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SECTION 6 — FRONT AND REAR SERVO UNITS

The front and rear servo units vary between different models of the gearbox. Identification of the various models and their interchangeability are as follows

From late 1953 onward the front servo unit is fitted with a light alloy valve body mounted externally on the servo body; the front band release cylinder is secured to the servo body by three setscrews. The rear servo is outwardly similar to earlier models but incorporates a drilled boss for the fitting of a compensator oil pressure pipe which connects with the front servo. These servo units can be fitted as a pair, with the compensator oil pressure pipe, to the early or late '1953' gearbox. The front servo can be fitted with an earlier rear servo not having a compensator oil pipe but the rear servo must not be fitted unless the compensator pipe and appropriate front servo are fitted also.

The early '1953' front and rear servo units are similar to the late '1953' units with the exception that compensator oil pipe bosses are not incorporated. These servo units cannot be fitted to the '1952' model gearbox.

The '1952' front servo unit incorporates the 4–3 timing valve, the quick-release valve and the rear pump non-return valve in the servo body to which the front band release cylinder is secured by two setscrews. The rear servo unit is outwardly identical to the early '1953' model. These servo units cannot be fitted to later boxes.

The servo units can be removed from the gearbox while it is installed in the car but the sump and filter must first be removed as described in Section 3.

Front and rear servos — To remove

The rear servo can be removed independently of the front servo, but as removal necessitates slackening the setscrews securing the front servo, instructions are given for removal of both servo units together. The front servo cannot be removed without removing the rear servo.

The disconnecting points are shown in Figure 60.

Slacken the front and rear band adjusting screw lock-nuts and unscrew the adjusting screws approximately five complete turns to release the pressure on the servo operating rods. Hook a piece of bent wire into the coils of the rear band release spring and secure it to prevent the spring from falling when the servo is removed.

Remove the governor oil delivery pipe, if necessary using light leverage near the ends of the pipe.

Slacken the setscrews securing both servo units to the gearbox casing; remove the compensator oil pipe, if fitted, front servo end first.

Remove the two setscrews securing the rear servo, carefully draw the rear servo away from the front servo, and withdraw the rear servo from the oil transfer pipe and from the gearbox. If the gearbox is installed in the car, care must be taken during this operation to support the rear servo and so avoid damage to the front servo and oil pipes. Remove the rear band release spring.

Support the front servo and remove the two securing setscrews. Push the rear oil pump discharge pipe as far as possible into the rear pump and carefully ease the front servo unit from the gearbox casing, turning it to disengage the rear oil pump discharge pipe and at the same time withdrawing it from the front oil pump delivery pipe.

If difficulty is experienced in disengaging the servo unit from the rear oil pump discharge pipe, slacken, and if necessary remove the front servo valve body. On '1952' gearboxes, slacken the setscrews securing the rear pump. If the valve body is to be detached from the front servo, remove the three securing screws, then slide the valve body toward the front and lift it from the servo body; retain the non-return valve spring and the ball.

If fault diagnosis has indicated that a servo unit might be defective, it should be checked as described under 'Front servo — To test' in order to ascertain which part is at fault before it is dismantled and inspected.

Front servo unit — To dismantle

Hold the servo unit with the valve body (see Fig. 61) uppermost to prevent the 4–3 timing valve from falling out when the valve body is removed. Hold the valve body against spring pressure and remove the three securing screws. Slowly release the pressure and remove the non-return valve ball and spring as the bodies move apart. Tip the servo body and allow the 4–3 timing valve to slide from its bore.

Depress the overrun valve retainer and withdraw the pin, retainer, spring and valve. If the retainer sticks in the bore, refit the valve body to the servo body, without the non-return valve and spring, then apply an air blast of approximately 70lb/sq.in. intermittently to the band release oil duct (see Fig. 65); this will have the effect of hammering the retainer without damage to the component parts. Do not use leverage between the valve and the dividing walls in the face of the valve body casting.

Depress the exhaust valve spring, using a screwdriver edge through the slot in the retainer, then slide out the retainer. Withdraw the spring and valve.

To dismantle the remainder of the servo unit, remove the three screws securing the band release cylinder and withdraw the cylinder from the servo body. Withdraw the band release piston from the front band release cylinder.

Remove the two springs and the retainer from the servo operating rod.

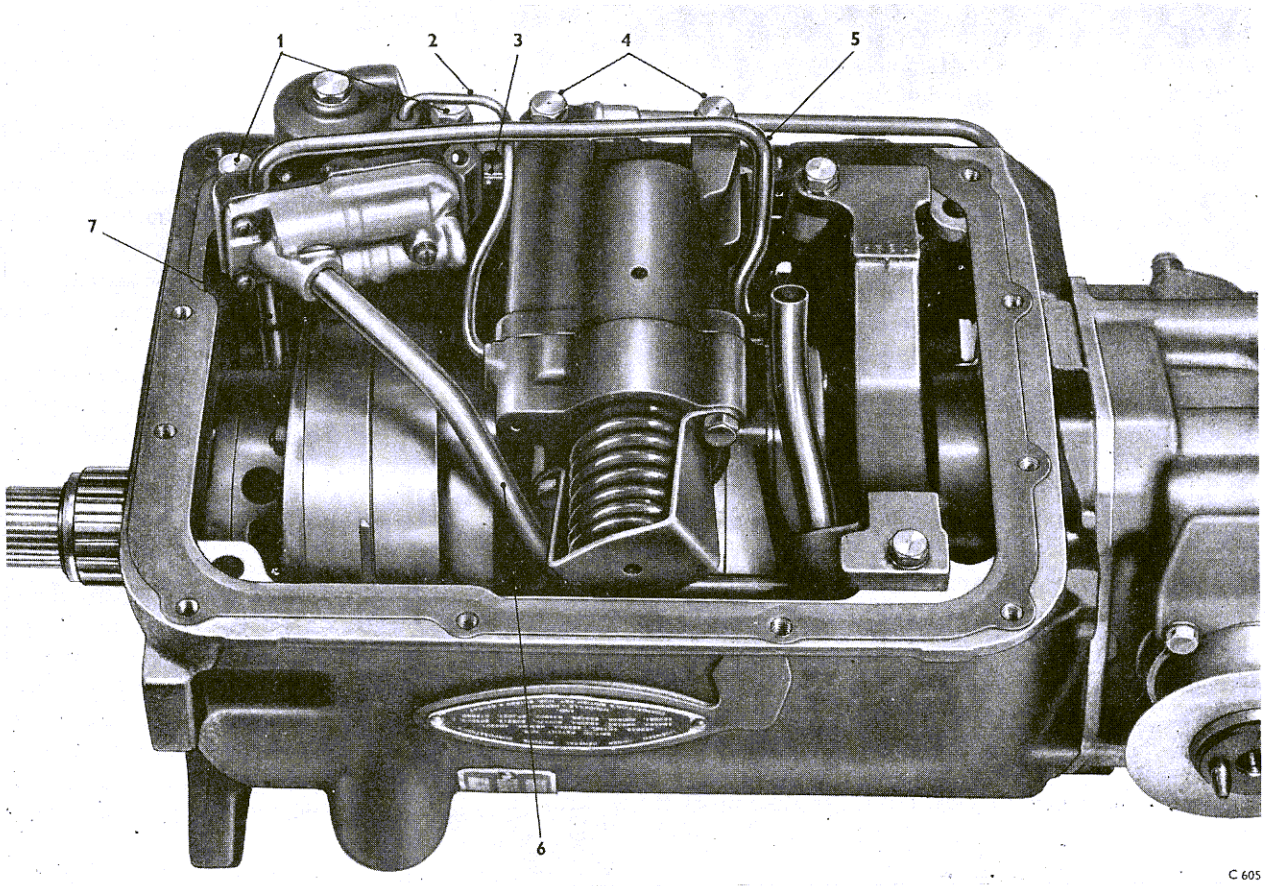

Fig. 60 Disconnecting points

1 FRONT SERVO RETAINING SETSCREWS
2 COMPENSATOR PIPE
3 OIL TRANSFER PIPE
4 REAR SERVO RETAINING SET SCREWS
5 GOVERNOR FEED OIL PIPE
6 REAR PUMP-TO-FRONT SERVO OIL PIPE
7 FRONT PUMP-TO-FRONT SERVO OIL PIPE

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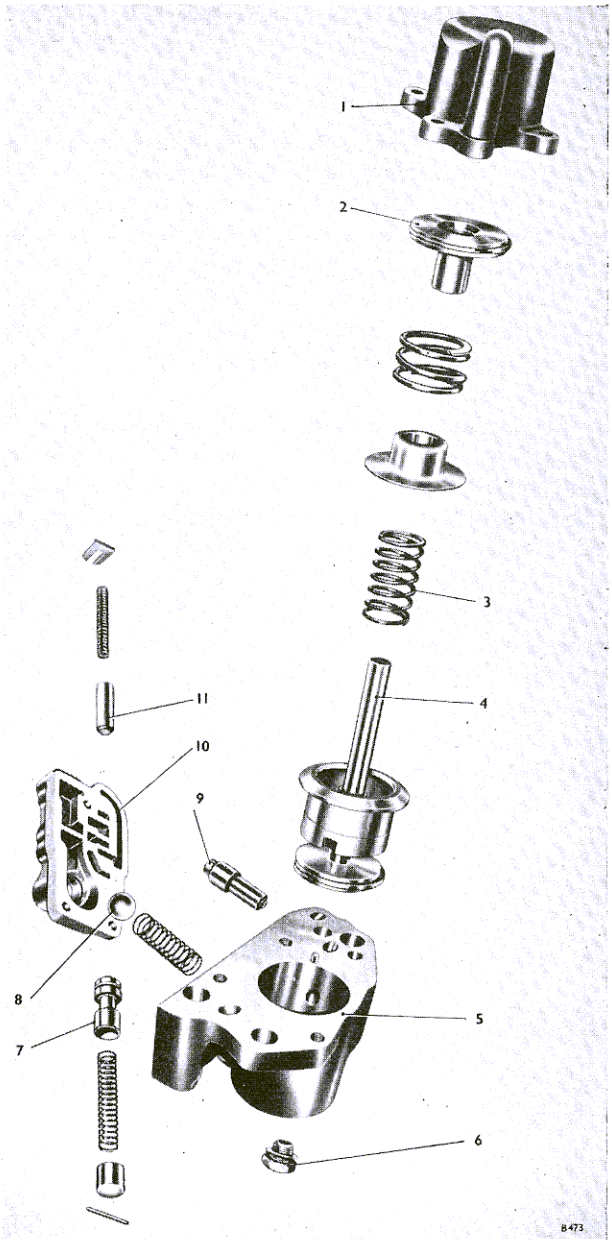

Fig. 61 Front servo—exploded

1 BAND RELEASE CYLINDER
2 BAND RELEASE PISTON
3 APPLY PISTON RETURN SPRING
4 APPLY PISTON ASSEMBLY
5 SERVO BODY
6 BLANKING PLUG
7 OVERRUN CONTROL VALVE
8 NON-RETURN VALVE
9 4–3 TIMING VALVE
10 VALVE BODY
11 LINE EXHAUST VALVE

Withdraw the compensator and band apply piston assembly from the servo body, using a press tool and distance piece through the blanking plug orifice. The compensator and band apply piston assembly cannot be dismantled further.

If the gearbox has covered a considerable mileage, and new piston rings are available, remove the old rings from the pistons. If new rings are not available, or the gearbox has only covered a low mileage, the rings should be inspected as described in 'Front servo — To inspect'.

Dismantling of a '1952' front servo, described in the following paragraphs, is slightly different to the procedure for dismantling current models.

The component parts are illustrated in Figure 62 to which reference should be made when dismantling the unit.

Remove the two setscrews and washers securing the front band release cylinder to the servo body and withdraw the cylinder and spring.

Unscrew the blanking plug from the servo body and withdraw the piston assembly. If the piston assembly sleeve is tight in the body, it can either be drifted or pressed out using a soft metal drift through the blanking plug orifice; take care not to damage the orifice threads. The piston assembly cannot be dismantled further.

Unscrew the blanking plug and remove the retainer and 4–3 timing valve.

Cut the end off the quick-release valve retaining pin, extract the pin and withdraw the spring and valve.

Unscrew the non-return valve seat and remove the spring and ball.

Rear servo unit — To dismantle

Dismantling of the rear servo (see Fig. 63) is best attempted using the special tool (STD 6012) to compress and release the inner and outer band apply springs. Do not unscrew the two strap securing setscrews until the springs are held captive, otherwise damage to the servo, or personal injury, may result.

Fit the servo unit in position on the base pegs of the special tool (see Fig. 64) and screw down the compressor spindle until it enters through the hole in the strap and just meets the boss on the top of the compensator piston. Fit the 'U' section distance piece in position.

If tool (STD 6012) is not available and a press is to be used, place the servo operating lever in its normal position and use a packing piece under the lever to support the unit in a vertical position under the plunger. Lower the press plunger until it just meets the strap; do not lower further, otherwise the strap may become distorted.

Unscrew and remove the two securing setscrews, then release the springs gradually until they are fully extended. Remove the strap, outer spring, compensator piston and inner spring.

Withdraw the compensator/release piston and compensator/release cylinder from the servo cylinder and remove the exhaust valve and spring from the compensator/release cylinder. Using a suitable bar on the operating rod, push out the main piston and spring from the servo cylinder.

If it is necessary to remove the piston from the compensator and release cylinder, stand the assembly on end, captive spring uppermost, then using leverage under both sides of the coil, remove the spring from the operating rod. The lowermost coil will be damaged on its withdrawal from the groove — it should therefore be renewed on assembly. Withdraw the piston from the cylinder.

If the operating lever is to be removed, withdraw the split pin, slide out the pivot pin, remove the operating lever from the lugs and slide out the eighteen needle rollers.

If the gearbox has covered a considerable mileage and new piston rings are available, remove the old rings from the pistons. If new rings are not available or the gearbox has only covered a low mileage, the rings should be inspected as described in 'Rear servo—To inspect.'

All parts should be cleaned thoroughly before the inspection, using a brush, compressed air and filtered cleaning fluid.

Oil ducts and valve bores must be washed and blown through to remove any particles which could eventually reach the control valve unit and cause faulty operation of the gearbox. Ensure that the leak hole in the non-return ball valve seating in the front servo is free from dirt or sludge.

Do not remove piston rings, except when essential to facilitate cleaning of the grooves; careless handling of these rings can cause distortion. The piston ring inside the front servo compensator piston assembly cannot be removed, but every effort must be made to flush the compensator chamber by introducing cleaning fluid and moving the operating rod to and fro.

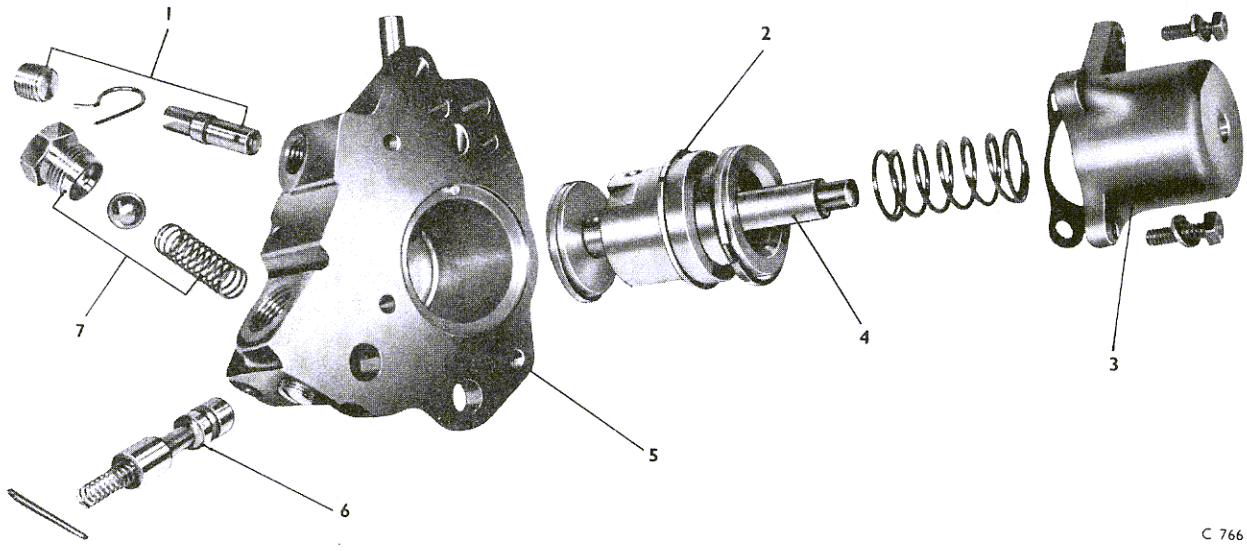

Fig. 62 Front servo—exploded (1952 cars)

1 4–3 TIMING VALVE
2 PISTON ASSEMBLY
3 CYLINDER COVER
4 BAND OPERATING ROD
5 FRONT SERVO BODY
6 QUICK-RELEASE VALVE
7 NON-RETURN VALVE

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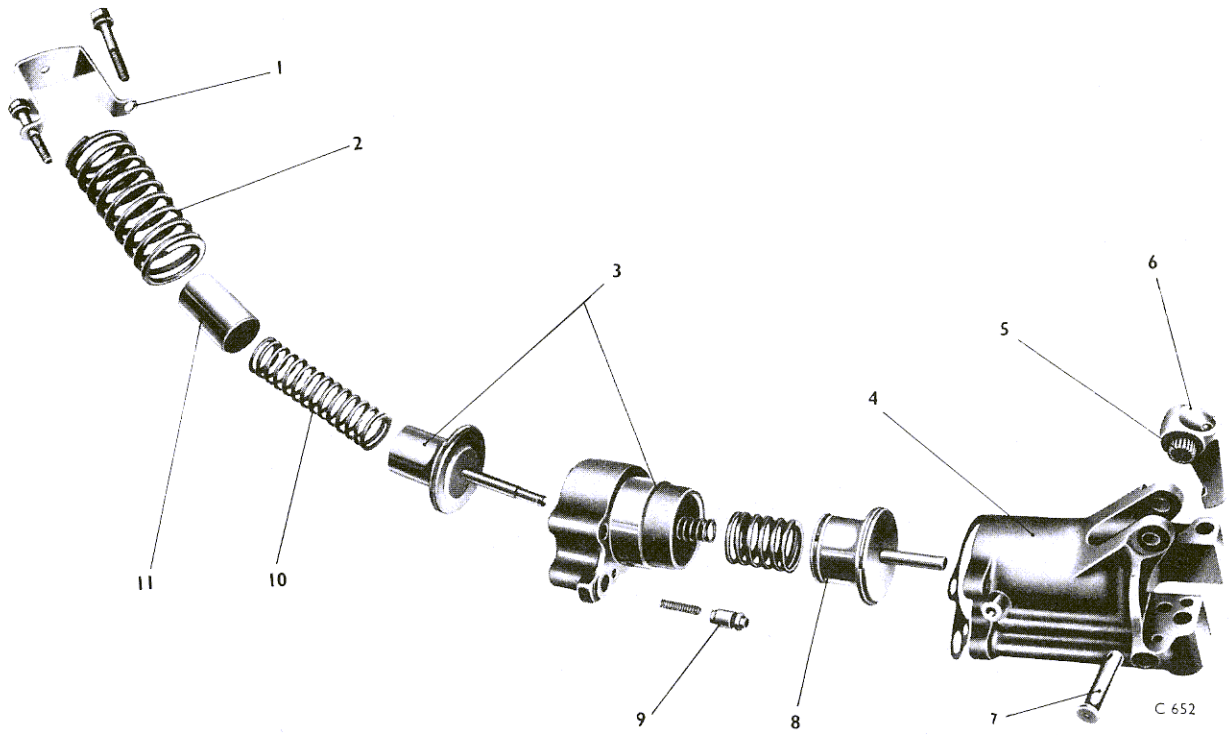

Fig. 63 Rear servo—exploded

1 STRAP
2 OUTER SPRING
3 COMPENSATOR AND RELEASE PISTON AND CYLINDER
4 SERVO BODY
5 NEEDLE ROLLERS
6 OPERATING LEVER
7 PIVOT PIN
8 BOOSTER PISTON
9 EXHAUST VALVE
10 COMPENSATOR SPRING
11 COMPENSATOR PISTON

Clean all pipes and check them for kinking at the bends. Check the ends for damage and for fit in their respective bores.

Check all permanent plugs for security.

Examine all springs for distortion and screw threads for damage. Damaged screw threads can be cleaned out in the normal manner providing that the correct taps and dies are used. In the case of the two setscrews securing the compensator and release cylinder to the rear servo cylinder, due consideration should be given to the load imposed on the threads when the servo is acting under oil pressure.

Opportunity should be taken to check the condition of the band linings as far as possible while in position on the drums. The bands must not be pulled away from the drums, otherwise they may become distorted and contact area lost.

Front servo — To inspect

Examine the piston bores in the servo body and the front band release cylinder for signs of scoring or of 'pick-up'. Check that the dowel in the servo body has not become damaged. This dowel is a loose fit in the servo body and is easily removable.

Examine the valves and bores for scoring. Oil the valves and check that they slide freely in the bores under their own weight. Examine the ball valve seating.

Examine the piston assembly externally for scores and the piston rings (if the old ones are being re-fitted) for chipped edges and uneven contact. Hold the outer body of the assembly and move the operating rod backward and forward to check for freedom of action; a cushioned effect coupled with the characteristic scraping action of a piston ring should be felt.

Check the face of the light alloy valve body for distortion, using a surface plate. Any distortion, particularly in the section between the main line oil passage and the overrun valve, will necessitate renewal.

The valve body complete with valves and springs can be renewed as a separate assembly, but the ball valve seating cannot be renewed independently.

Unserviceability of the servo body, front band release cylinder, valves or the piston assembly will necessitate renewal of the complete servo unit as these items are selectively fitted on initial assembly. Other components such as piston rings can be renewed separately.

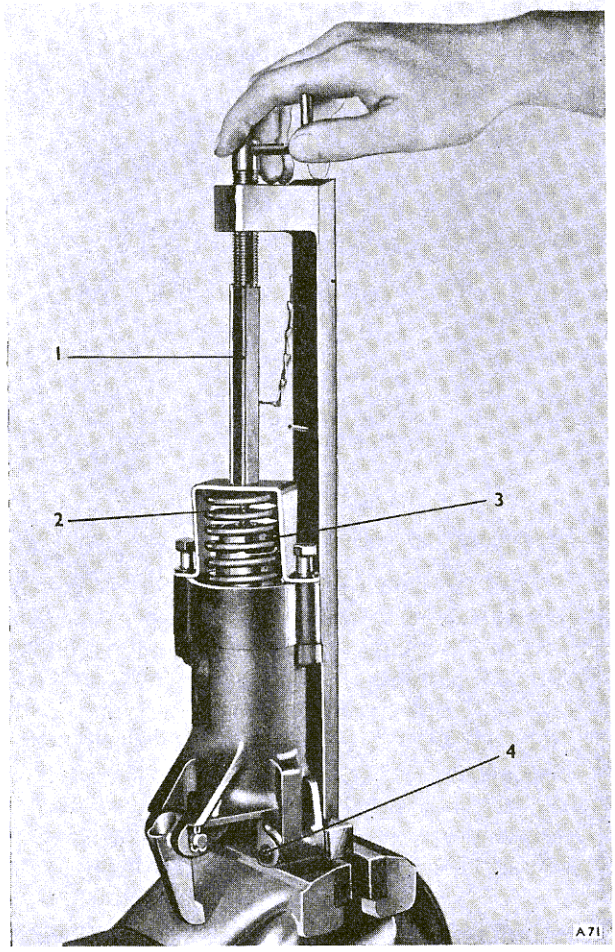

Fig. 64 Dismantling rear servo

1. DISTANCE PIECE
2. COMPRESSOR SPINDLE
3. COMPENSATOR PISTON
4. BASE PEG

Rear servo — To inspect

The rear servo should be inspected in the same manner as the front servo with the addition of the following items.

Examine the spring retaining strap for cracks at the bends and for bending across the hole in the top section.

Examine the compensator and release piston internally and the compensator piston externally for scoring; examine both pistons for burrs on the rims of the open ends.

Examine the restrictor valve plate in the base of the compensator and release cylinder for security.

Examine the pivot pin and the bore of the band operating lever for wear and bedding of the needle rollers. Assemble the pivot pin and needle rollers in the bore and check for play. If wear or excessive play is apparent, renew the parts. Check the fit of the pivot pin in the lugs on the servo body.

Unserviceability of the following parts will necessitate renewal of the complete servo unit as these items are selectively fitted on initial assembly.

Compensator/piston.
Compensator/release piston.
Compensator/release cylinder.
Main piston.
Servo cylinder.
Exhaust valve.

Front and rear servos — To assemble

When assembling the servo units ensure that all parts are clean and oiled; do not fit sliding parts into dry bores. Refit any piston rings that have been removed. Fit new jointing where applicable but **do not** use jointing compound. Enter piston rings squarely to avoid scraping the cylinder walls.

Front servo — To assemble

If necessary, fit a new piston ring onto the band apply piston and fit the assembly into the bore of the servo body.

Align the dowel slot in the sleeve with the dowel in the servo body and push in as far as possible by hand; a press tool may be necessary to push the assembly

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fully home. The sleeve should fit the front servo body with an interference fit of 0·000 in. to 0·001 in.

If necessary, fit a new piston ring onto the band release piston, then fit the piston to the band release cylinder, using three 0·0015 in. feeler gauges to enter the piston ring over the steps in the bore.

Fit onto the shaft of the band release piston, the band release return spring, retainer and the compensator return spring.

Fit the band release cylinder to the servo body, then enter, but do not tighten the three securing setscrews. Turn the band release cylinder anti-clockwise to ensure that the flange does not overlap the front pump delivery duct.

Torque tighten the three securing setscrews.

Fit the exhaust valve, spring and retainer, taking care to centralise the exhaust valve spring in the depression in the retainer to obviate side thrust on the valve.

Fit the overrun valve, spring, retainer and pin. Ensure that the end of the overrun valve retainer pin is below the surface, otherwise it will prevent the two faces from meeting and will permit oil leakage.

Fit the 4–3 timing valve to its bore in the servo body and ensure that it is below the surface, then fit the ball valve and spring and fit the valve body on to the servo body; secure with the three setscrews. Torque tighten the securing setscrews evenly to prevent distortion of the alloy body.

Assembly of the '1952' front servo is the reverse of dismantling and in most ways similar to the procedure described for current front servos. The following paragraphs give a few points which should be borne in mind when assembling.

The piston assembly should be pushed to the end of the bore to ensure that the operating rod is correctly aligned in the guide hole when fitting the release cylinder.

Align the dowel slot with the dowel pin before entering the piston assembly into the servo body. Enter the compensator sleeve squarely in the bore and press it in as far as possible by hand. If necessary use a press tool but avoid canting the sleeve, otherwise it may seize in the bore, or the piston ring may become wedged or broken.

Fit a new quick-release valve retainer pin and peen the head to secure.

Ensure that the 4–3 timing valve retainer spring is locked in position by spring action in the depression in the servo body.

Rear servo — To assemble

Assemble the needle rollers into the bore of the operating lever, retaining them in position with petroleum jelly, then fit the assembly to the servo body with the pivot pin. Lock the pivot pin in position with a split pin.

Fit the compensator and release piston in the cylinder. Stand the assembly on end, operating rod uppermost, then push the new spring, smallest coil first, on to the rod until it comes to rest in the groove. Fit the paper jointing in position on the end face.

Fit the spring in position in the bore of the main piston, ensuring that it is pressed into its housing, this should be an interference fit of 0·001 in.; slide the main piston into the servo cylinder. Assemble the exhaust valve spring into the hollow of the exhaust valve, then insert both into the bore of the compensator/release cylinder. Ensure that the spring is home in the smaller bore and that the valve is seated correctly over the spring; it is possible for the spring to become trapped by the rim of the valve. This can cause mal-functioning of the gearbox when moving from first gear, or when the selector lever is moved into range '2' with the engine running and the car stationary ('1952' model).

Lay the servo cylinder and the compensator and release cylinder assembly horizontaly. Align the exhaust valve with the orifice in the servo body then bring them together, ensuring that the exhaust valve enters the orifice without trapping the paper joint.

Stand the assembly upright then fit the inner spring, compensator piston, outer spring, strap and setscrews.

Screw out the spindle and mount the servo on the base pegs of the special tool (STD 6012). Screw down the spindle through the hole in the strap and onto the boss on the compensator piston. Continue to screw down until the compensator piston is about to enter the bore of the release piston. Lift the outer spring and strap clear of the compensator piston. Carefully align the compensator piston in its bore then screw down the spindle until the piston is entered in the bore of the release piston. Compress the outer spring by hand until the distance piece can be fitted to the tool, then screw down the spring with the tool until the strap just meets the facing on the compensator cylinder. Fit and torque tighten the securing setscrews.

If assembling the rear servo under a press, care must be taken to ensure that the piston enters the bore squarely; the outer spring cannot be lifted to facilitate access as on the special tool.

Servos — To test

The servo units can be tested functionally only by using a special test rig, or by refitting them to the gearbox and carrying out a road test as described in Chapter 2.

Movement of the servo pistons and freedom of the valves in their bores can be tested however, by applying an air pressure of approximately 70 lb/sq.in. to specified oil ducts and observing the movement. Internal leaks or sluggish valves, which could cause faulty operation of the gearbox, will not be revealed by these tests.

Front servo — To test

Apply air pressure to the band apply duct (see Fig. 65). The operating rod should move out to its fullest extent and the 4–3 timing valve should be heard and seen to move through the compensator pipe hole on top of the servo body. If the 4–3 valve does not move, shake the valve to the other end of its bore and repeat the check; this valve is not subject to spring pressure and therefore will not return once it has moved.

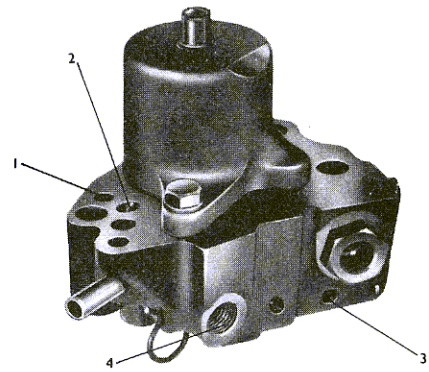
Hold a finger on the overrun valve housing and apply air pressure intermittently to the main line duct; movement of the valve should be felt. If doubt exists, exert a slight pressure on the overrun valve retainer, using a stiff metal rod, and repeat the check; movement of the rod should be felt.

Cover the front pump delivery duct and apply air pressure to the other end of the duct. Oscillation of the exhaust valve should be felt and will probably be heard.

Air testing of '1952' front servo is somewhat different to the procedure described above and is as follows

Remove the blanking plug from the 4–3 timing valve bore, hold the servo with the bore uppermost, then apply air pressure to the band apply duct (see Fig. 65). This should move the servo piston and cause the operating rod to move out to its fullest extent and also lift the 4–3 timing valve, as seen through the blanking plug orifice. Refit and tighten the blanking plug.

Apply air pressure intermittently to the band release duct and observe to ensure that the exhaust valve moves to and fro across the exhaust port in the side of the casing adjacent to the non-return valve seating.



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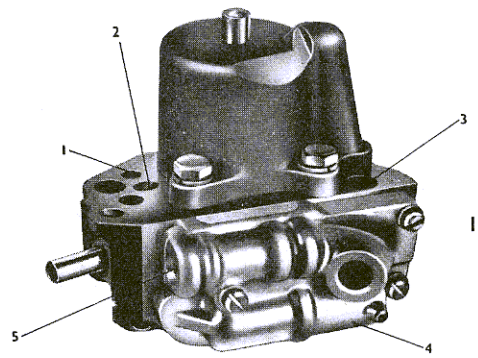

1953

Fig. 65 Air pressure test—Front servos

1952 SERVO

1. BAND APPLY DUCT
2. BAND RELEASE DUCT
3. EXHAUST PORT
4. 4–3 TIMING VALVE

1953 SERVO

1. BAND APPLY DUCT
2. BAND RELEASE DUCT
3. FRONT PUMP DELIVERY DUCT
4. OVERRUN CONTROL VALVE HOUSING
5. EXHAUST VALVE HOUSING

Rear servo — To test

Apply air pressure to the band release oil duct (see Fig. 66); the operating rod should move into the servo cylinder.

Apply air intermittently to the 1–2 oil duct; the exhaust valve should be felt to move to and fro in its bore. A piece of stiff wire inserted through the pressure balance hole in the end of the exhaust valve bore will confirm this movement.

Front and rear servos — To fit

If the rear pump and governor securing bolts have been slackened during dismantling, tighten them and check the alignment of the governor sleeve as described in Section 5. This can be carried out without

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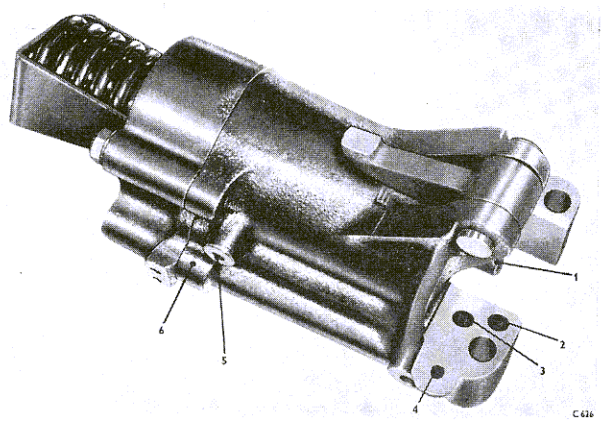

Fig. 66 Air pressure test—Rear servo

1 OPERATING ROD
2 BAND RELEASE OIL DUCT
3 COMPENSATOR OIL DUCT
4 1–2 OIL DUCT
5. COMPENSATOR OIL PIPE DUCT
6. EXHAUST VALVE HOUSING

removing the control valve unit.

Fit the rear oil pump discharge pipe into the bore in the rear pump ensuring that it is fully home. Ensure that the front pump delivery pipe is fully home in the front pump.

Rotate the front drum band until the slot for the operating rod is in the correct position and the other end of the band is engaged with the adjusting screw. Engage the band operating rod in the band slot, then manoeuvre the servo unit into position, engaging the front pump delivery pipe and the rear pump discharge pipe in their respective bores. Do not fit the securing setscrews at this stage.

Fit the rear band release spring in the housing in the end of the rear band, using petroleum jelly to hold it temporarily in position. Engage the short end of the operating strut in the spring coil and tie the ends of the band together with a piece of wire, this will hold the spring in position during subsequent operations; the wire should be fixed in such a manner that it can be removed easily at a later stage. Rotate the band until it engages with the adjusting screw.

Hold the rear servo operating lever against the operating rod, then move the rear servo unit forward to enter the transfer pipe on the front servo unit into its bore, at the same time engage the socket on the operating lever with the end of the operating strut.

Push both servos to the face on the gearbox casing, then fit and evenly torque tighten the securing setscrews, taking care that the front and rear pump pipes fully engage smoothly; the rear servo must be supported during this operation. Check that the band release spring is in the correct position, then remove the locking wire from the ends of the band ensuring that no wire is left in the gearbox.

Adjust the setting of the front and rear bands as described later in this Section.

Fit the compensator pressure pipe (if applicable) and the governor oil delivery pipe.

Fit the oil filter and sump as described in Section 3. then carry out a road test as described in Chapter 2,

Bands — To set

Setting of both bands must be carried out whenever a servo unit has been removed and may also be necessary to rectify faulty operation of the gearbox. The procedure is the same whether the gearbox is installed in the car or on the bench.

Front band — To set

The tools used for setting the front band are, spanner (RH 131), gauge (RH 671 for '1952' servos with a tapered thread) and gauge (UR 3144) — see Chapter 4 — Tools.

It is necessary to use the spanner, only if the gearbox is in position in the car. The outer box spanner fits on to the lock-nut and the inner adjusts the bands.

Unscrew the blanking plug from the front servo body and screw in the setting tool as shown in Figure 67. Turn the plunger nut by hand until the plunger makes contact with the servo piston. Turn the drum by hand in the opposite direction to normal rotation to centralize the band; using a spanner, screw in the plunger five complete turns. Check that the knurled washer cannot be rotated; if it is loose, slacken the band adjusting screw until the washer is gripped.

Hold the knurled washer of the tool as shown in Figure 67, then tighten the band adjusting screw until the washer **just slips.** Hold the adjusting screw to prevent it from turning, then tighten the lock-nut to the correct torque loading. Check that the tension on the knurled washer has not changed indicating that the setting has not altered.

Slacken the plunger nut more than five turns, to relieve the pressure on the screw thread in the servo body; unscrew the tool, then refit and tighten the blanking plug.

Rear band — To set

The tools required for setting the rear band are, spanner (RH 131) and gauge (23789/G1002) — see Chapter 4 — Tools.

Remove the governor oil delivery pipe.

Check that there is a clearance between the end of the operating lever and the operating rod of the rear servo; if necessary, slacken the band adjusting screw. Turn the rear drum in the opposite direction to the normal rotation to centralize the band. To ensure that the band is centralized, hold a screwdriver against the riveted end of the band and shock it into position on the drum.

Hold the band setting gauge with the cut-away leg firmly against the spring end of the servo and the other end of the gauge resting on the servo operating rod, as shown in Figure 68.

Screw in the adjusting screw until the face of the operating lever just touches the gauge; care must be taken not to allow the gauge to be pushed by the operating lever, otherwise an incorrect setting will be obtained. If this occurs, slacken the adjusting screw

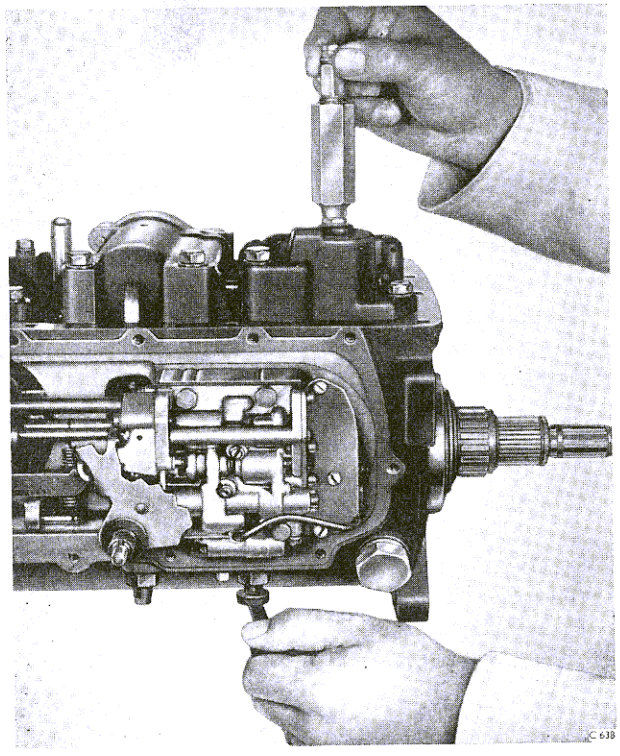

Fig. 67 Setting the front band

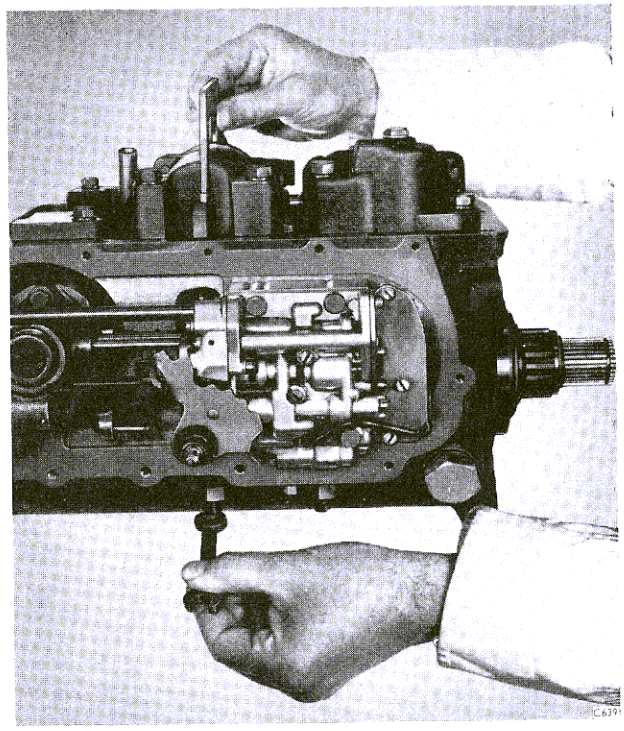

Fig. 68 Setting the rear band

and recommence the setting operation, which must always be carried out by adjusting the operating lever moving towards the gauge and not away from it. Firmly hold the adjusting screw and tighten the lock-nut to the correct torque loading. Check that the setting has not altered.

Refit the governor oil delivery pipe.

Gauge (UR 3144) — To check

Instances have occurred of the lock-nuts, which regulate the spring loading in tool (UR 3144), slackening off, resulting in inaccurate adjustment of the front band.

Remove the plunger assembly from its housing and check the length of the spring under a compression; this should be 1·160 in. ± 0·003 in.

If the spring length is incorrect adjust the nut until the correct length is obtained, then lock together the two nuts and peen over the end of the thread to ensure that they do not work loose.

It is recommended that tool (UR 3144) should be frequently checked approximately every three to six months, depending on how often the tool is used.