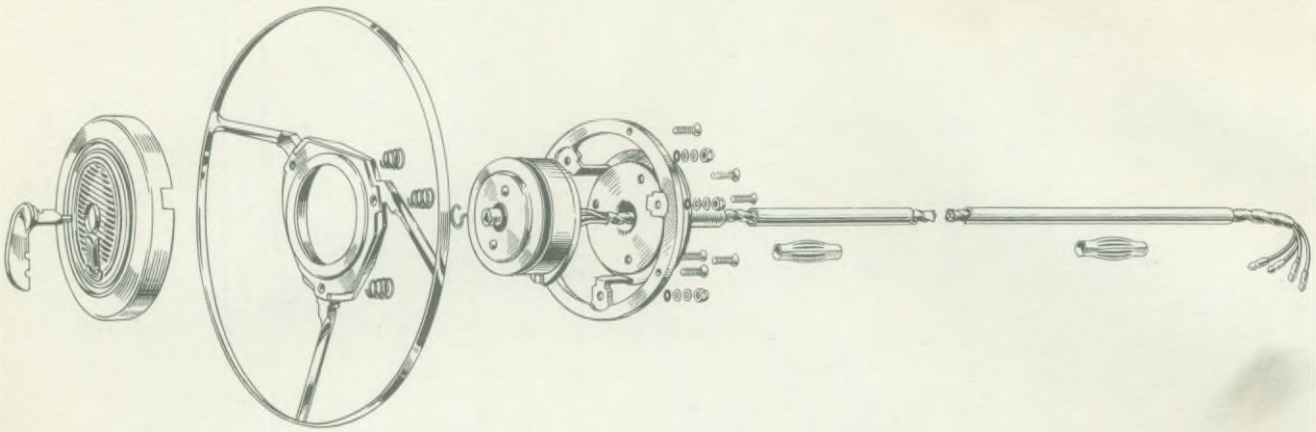


Fig. 39. Exploded view of steering control assembly

imately horizontal and to the right of the steering column in the " Neutral " position. As with the R.H.S. Model, there should be a minimum clearance of $1\frac{1}{8}$"—$1\frac{3}{8}$" between the underside of the steering wheel and the lever knob, when the " First " or " Reverse " gear is engaged.

As with the R.H.S. steering models, the connecting rods to the gearbox when this unit is in the " Neutral " position, should be adjusted for length so as to permit unrestricted upward and downward movement of the operating lever, this will ensure the alignment of the key on the operating rod with the recess in each of the two levers.

TO REMOVE AND RELEASE STEERING CONTROL ASSEMBLY.

If it is desired, for any reason, to replace the Steering Control Assembly, which is shown in exploded detail in Fig. 39, this can be quite easily arranged. The trafficator ring should be released by withdrawal of the three grub screws, as shown in Fig. 17, the electrical cables should be disconnected at the snap-in connector, after which the control assembly can be withdrawn, leaving the long tube in position in the steering unit.

ADDITIONS

FRONT SUSPENSION AND STEERING

Removal of Steering Unit.
(Cam Gear and Burman Steering Units).
Page 15, Paragraph 4.

Where the steering column is fitted with a " two-piece " stator tube and steering hub assembly, it is not necessary to remove the nut and olive at the base of the stator tube and the whole tube itself for this operation, nor is it necessary to drain the oil. Instead, merely remove the three grub screws from the steering wheel boss and after " breaking " the electrical snap connectors at the base of the column, withdraw the central control assembly (which has a short tube spigotted on to the upper end of the main stator tube) at the same time feeding the connection end of the trafficator and horn circuit harness up the stator tube as it is pulled through from inside the Car.

THE BURMAN L.3. STEERING UNIT.

(Det. No. 301160 for Vanguard R.H. and L.H. steering and Det. No. 301161 for Triumph Renown).

The Unit described on pages 25 and 26 of this Section was used on the " Vanguard " Models up to V.138851 and on the Triumph " Renown " up to TDB.5398. As from Commission Number V.138852 and TDB.5399 for " Vanguards " (Series I and Triumph Renowns respectively) a new method of adjusting the rocker shaft " lift " was incorporated in Burman Steering Units.

This has been achieved by making the adjusting screw (shown as item 8 on the exploded view Fig. 31 on Page 24) integral with the cover plate which, at a later date was increased in thickness from .250" to .3125" to improve its rigidity. The new assembly, namely the cover

FRONT SUSPENSION AND STEERING—ADDITIONS.

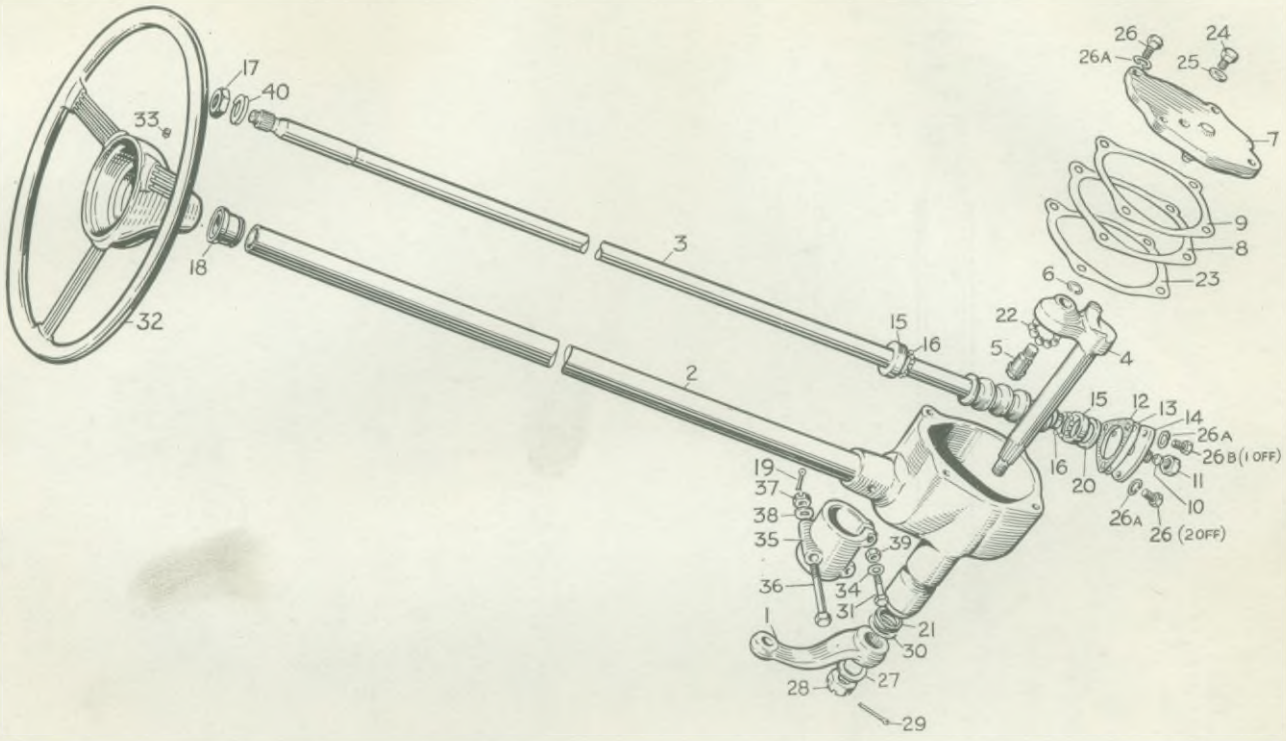


Fig. 40. Exploded view of Burman L.3 steering gear details as fitted to the " Vanguard ".

NOTATION FOR FIG. 40.

Fig.	*Item*
1	Drop Arm.
2	Steering Tube and Box Assembly.
3	Inner Column and Cam Assembly.
4	Rocker Shaft.
5	Ball Peg.
6	Circlip.
7	Cover Plate ($\frac{5}{16}$" thick).
8	Paper Washer. (.010").
	Transparent Plastic Washer (.002").
9	Mauve Plastic Washer (.005").
	Red or Yellow Plastic Washer (.010").
10	Olive.
11	Nut
12	Paper Washer.
13	Washer—Steel.
14	End Plate Assembly.
15	Cup for Balls.
16	Balls $\frac{7}{32}$" Dia.
17	Nut—Steering Wheel.
18	Top Bearing Assembly.
19	Pin Cotter.
20	Washer—Packing.
21	Rubber " O " Ring for Rocker Shaft.
22	Ball $\frac{3}{8}$" Dia.
23	Steel Shim (.004/5").
24	Plug—Oil Filler.
25	Washer—Filler Plug.
26	Bolt $\frac{5}{16}$" B.S.F. × $\frac{7}{8}$".
26A	Washer Lock.
26B	Bolt $\frac{5}{16}$" B.S.F. × $\frac{5}{8}$".
27	Washer.
28	Slotted Nut $\frac{3}{4}$" B.S.F.
29	Split Pin.
30	Dished Washer Retaining Ring.
31	Bolt Clamp.
32	Steering Wheel.
33	Grub Screw No. 10F.
34	Washer Lock.
35	Trunnion Bracket.
36	Bolt for Trunnion Bracket.
37	Nut Slotted $\frac{1}{2}$" × 20 N.F.
38	Washer—Plain.
39	Nut $\frac{5}{16}$" × 24 N.F.
40	Spring Washer.

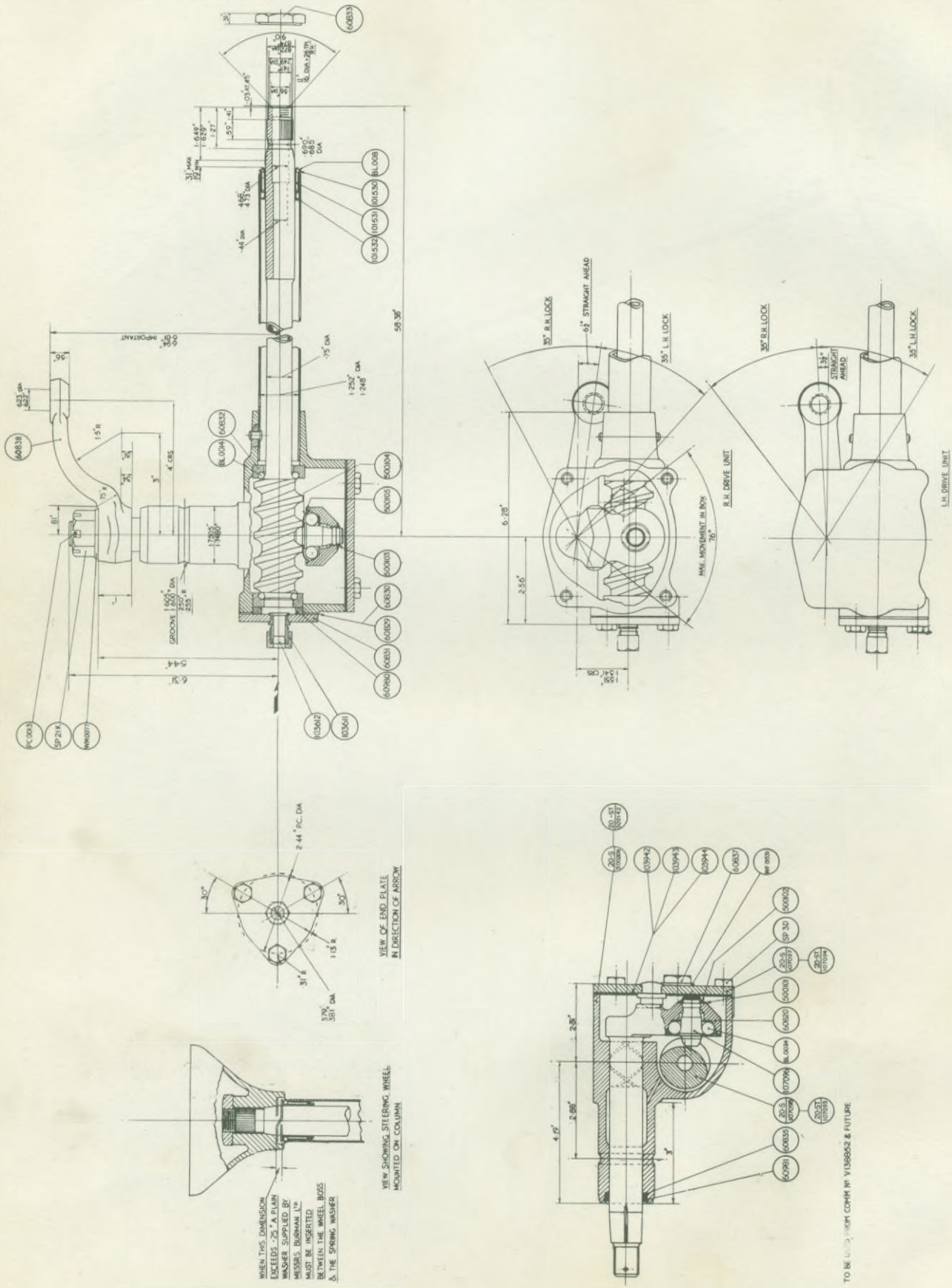


Fig. 41. Arrangement of Burman L.3 steering unit.

plate with the solid type adjuster button welded in position, is shown as item 7 on the exploded view Fig. 40 on page 36 of this amendment.

Incorporated also in these latest type steering units, mentioned above, are two other modifications. The top felt bush was replaced by a spring loaded ball race which was introduced at commission number V.100,144 (and TDB.2700 Renown) and considerably earlier in production the top of the inner column was increased in internal bore diameter to accommodate a two-piece stator tube and steering control unit instead of the original one-piece assembly. This was introduced at commission Number V.34729.

TO MODIFY OLD TYPE L.3 BURMAN STEERING UNIT.

Cover Plate.

The first modification mentioned above, merely necessitates the replacement of the old $\frac{1}{4}$" cover plate (Det. No. 60823) by the new $\frac{5}{16}$" thick plate (Det. No. 107097) with the solid type adjuster button and the employment of various thicknesses of steel or plastic shims ranging from .002" to 010" with paper washers (all of which are detailed in the notation for Fig. 40 on page 35 to effect the adjustment).

There are, however, two stages to this adjustment, firstly the correct setting and preloading of the races carrying the inner column and secondly the shimming and " high-spot " location of the cover plate. Full details of the procedure to be followed for these adjustments are given under " STEERING BOX ADJUSTMENTS " below.

Top Column Ball Race.

The replacement of the top felt by the spring loaded ball race assembly (shown in Fig. 42) is an operation which merely necessitates the removal of the steering wheel and steering control unit and can then be carried out with the steering column still in position in the car.

First, the top of the outer tube must be slightly shortened to the dimension shown in Fig. 42. The tube should be carefully circumscribed to this dimension, then with the original felt bush **left in position** the surplus tubing should be carefully removed with a fine bladed hacksaw and the tube end trued up to the scribed line with a fine file. The original felt bush, which will prevent any swarf or filings getting down the column, should now be removed and scrapped and the ball bearing assembly (Det. No. 101529) inserted followed by the

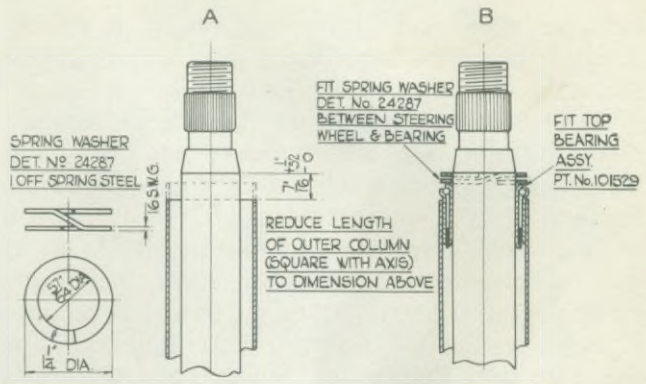


Fig. 42. Modification of upper steering column to replace felt bush by ball race.

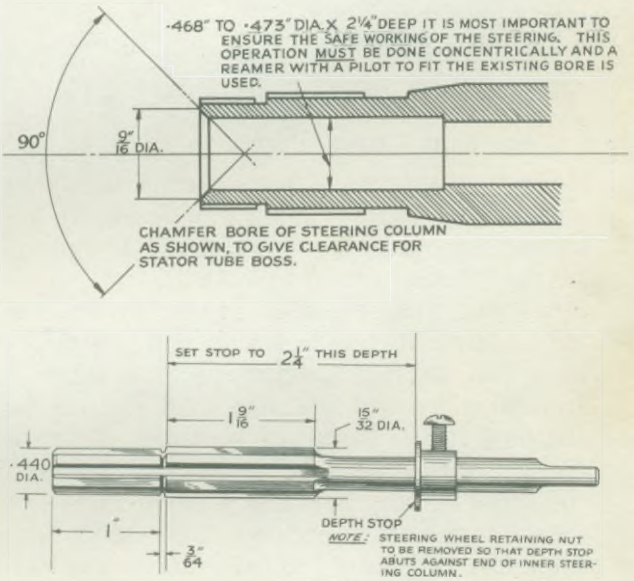


Fig. 43. Modification to inner column to take composite control unit.

double spring washer (Det. No. 24287) as shown in Fig. 42.

Two-Piece Steering Control and Stator Tube Assembly.

The original one-piece steering control assembly (Det. No. 58059) where the stator tube was an integral part of the control head, is no longer available. Should a replacement be required, the later two-piece assembly (Det. No. 300427) with the stator tube detachable from the control head, will have to be used. This, however, will necessitate reaming out the top of the inner steering column to $\frac{5}{32}$" by $2\frac{1}{4}$" deep and chamfering the end at 90° to $\frac{9}{16}$" dia. (If it has

not already been done in production) to accommodate the extra diameter of the short coupling sleeve on the new type control head.

All steering units returned to the Factory for reconditioning are automatically modified, but if it is necessary to modify a column outside the Factory, it is most important that it is reamed with a suitable reamer and NOT drilled out as the concentricity of the bore must be rigidly maintained if the strength of the modified column is to be within the safety limits required. For this purpose, details for self-manufacture of a suitable reamer are given in Fig. 43 together with a drawing of the modified column. A suitable reamer has been manufactured for this purpose by Messrs. V. L. Churchill & Co. and can be obtained direct from them.

STEERING BOX ADJUSTMENT.

Shimming End Cover Plate.

1. Position the inner column fitting the upper and lower bearings with the assembly inverted. Locate the loose balls in grease whilst entering the inner column.
2. Hold the outer member of the lower race hard against its ball bearings with a straight edge and insert a feeler gauge between this straight edge and the machined end of the steering box casting to measure the protrusion of the race. The clearance between the straight edge and the flanged face, less .001″—.002″ for preload, represents the thickness of shims required under the end cover. The preload should just nip the ball bearings above and below the worm so that these cannot be moved with a small lever. The part numbers of the shims for this cover plate are 60829 (Paper) and 60830 (Steel). Shim Packs should be measured with a micrometer gauge, as the nominal dimensions can be misleading.

Cover Plate or Adjuster Screw Setting.

1. This adjustment is most conveniently carried out with the unit removed from the vehicle.
2. Adjustment must be made with the steering box filled with oil.
3. Adjust thickness of shims (or set adjuster screw when fitted) until the " high " or " tight " spot gives a resistance which corresponds to $\frac{1}{2}$—$1\frac{1}{2}$ lbs. at wheel rim. An approximation can be obtained by adjusting until the inner column can just be turned over the " high " spot by hand, gripping the splines at the upper end of the inner column.
4. The " high " spot should now be located. Location of the " high " spot is best obtained by approaching it, in turn, from each lock and marking the top of the inner column with a pencil to correspond with a 12 o'clock mark on the outer column, when resistance to turning begins to increase. The " high " spot will be located by splitting the arc between the two marks on the inner column with the mark on the outer column. The point on the inner column, opposite the mark on the outer column, is obviously the " high " spot position.
5. With the " high " spot opposite the 12 o'clock marking on the outer column, fit the steering wheel on its splines, so that the aligned spokes are horizontal. The number of turns measured to each of the locks from " high " spot, or straight ahead position, should be equal to within $\frac{1}{8}$ of a turn. If the necessary degree of equality is not obtained, the thrust button is not central with the rocker shaft.

   To centralize the thrust button with the rocker shaft, slacken the cover plate bolts until these just provide a nip and then tap the cover plate fore and aft, along the axis of the steering column. The bolts should then be retightened, the " high " spot relocated, as explained above, the steering wheel refitted and the turns from " high " spot to each lock again checked. This adjustment will have to be made progressively, in the absence of a setting gauge, as used by the manufacturers. Where a left hand lock is short, the cover plate should be tapped towards the steering wheel on a " Vanguard " Assembly and away from it for a " Renown ". With experience, the mechanic will find little difficulty in making this adjustment.

   This procedure for carrying out steering box adjustments has been compiled in the light of experience gained from observations during the course of several years of operational conditions. The information, therefore, supersedes that detailed on pages 25 and 26 of this Section, under the heading " The Burman L.3 Steering Gear " and should be applied when servicing the previous types of Burman L.3 units with the screwed adjuster, which were fitted to the earlier Vanguard Models.

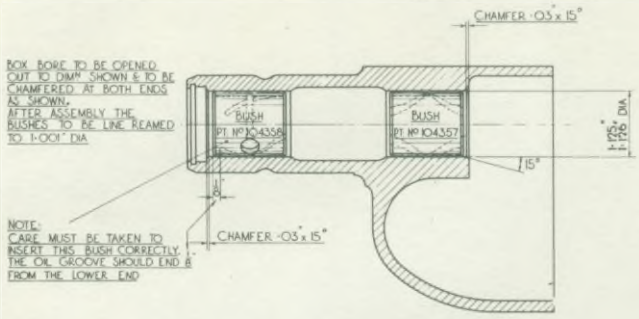


Fig. 44. Reconditioning rocker shaft bore in steering box.

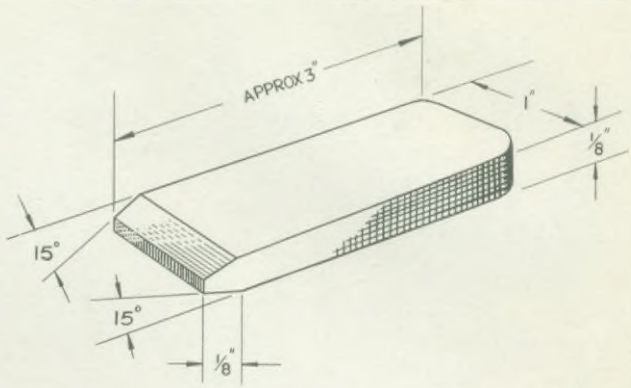


Fig. 45. Gear locking wedge for adjusting gear shift control.

RECONDITIONING BURMAN L.3 STEERING UNITS.

Where there is difficulty in obtaining complete replacement Burman Steering Units, self reconditioning is possible where both the facilities and required spares are available.

The two ball races at either end of the steering worm should be replaced completely if either the cups or the balls show any signs of pitting; also the top column ball race assembly should be thoroughly inspected.

The rocker shaft bore, which is machined directly in the steering box casting, will have to be line bored to 1.125" dia., bushed and then line reamed to 1.001" dia. Fig. 44 shows full machining details and bush part numbers.

This reconditioning scheme applies to Burman Steering Units only and NOT to the Cam Gear products.

MODIFICATION AND SETTING OF SLIDING GEAR TYPE GEAR SHIFT MECHANISM. (Right Hand Steering).

The condition of rubber washers fitted either side of the trunnions at the top of the two operating rods is critical if the setting of the gear shift mechanism is to be maintained for ease of operation. Maladjustment of these rods will not only make " gear changing " difficult for the driver, but will introduce an unnecessary rate of wear in the mechanism. The deterioration of the rubber is usually caused, in this Country, by the application of oil which rapidly perishes the rubber washers and destroys the adjustments. Severe climatic conditions overseas can also achieve the same detrimental results.

Where deterioration is experienced with these rubber washers, the whole trunnion assembly may be replaced by clevis joints similar to those already fitted to the lower ends of the rods, but this will entail fitting two new operating rods although these can be manufactured from the existing rods by shortening and suitable bending.

Full details for carrying out this modification are available from our Service Department.

When adjusting the lengths of the rods, start with gear shift control lever at the lower (" second and top ") end of the neutral gate and move it slightly up towards the steering wheel so that the action of the baulk plate can be felt limiting any arcuate travel. Halve this movement (as shown in inset in Fig. 37) and hold the shift lever in exactly this position ensuring that the " second and top " operating gear is correctly meshed with the gear on shaft A (the lever should lie approximately 20° above the horizontal). Adjust the length of the second and top rod until the clevis pin can just be inserted.

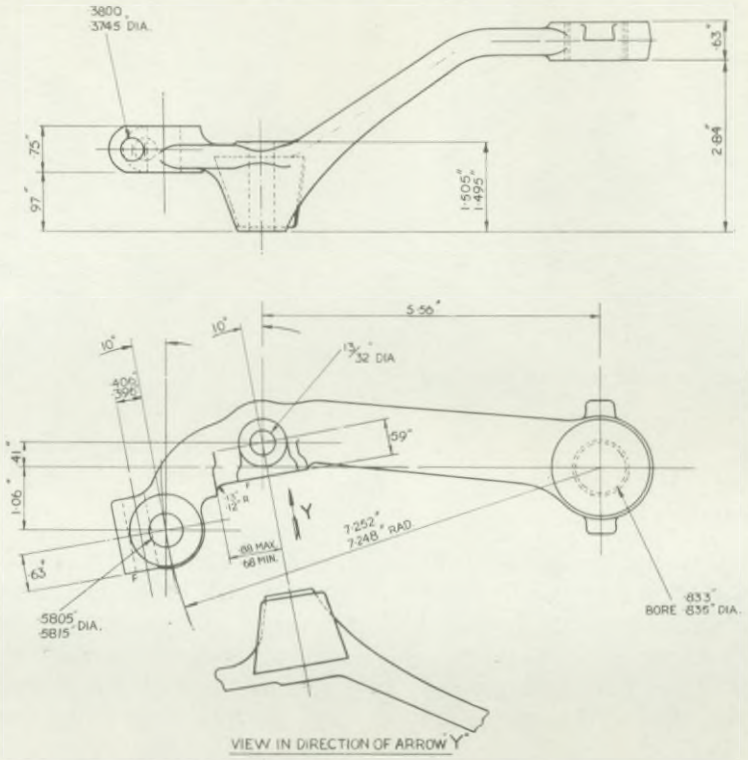
Position the " first and reverse " operating lever (approximately 20° below the horizontal) and align the teeth of this gear with those on the gear attached to the " second and top " lever and adjust length of rod to suit.

To ensure that the gear teeth are exactly aligned, a locking wedge such as that illustrated in Fig. 45 which can easily be self-manufactured, should be inserted into the teeth of the two gears and held there whilst adjusting the length of the last (first, reverse) rod, with the whole mechanism in the neutral position.

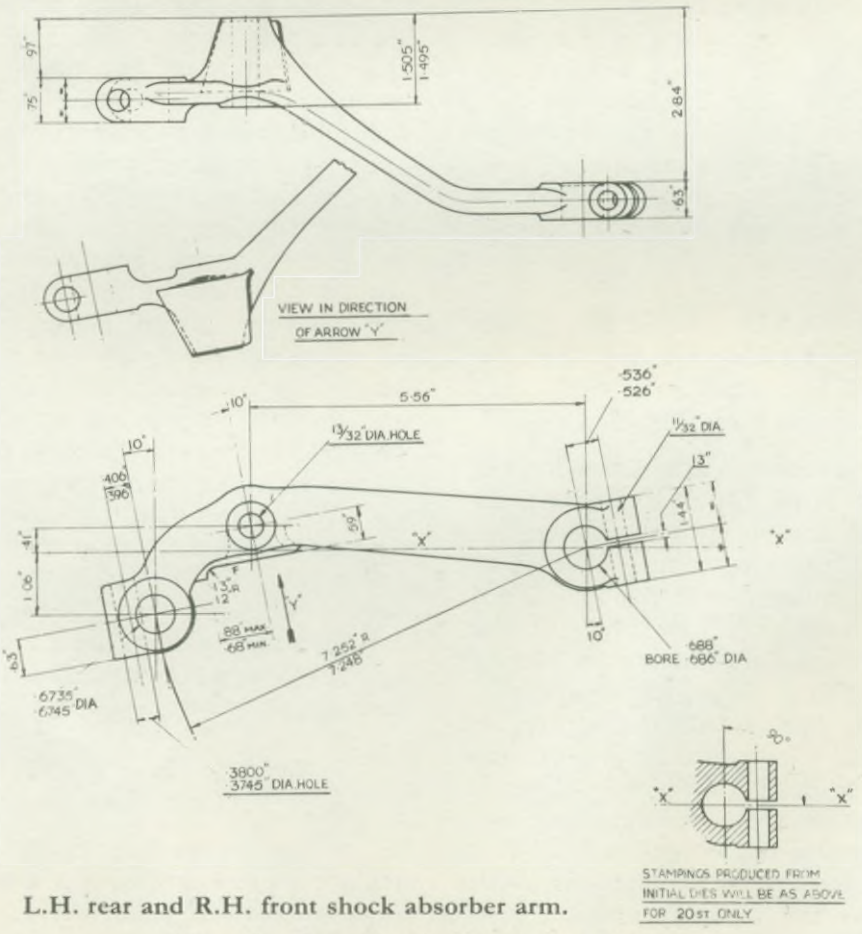
GEAR SHIFT MECHANISM. (Left Hand Steering).

Clevis joints may again be employed to replace the rubber washer and trunnion assemblies fitted to the left hand steering Series I Models.

The gear shift mechanism fitted to the later



L.H. front and R.H. rear shock absorber arm.



L.H. rear and R.H. front shock absorber arm.

Fig. 46. Front shock absorber arm details.

Series I Models have a neutral locating peg attached to the "first and reverse operating lever". The position of the neutral gate is therefore already pre-determined and this rod merely has to be adjusted in length to fit. If the operating lever is now moved halfway down the neutral gate it will determine the neutral position for the second and top lever and this rod can then also be adjusted in length to suit.

Both selectors in the gearbox should be in their neutral position throughout the whole operation.

VANGUARD—SERIES II

FRONT SUSPENSION AND STEERING

SUPPLEMENT

The construction and functioning of the front suspension and of the two alternative types of steering units employed is basically the same as for the Series I Vanguard models except for a few minor modifications.

The Series I information details in the main section and the amendment is, therefore, still applicable, and any deviations from this for the Series II are detailed below.

AMENDED NOTATION FOR FIG. 2. (PAGE 4) FOR SERIES II.

No.	*Detail*	*Item*
36	105408	Centre Tie Rod End Assembly (L.H.)
37	105407	Centre Tie Rod End Assembly (R.H.)
38	NL2211	Nut Slotted $\frac{7}{16}$" × 20 NF.
39	WP0011	Washer Plain
	PC0020	Split Pin.
40	105379	Auxiliary Drop Arm Assembly.
50	30214	Damper (Girling).
50A	201302	Damper (Armstrong).

STEERING UNITS.

Three different types of steering units are employed on the Series II models, two for the home market and built up cars for export, a Cam Gear model (type PL.1588) and a Burman model type L.3) and one for the C.K.D. models which is a Cam Gear Unit (type PL.1728 U).

CAM GEAR (TYPE PL.1588).

This is the same unit that has been used on the Series I models and a description, tests and adjustment instructions will be found starting on Page 12 of the main section.

BURMAN (TYPE L.3.)

This unit is the same as that used on the later Series I models which incorporated the fixed thrust button adjusted by shims. For description and adjustment instruction see this Section in the Series I Manual.

CAM GEAR (TYPE PL.1728 U).

This unit will not normally be found on cars destined for the home market as it has only been fitted to certain export models. It is similar in construction and operation to the type PL.1588 which is used on home models. However it is not interchangeable with this unit as the main " box " casting is somewhat larger in all proportions and consequently will not fit into a chassis that has not been specially built to give adequate clearance; only certain C.K.D. chassis destined for export have been so constructed. In an emergency, however, it would be possible to fit a home type steering unit (i.e. either a Burman type L.3 or a Cam Gear type PL.1588) as a replacement for the Cam Gear type PL.1728 U as there would be more than sufficient clearance for such a replacement operation.

The Cam Gear unit type PL.1728 U can be recognised easily by three salient points. Firstly, the casting around the worm gear at the end of the column on the opposite side to the rocker shaft is " square " in section, whereas the PL.1588 type was " round " in section. Secondly, the filler plug is screwed into a boss cast at an angle to the remainder of the cover so that the top of the plug is horizontal when the column is lying in its " fitted " attitude, and the filler plug on the earlier ones was screwed straight into the tapped hole in the box cover. Thirdly, this unit has a steering ratio of 15 : 1 as against the original unit which had a 14 : 1 ratio.

GEAR SHIFT MECHANISM (Right Hand Steering).

The gear shift mechanism fitted to the current Series II R.H.S. Models is somewhat similar in construction to that used on Series I and present left hand steering Models, the required reversal of action being achieved by two

STEERING ANGLES	
BACK LOCK	FRONT LOCK
2°	2°
4°	4°
6°	6°
8°	8°
10°	10°
12°	11-48
14°	13-30
16°	15-15
18°	17°
20°	18-45
22°	20-30
24°	22°
26°	24°
28°	26°
30°	27-45
32°	28-30

WHEEL CAMBER ANGLE =2°POSITIVE
CASTER ANGLE =1°POSITIVE
KING PIN INCLINATION =7½°
TRACK AT GROUND LEVEL =4'-2½"

SCRAP VIEW SHOWING LIP ON BOSSES

ARMS SPECIFIED FITTED FROM COMM Nº V90234

200498

200499

5·75"x16" TYRE SECTION SHOWN
5·50"x16" AND 6·00"x16" ALSO FITTED.

GIRLING ASSY.

200433

BRACKET ASSY

59179 19766 / 50SF 101395

NOTE: FITTED LENGTH OF SPRING 59179 - 8¼" ± 3/32"
FITTED LENGTH OF SPRING 101395 - 8" ± 3/32"

114"

RUBBER BEARING ASSEMBLY

IN ORDER THAT THE RUBBER BEARINGS CAN BE ASSEMBLED CORRECTLY WITH THE RUBBER FLANGES OF EQUAL WIDTH WHEN NUTS ARE TIGHTENED RIGHT UP. IT IS MOST IMPORTANT THAT THE FOLLOWING PROCEDURE BE ADOPTED. PLACE BOTH BEARINGS INTO WISHBONE WITH THE OUTER BEARING FLANGE IN CONTACT WITH THE OUTER FACE OF WISHBONE. ASSEMBLE ON TO FULCRUM MAINTAINING BEARINGS IN THE POSITION SPECIFIED ABOVE WHILST TIGHTENING UP SLOTTED NUTS.

200409 ARMS SPECIFIED FITTED FROM COMM Nº V 90486

200808

STEERING UNIT REMOVAL (20S)

NOTE: WHEN REMOVING STEERING FROM EITHER RIGHT OR LEFT HAND CARS IT IS ESSENTIAL THAT THE FOLLOWING PROCEDURE BE ADOPTED.

1. DISCONNECT WIRING & REMOVE CONTROLS.
2. REMOVE STEERING WHEEL.
3. LOOSEN COLUMN TOP BRACKET.
4. REMOVE GEAR LEVER CLAMP BRACKET AT TOP OF COLUMN.
5. REMOVE CAPS OF BOTH GEAR CHANGE BRACKETS UNDER BONNET
6. REMOVE LARGE & SMALL BOLTS FROM IDLER LEVER BRACKET
7. REMOVE CENTRE ROD-BALL FULCRUM FROM LEVER ON STEERING UNIT TAKING IDLER LEVER BRKT., & CTR., ROD OFF CHASSIS.
8. REMOVE BOLT FROM STEERING UNIT TRUNNION BRACKET & REMOVE UNIT FROM BELOW CHASSIS.

NOTE:- LUVAX OR ARMSTRONG SHOCK ABORBERS ARE FITTED IN PAIRS: BOTH TYPES ARE SHOWN FOR ILLUSTRATION PURPOSES ONLY.

ARMSTRONG ASSY.

500436

5" BUMP

5" REBOUND

SCRAP VIEW SHOWING ASSY. OF TIE ROD END WITH STEERING LEVER

Fig. 1. Front Suspension and Steering Arrangement Drawing.

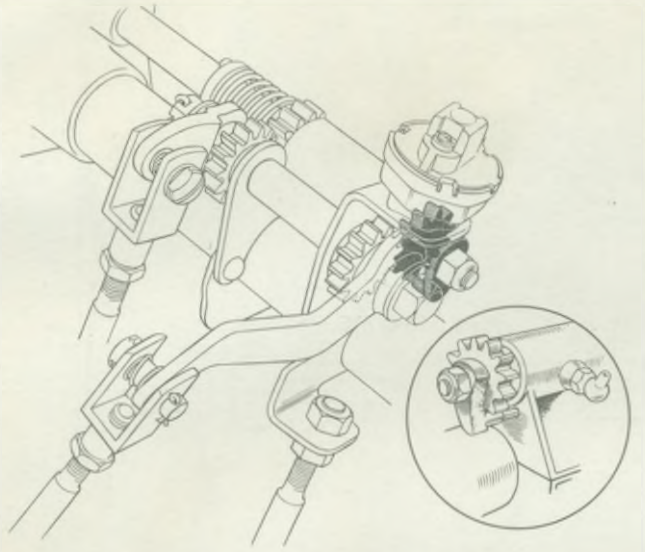


Fig. 2. Line Drawing of R.H.S. gear shift control unit.

simple gear trains in constant engagement, in place of the sliding gear and baulk plate used before.

As can be seen from Fig. 2 there is a sliding pin attached to a plate at the lower end of the control shaft which passes through the " first and reverse " operating gear and mounting bracket, positively locating this lever in the neutral position. When the control lever is released the control shaft remains in engagement with the " second and top " operating lever under the action of the axial loading spring fitted over the control shaft itself. The setting of the mechanism and adjustment of the rod lengths is a relatively simple operation.

As can be seen in Fig. 3 the change speed unit is set so that the lower face of the pressed steel outer casing is $24\frac{1}{2}$" from a transverse line drawn across the lid of the steering box passing through the rocker shaft abutment centre, in the case of a Burman Steering unit (or screw in the case of a Cam Gear unit).

With the control box provisionally located the top clamp can be positioned. Two requirements must be satisfied before tightening the clamp.

Firstly, the clamp must be positioned longitudinally on the steering column outer tube so that the control shaft travel is not limited in either direction by the clamp, and also that when the control lever is pulled up the neutral gate towards the steering wheel there is $1\frac{3}{8}$" clearance between the control lever knob and the underside of the steering wheel rim.

To achieve this it may be necessary to reposition the control box slightly further **up** the column towards the steering wheel, but the box should never be repositioned further **down** the column than the specified $24\frac{1}{2}$".

Secondly, having found this position, scribe two marks on the column either side of the clamp to assist in maintaining this part of the setting, then partially rotate the clamp around the column to align it perfectly with the control box so that the bushes do not have a binding effect on the control shaft and the latter is quite free to move up and down.

The stay rod should next be fitted between the chassis and the control box and adjusted in length as necessary.

With both gearbox selectors in the neutral position and the gear shift control lever released the " first and reverse " operating lever will automatically be locked in its neutral position by the sliding pin. The " first and reverse " rod can now be screwed into the lower clevis joint on the cross-shaft and adjusted in length until the clevis pin can just be inserted coupling the top clevis joint to the eye of the operating lever with the split pin hole end of the clevis pin facing towards the steering box.

The second and top operating lever should now be moved into its neutral position and held there. This position can be ascertained by the unhampered movement of the gear shift control lever up and down its neutral gate. The " second and top " rod can then be similarly attached to its appropriate cross shaft and adjusted in length to suit. Here, however, the clevis pin is inserted facing towards the steering wheel. After checking the operation the two lock nuts on each rod should be finally tightened and split pins inserted secure the clevis pins.

GEAR SHIFT MECHANISM (Left Hand Steering). See Fig. 3.

The gear shift mechanism fitted to current Series II L.H.S. models is similar in appearance to that used before, but now also incorporates a sliding pin attached to a plate at the lower end of the control shaft which passes through the " first and reverse " operating gear positively locating this lever in its neutral position.

The sequence to be followed for setting the control box and adjusting the operating rods is the same as for the right hand steering gear shift mechanism. The only difference being that both clevis pins, coupling the upper ends of the rods to the control box levers should be inserted with their split pin hole ends towards the steering box.

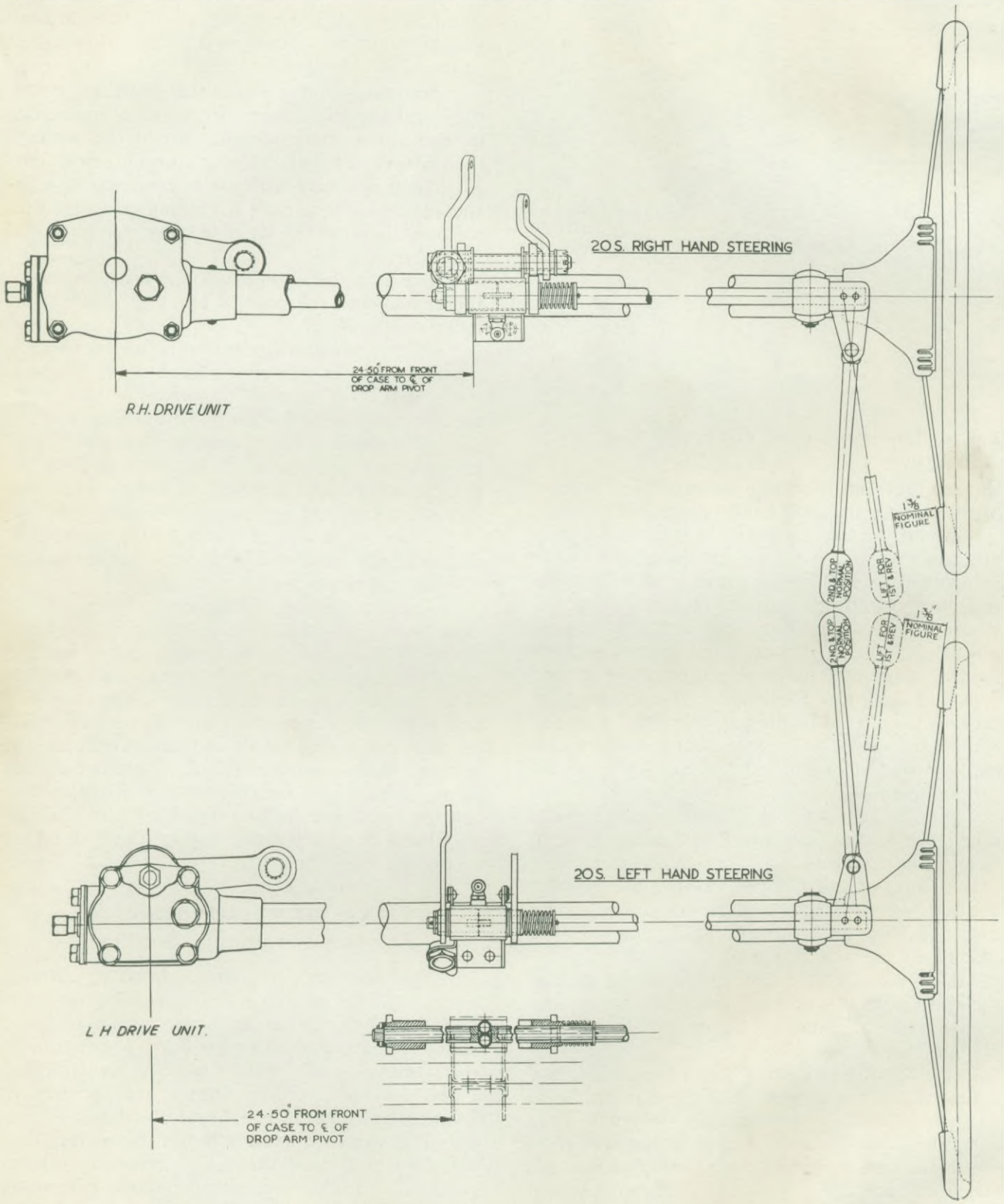


Fig. 3. Arrangement of L.H. and R.H. gear shift mechanism on steering columns. Burman Type L 3 and Cam gear Type PL 1588 shown.

Camber Adjustment (Fig. 4)

As a result of requests from Distributors and Dealers, principally from overseas, it has been decided to introduce a direct means of adjusting the front wheel camber. This was, previously, only possible indirectly by including packings of different thicknesses between the rear axle and the road springs.

The bottom inner fulcrum brackets which were previously bolted direct to the underside of each chassis side member are now mounted in brackets, each of which is bolted to the chassis on the underside of the frame as shown in Fig. 4.

The normal disposition of adjustment shims employed during manufacture is four shims to the outside and six towards the centre of the

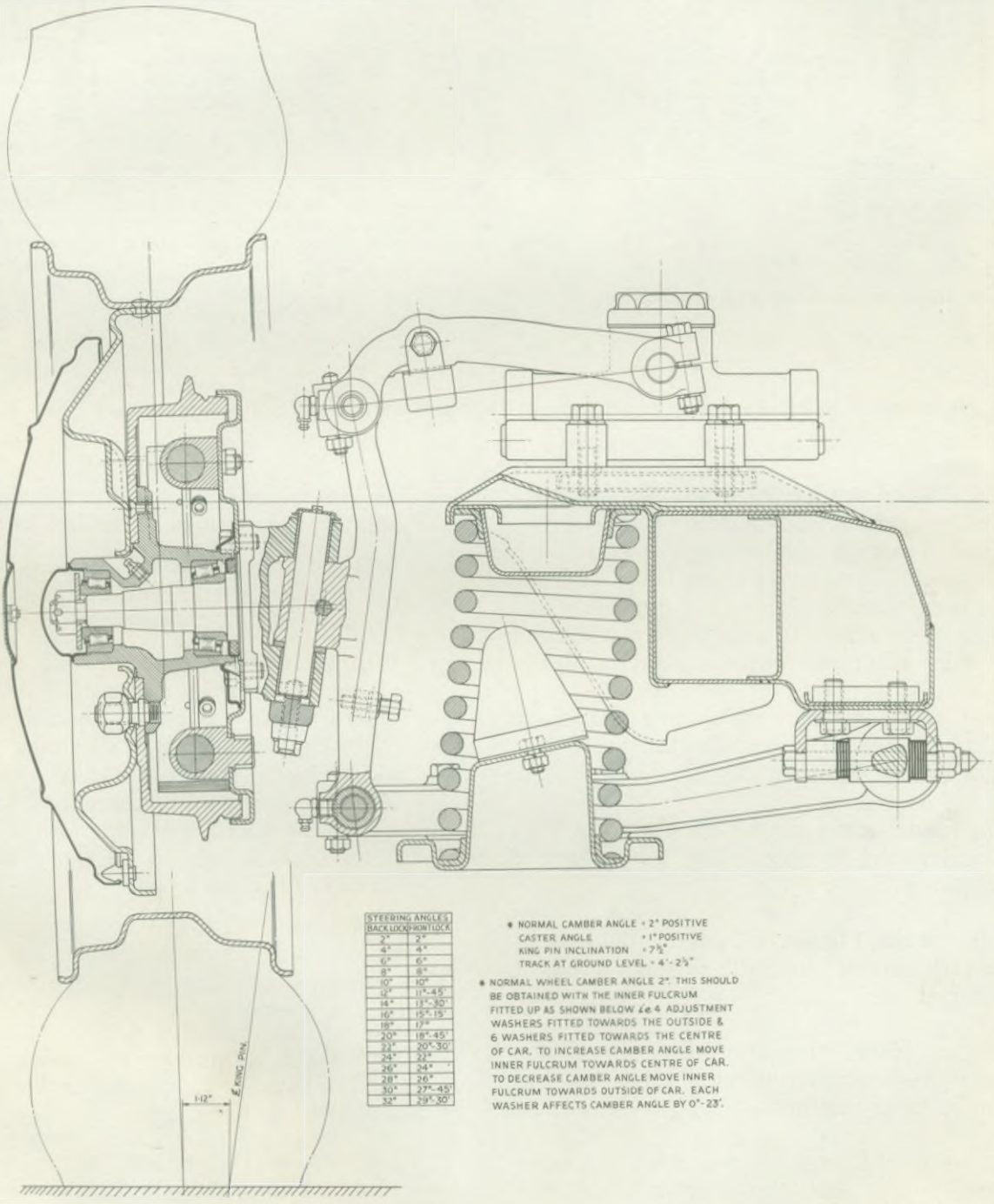


Fig. 4. A scrap view of the Front Suspension arrangement drawing showing camber adjustment.

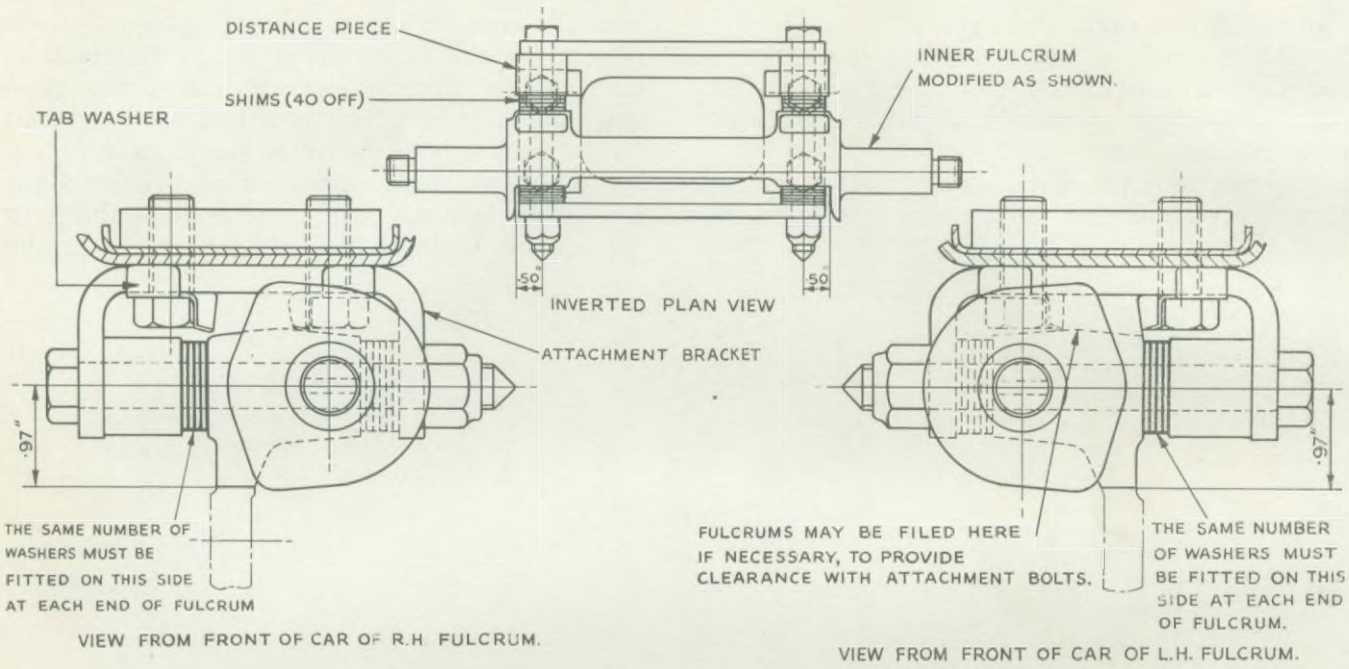


Fig. 5. Modification to inner fulcrum attachment to facilitate wheel camber adjustment.

chassis. This allocation of shims usually provides the specified wheel camber of 2° positive. If it is found that the camber angle is insufficient it will be necessary to move shims from the inner side of the fulcrum bracket to the outer side and vice versa to decrease the angle. Redistribution of each shim affects the camber angle by 0° 23′.

This adjustment was incorporated on Vanguard Series II after Commission No. V.224942 and on Renown Models TDC.2250.

This modification can be incorporated (Fig. 5) on earlier cars by observing the following instructions:—

1. With the hand brake on jack up the front of the car, remove the road wheels and front road springs.

2. Remove cotter pins at outer ends of the lower wishbones, screw out shackle pins and remove inner fulcrums.

3. Cut away the lugs of the inner fulcrums (those which took the shorter attachment bolts) to 0.97″ from the centre of the bore which previously accommodated the longer attachment bolt. Level the boss faces to 0.5″ to ensure clearance between the fulcrum and the bracket attachment bolts.

4. Bolt the four attachment brackets (two bolts per bracket) to the chassis frame and lock the bolts with tab washers.

5. With the distance piece towards the outside of the car, then four shims followed by the inner fulcrum (the bosses toward the outside of the car) and a further six shims, bolt each end of the fulcrum to the attachment bracket using the previous attachment bolt bore. It should be noted that the same number of shims must be placed on the same side of the fulcrum at each end.

6. Re-assemble the suspension, replace the road wheels and remove jacks. The camber angle can now be checked under normal laden conditions.

With the fulcrum attached to the chassis as described in Para. 5, the normal angle of camber, 2° positive, is obtained.

To increase the camber angle, move the inner fulcrum towards the centre of the car. Conversely, to decrease the angle, move the inner fulcrum away from the centre of the car. Each shim affects the camber angle by 0° 23″.