POWER SHIFT TRANSMISSION HOUSING REMOVAL-INSTALLATION

With lift arms lowered, drain oil from transmission housing and rear transmission housing, taking care not to mix the two types of oil. The proceed as follows:

⚠ CAUTION ⚠

Lift and handle all heavy components using a suitable lift.
Ensure that units or parts are supported by suitable sligns or hooks. Ensure that no one is in the vicinity of the load to be lifted.

— remove side panels and disconnect battery negative lead.

— disconnect exhaust silencer from turbocharger and remove.

— remove two capscrews retaining rear of hood; capscrews are provided with plastic protectors. Remove bolts at front and rear of hood;

— slacken clip and disconnect air cleaner from rubber air cleaner hose. Remove hood together with air cleaner;

— remove front axle drive shaft and associated guards;

— disconnect tractormeter cable and associated bracket. Disconnect alternator cable, starter cable, and all electrical wiring to dashboard and cab instruments and instruments and indicators;

— drain coolant from cab heater cock and disconnect heater delivery lines. Where fitted, disconnect air conditioner lines and associated bracket;

— drain fuel through auxiliry tank hose fittings. Disconnect all lines from fittings and remove auxiliary fuel tanks with brackets;

— disconnect fuel lines from feed pump, injection pump and injector return. Disconnect accelerator and engine shut-off links and remove steering bracket from transmission housing;

— disconnect pressure switch lines from oil delivery line to transmission and transmission oil level indicator;

— disconnect power steering control valve line from reservoir and transmission oil delivery line. Disconnect steering pump-to-control valve line from fitting, transmission delivery line from fitting, and steering cylinder delivery pipes from hose fittings;

— remove brake line bracket from engine and from reservoir on transmission delivery line;

— disconnect lift delivery line and front differential lock delivery line from associated fitting and remove rubber hose on lift suction lines. Remove clip retaining the above lines to transmission housing;

— disengage mechanical reverser or creeper and remove lower control board guard, footboard cover and, where possible, footboard cover support;

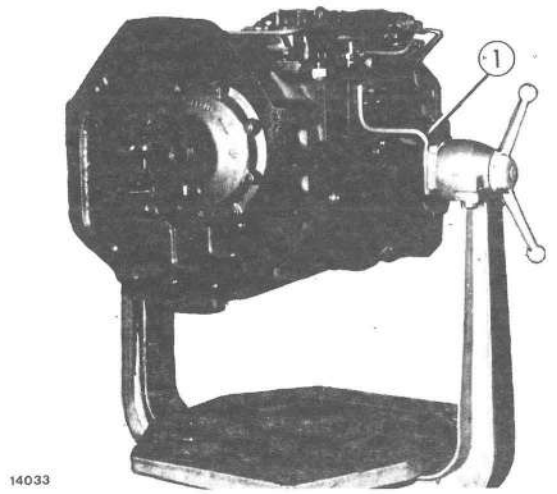
— remove transmission and splitter selector shaft retaining screws. Disconnect inching circuit line and inlet line from transmission control valve;

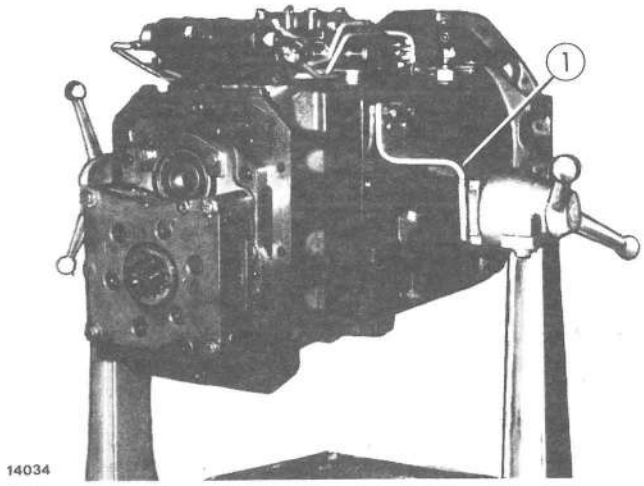
— position stand with guides **292320** with stationary section under rear transmission housing, one mobile section under the oil pan, and the other mobile section under the transmission housing. Place a stand under rear bar to prevent tractor from overturning;

— remove sidemember retaining screws, apply parking brake and chock front axle;

— remove two bolts retaining platform to front support and slacken four bolts retaining platform to rear supports. Raise platform by 5 to 6 cm (0.2 to 0.25 in) and hold in this position by means of two telescoping stands **292858** positioned at front sides of platform;

— remove screws retaining transmission housing to rear transmission housing and separate engine together with transmission housing.





Power shift transmission installed on revolving stand 290086.

DISASSEMBLY

⚠ CAUTION ⚠

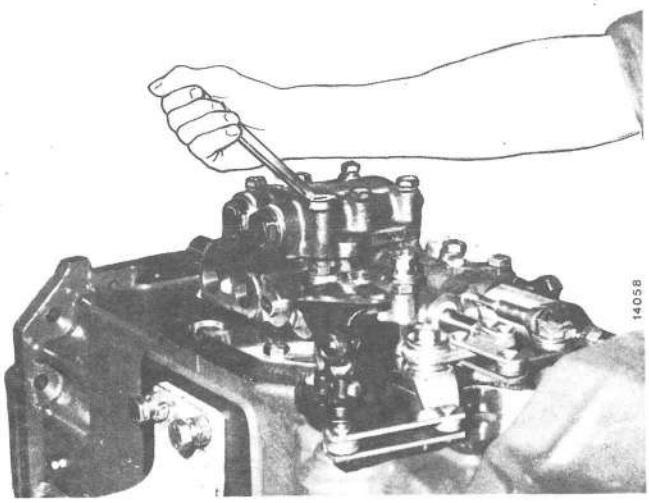
Handle all parts with care. Do not put hands or fingers between parts. Wear safety items such as goggles, safety shoes and gloves.

To facilitate disassembly operations, place transmission/rear transmission housing on revolving stand **290086** and secure through brackets **293868** (1).
The proceed as follows:

— remove control valve and accumulator pipe fitting from transmission housing, retarder valve unit, control valve, transmission housing cover and accumulators. Remove control valve and accumulator pipes;

— take off brackets and remove accumulators;

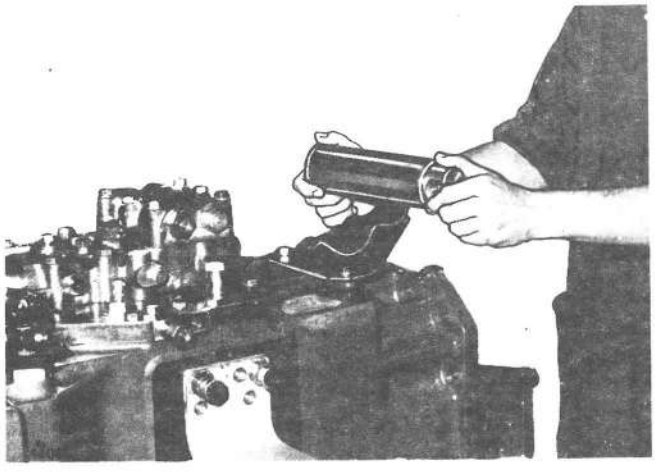
— remove control valve retaining screws and take off retarder valve unit;



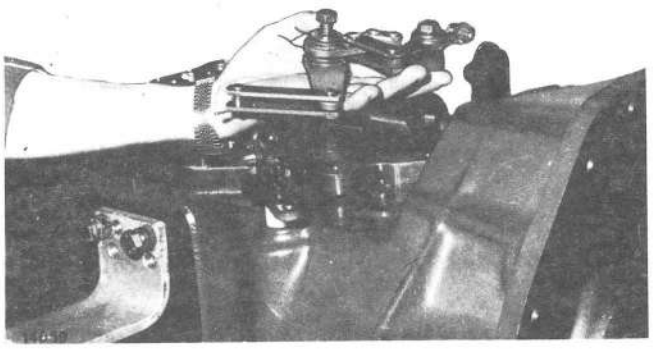
Removing (installing) retarder valves.

— disconnect pivots and lift off entire control valve linkage assembly as shown below;

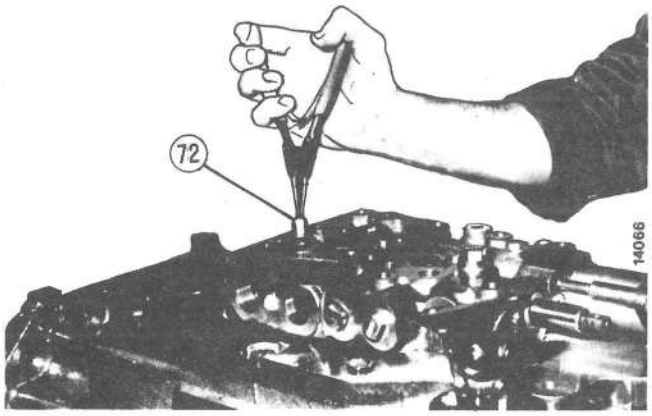
— remove retarder valve nozzles (72, page 18) from control valve body;



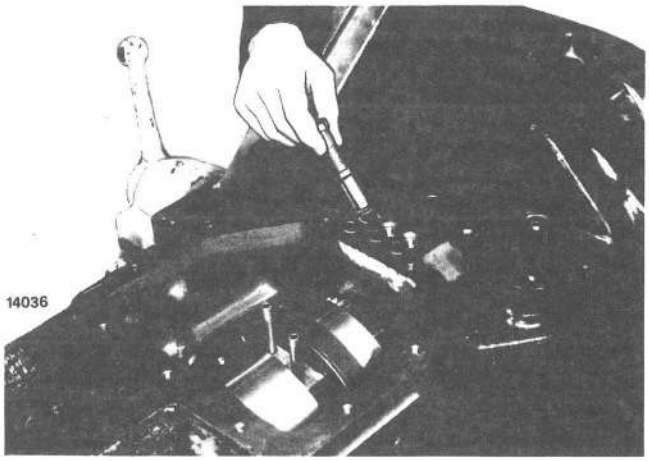
Removing (installing) accumulators.



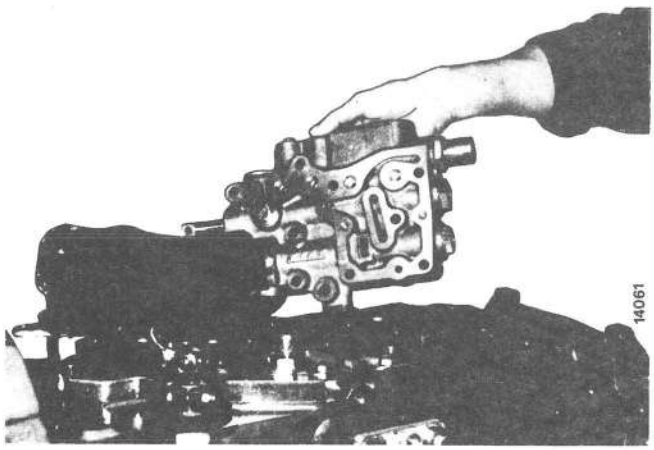
Removing (installing) control valve linkage.



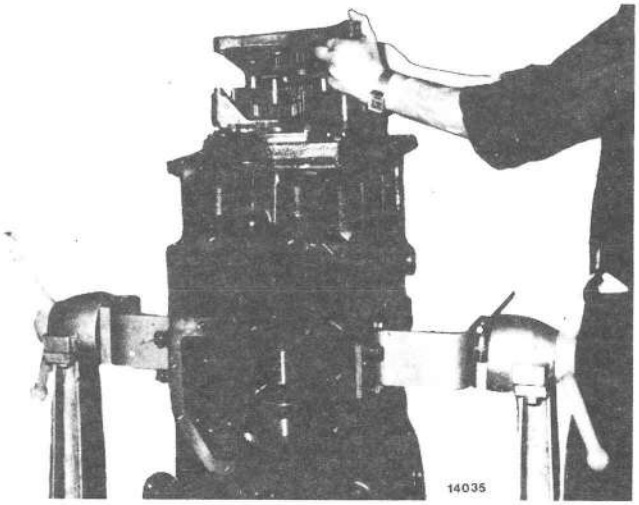
Removing retarder valve nozzles (72).
(**Note** - On assembly, ensure that nozzles are positioned as shown on page 26, i.e. with milled notches facing retarder valves).



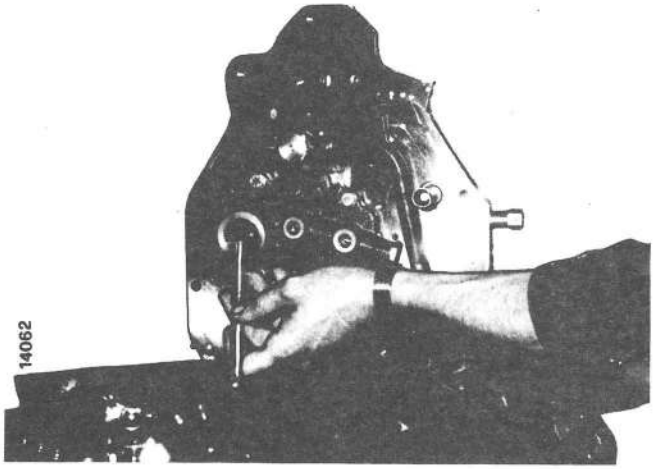
Removing (installing) oil delivery fittings.



Removing (installing) control valve.



Removing (installing) mechanical reverser.



Removing (installing) transmission housing cover.

— remove screws retaining control valve to transmission housing cover and take off control valve;

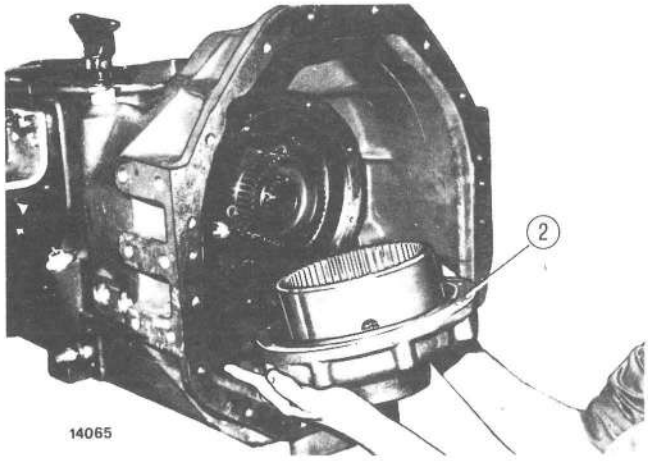
— remove screws retaining cover to transmission housing and take off cover complete with clutch C and D delivery manifold and band brake push rod;

— remove three o-rings and three oil delivery fittings using a screws as shown above;

— remove mechanical reverser on creeper, followed by splitter;

Note - Mechanical reverser, creeper and splitter units fitted on POWER SHIFT transmission tractors are identical to those on standard transmission tractors. See the reverser, creeper and splitter removal, overhaul and installation procedures.

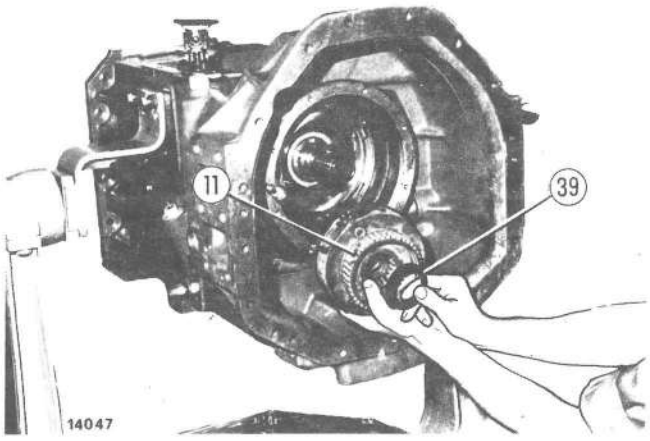
CAUTION - Thread of nut (C_2, page 8) is LH. Turn nut clockwise to back off, or counter-clockwise to tighten.



Removing front reduction unit cover (2).

— remove screws (C_5) from front of transmission housing and take off front reduction unit cover (2) together with clutch B;

— remove retaining ring (39) and take out planet carrier (11), retrieving shim (79);

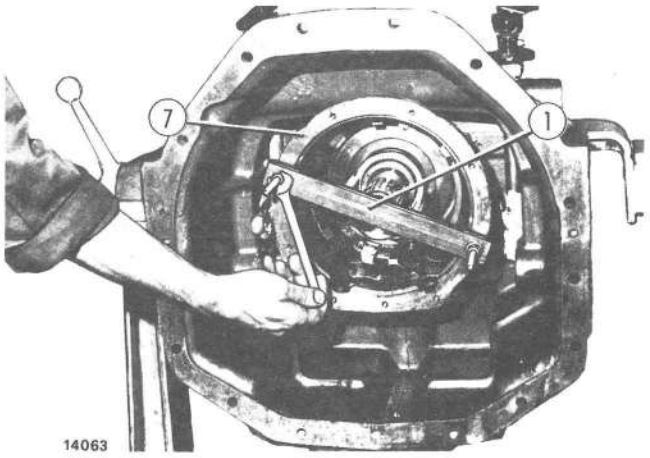


Removing reduction unit planet carrier.
11. Planet carrier - 39. Retaining ring.

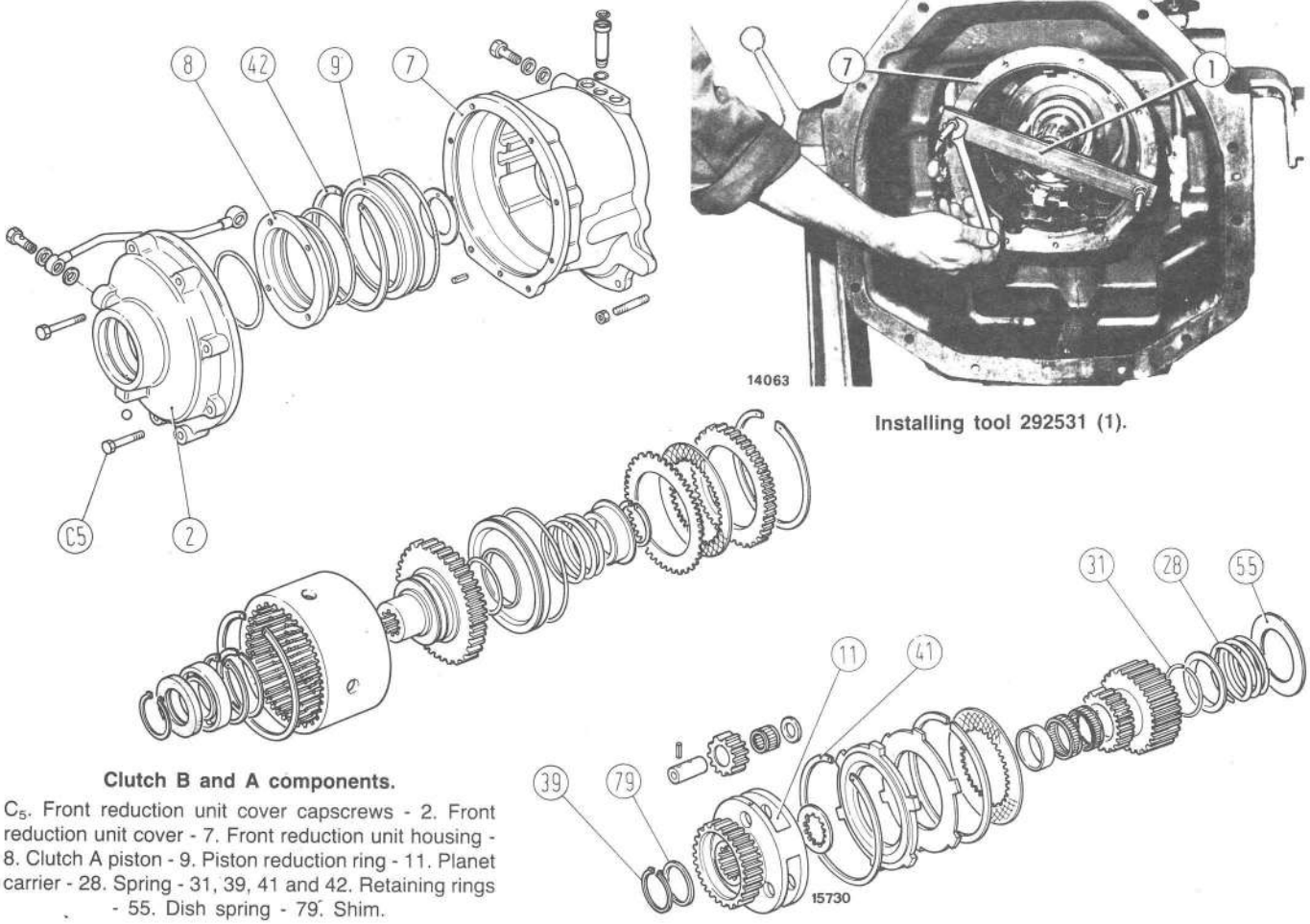
— remove retaining ring (41) and clutch A discs;

— install spring compressor **292531** (1) on front reduction unit housing (7) and compress spring (28);

— remove retaining ring (31) and slacken compressor (1) nuts to retrieve spring (28) and dish spring (55);

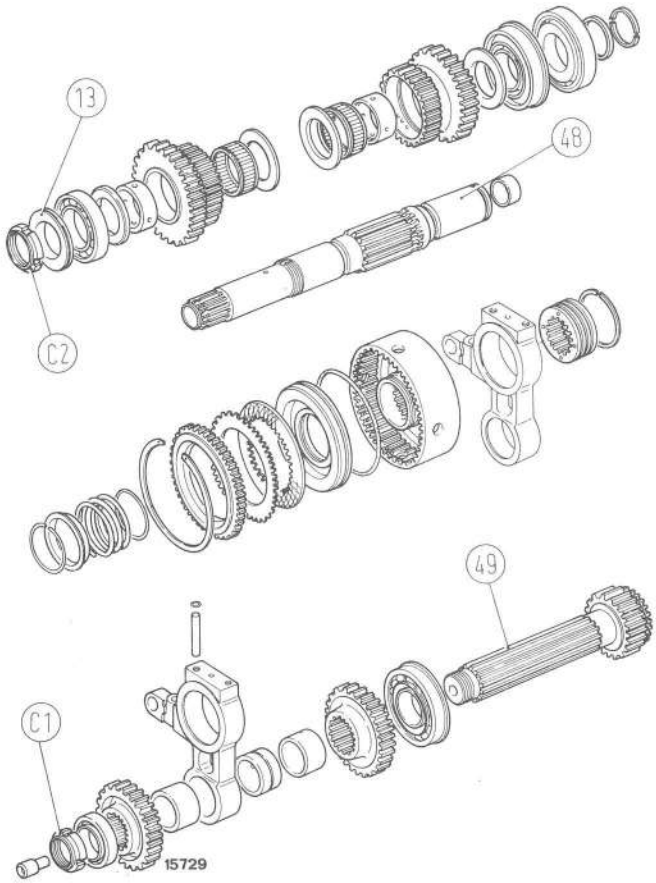


Installing tool 292531 (1).



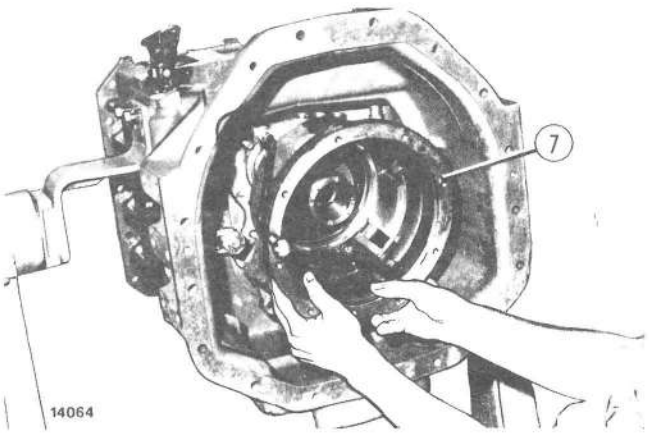
Clutch B and A components.

C_5. Front reduction unit cover capscrews - 2. Front reduction unit cover - 7. Front reduction unit housing - 8. Clutch A piston - 9. Piston reduction ring - 11. Planet carrier - 28. Spring - 31, 39, 41 and 42. Retaining rings - 55. Dish spring - 79. Shim.



Clutch D and C components.

C_1. Driven gear shaft nut - C_2. Drive gear shaft nut - 13. Bearing thrust washer - 48. Transmission drive shaft - 49. Transmission driven shaft.



Removing front reduction unit housing (7).

— install two M_6 screws in threaded holes on piston (8, page 19) and tighten until piston is forced out of seat;

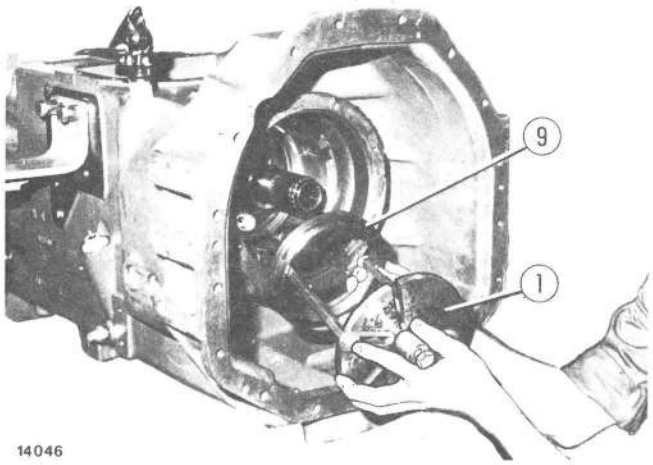
— remove retaining ring (42, page 19), install tool **292533** (1) and remove piston reduction ring (9);

— remove eight nuts retaining front reduction unit housing (7) and remove housing;

— remove transmission drive shaft bearing retaining screw (C_2) and take off thrust washer (13);

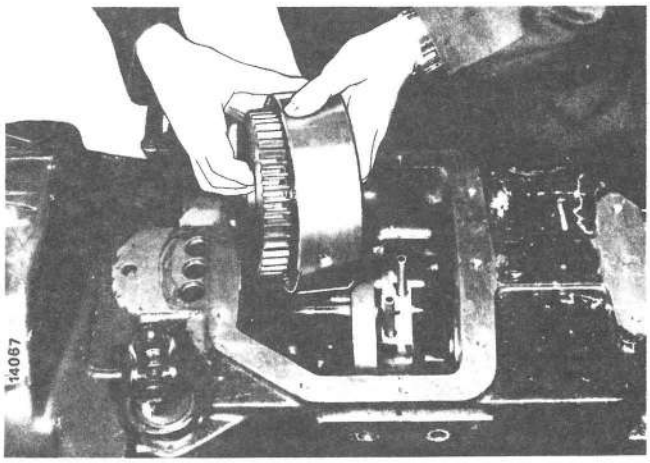
— remove transmission drive shaft using a suitable punch applied to front of shaft;

— remove clutch C. Remove retaining ring from seat on lower band brake shaft, slide block and band brake towards rear wall of transmission housing and remove clutch D;

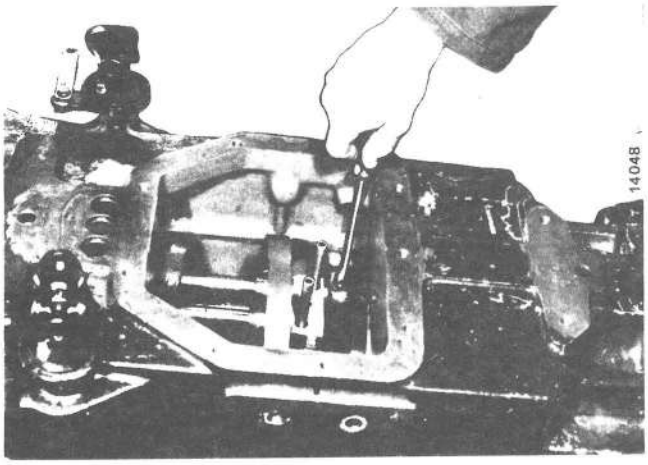


Installing tool 292533.

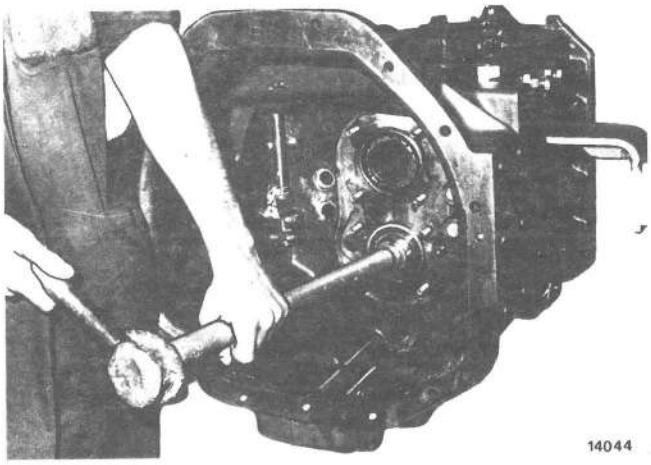
1. Tool **292533** - 9. Piston reduction ring.



Removing clutches C and D.



Removing band brake.



Removing transmission driven shaft.

— remove band brake shaft pin, take the two remaining retaining rings off the shafts and remove from housing together with band brake;

— remove transmission driven shaft bearing nut (C_1, page 20) and remove shaft using a driver as shown. Retrieve spacers and gears from inside housing;

CLUTCH B OVERHAUL

⚠ CAUTION ⚠

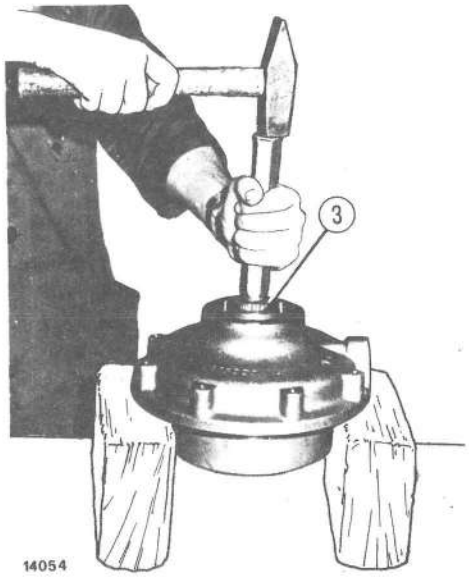
Handle all parts with care. Do not put hands or fingers between parts. Wear safety items such as goggles, safety shoes and gloves.

Proceed as follows:

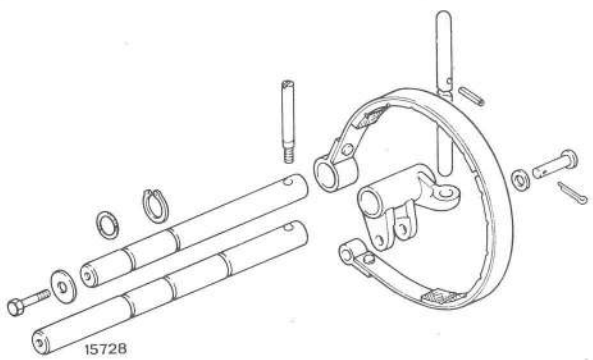
— remove seal (4, page 22) and retaining ring (34) from clutch B front cover;

— strike front end of ring gear shaft (3) to force clutch B assembly out of cover;

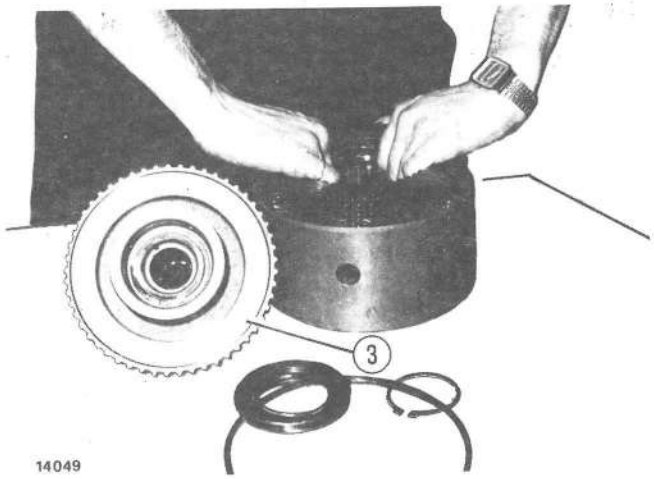
— remove retaining ring (37, page 22) and remove ring gear shaft (3) and clutch B discs as shown;



Disassembling clutch B.
3. Ring gear shaft.

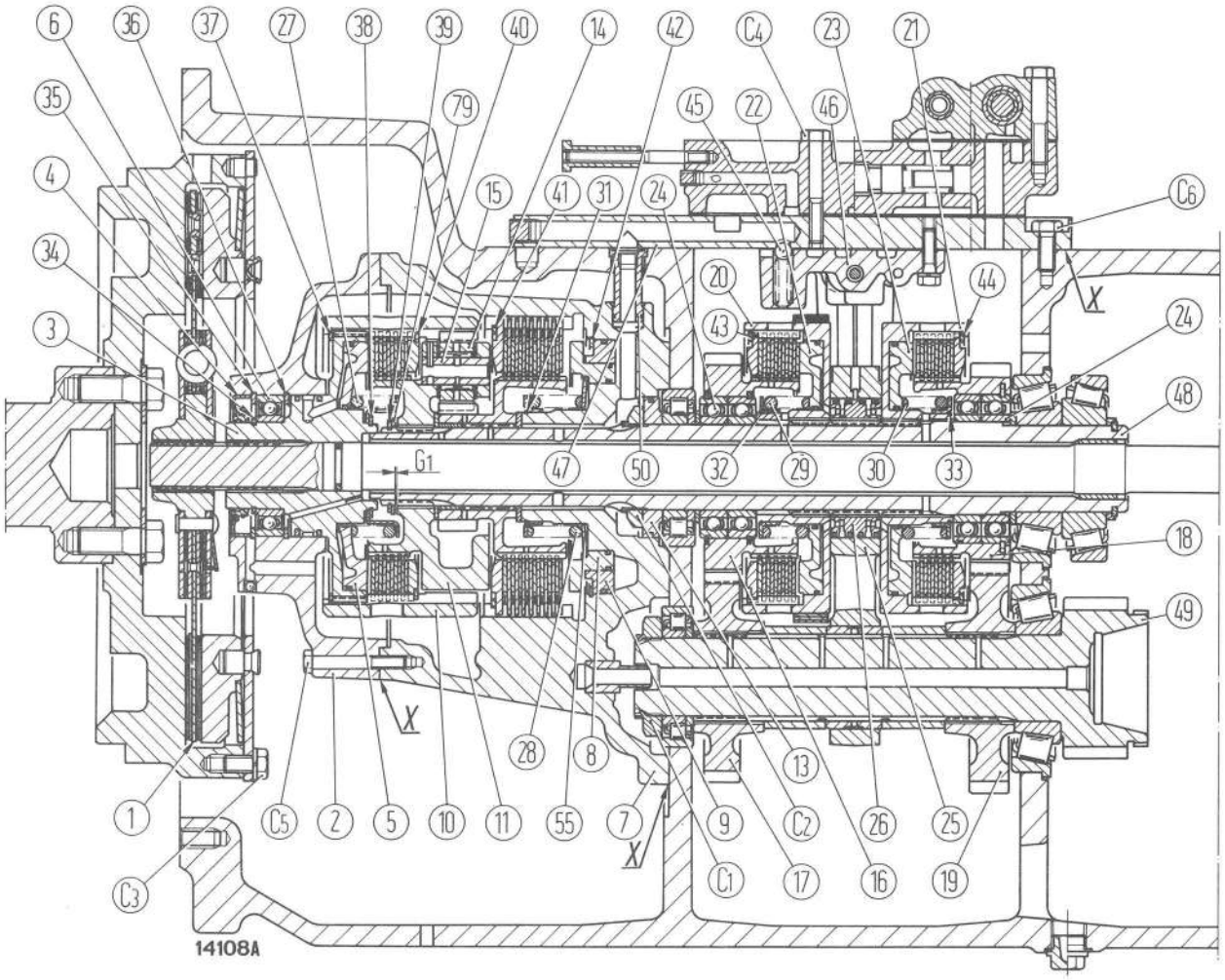


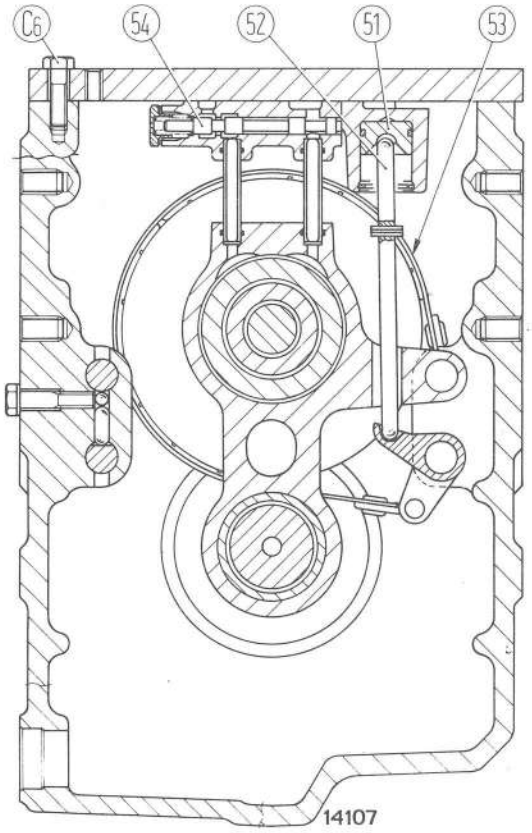
Band brake components.



Removing clutch B discs.
3. Ring gear shaft.

POWER TRAIN:
POWER SHIFT transmission

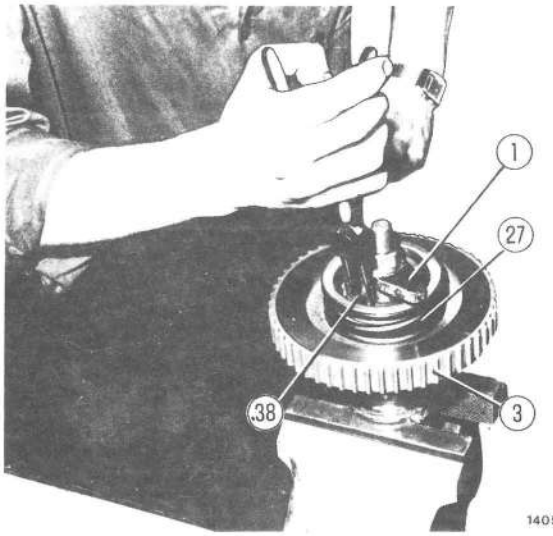




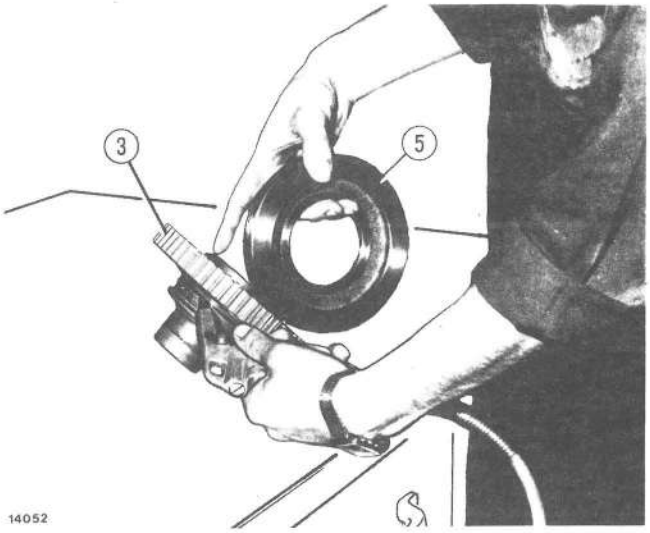
Sections through POWER SHIFT transmission.

C_1. Driven gear shaft nut - C_2. Drive gear shaft nut - C_3. Coupling capscrews - C_4. Control valve capscrews - C_5. Front reduction unit cover capscrews - C_6. Top transmission housig cover capscrews - G_1 = 0.3 to 0.5 mm (0.01 to 0.02 in) Transmission drive shaft clearance - 1. Damper plate - 2. Front reduction unit cover - 3. Ring gear shaft - 4. Seal - 5. Clutch B piston - 6. Bearing - 7. Front reduction unit housing - 8. Clutch A piston - 9. Piston reduction ring - 10. Ring gear - 11. Planet carrier - 12. Sun gear - 13. Thrust washer - 14. Planet wheel - 15. Planet journal - 16 and 18. Drive gears - 17 and 19. Driven gears - 20. Clutch D bell housing - 21. Clutch C bell housing - 22. Clutch D piston - 23. Clutch C piston - 24. Transmission drive gear bearings - 25. Outer delivery manifold - 26. Inner delivery manifold - 27, 28, 29 and 30. Disc springs - 31, 32 and 33. Spring retaining rings - 34, 35, 36, 37, 38, 39, 40, 41, 42, 43 and 44. Retaining rings - 45. Lube pressure regulating valve - 46. Delivery manifold - 47. Top transmission cover - 48. Transmission drive shaft - 49. Transmission driven shaft - 50. Oil delivery fitting - 51. Band brake piston - 52. Band brake push rod - 53. Brake band - 54. Dump valve - 55. Dish spring - 79. Shim.

Note - On assembly, throughly clean and degrease mating surfaces X and apply one of the jointing compounds indicated on page 6, section A.



Removing (installing) clutch B disc spring.
1. Spring compressor **292530** - 3. Ring gear shaft - 27. Spring - 38. Retaining ring.



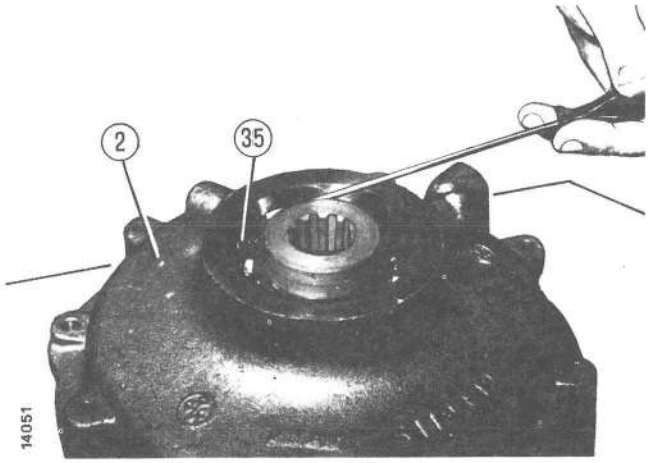
Removing clutch B piston.
3. Ring gear shaft - 5. Piston.

— install spring compressor **292530** (1) on ring gear shaft;

— tighten tool nut to compress clutch B disc spring (27) and remove retaining ring (38). Slacken tool nut and retrieve spring (27) with associated cup;

— introduce compressed air through a port on ring gear shaft (3) to force out piston (5);

When reassembling clutch B, install bearing retaining ring (35, page 22) so as not to block lube port on front reduction unit cover (2).



Installing bearing retaining ring.
2. Front reduction unit housing - 35. Retaining ring.

CLUTCH C (OR D) OVERHAUL

⚠ CAUTION ⚠

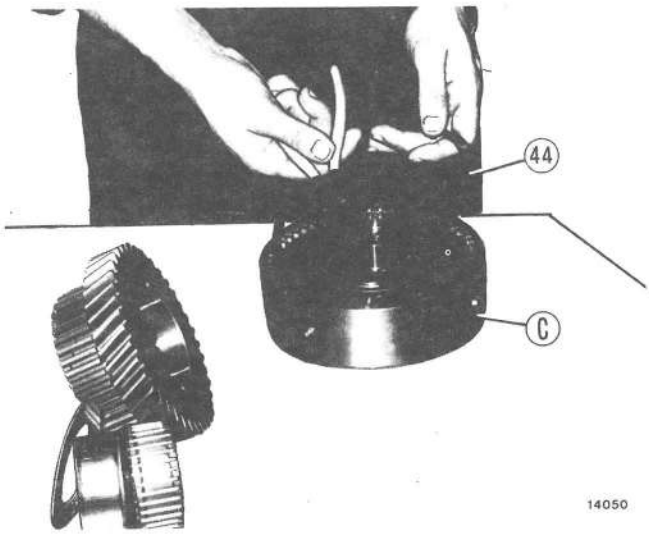
Handle all parts with care. Do not put hands or fingers between parts. Wear safety items such as goggles, safety shoes and gloves.

Proceed as follows:

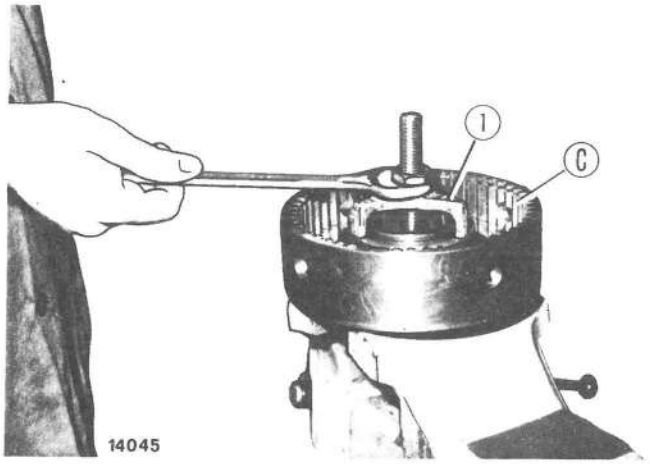
— remove retaining ring (44) and clutch discs;

— install tool **292530** (1, page 24) on clutch C bell housing;

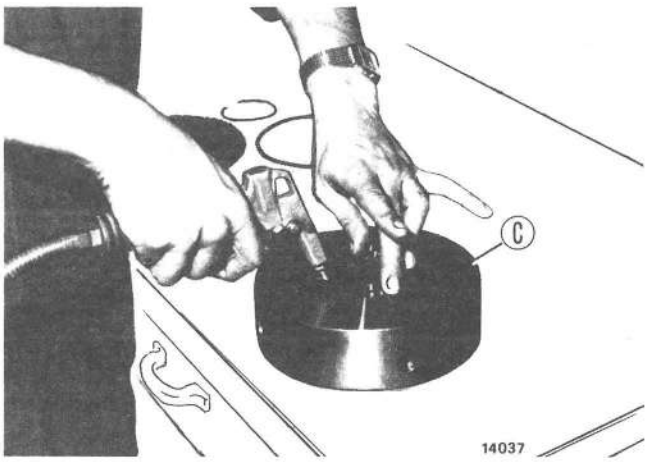
— tighten tool nut (1) to compress clutch spring (30, page 22), remove retaining ring (33, page 22), back off tool nut and retrieve spring together with cup;



Removing clutch C (or D) discs.
44. Disc retaining ring.



Removing (installing) clutch C spring.
1. Tool **292530**.



Removing clutch C piston.

— introduce compressed air through a port on clutch bell housing to force out piston (23, page 22).

CONTROL VALVE OVERHAUL

⚠ CAUTION ⚠

Use suitable tools to align holes. DO NOT USE HANDS OR FINGERS.

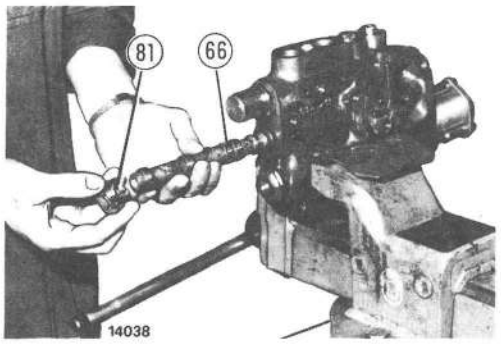
Proceed as follows:

— remove plugs (80, page 25) and retrieve gear selector spindle detent balls (73) and springs (74);

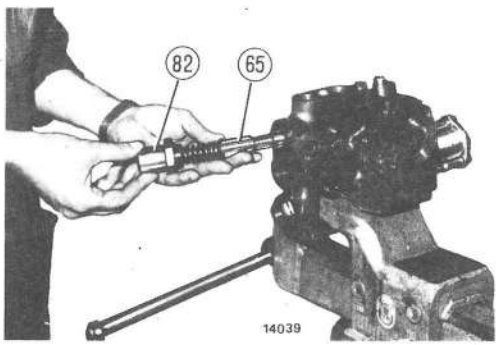
— remove plug (81, page 25) and withdraw gear selector spindle (66);

— remove plug (82, page 25) and take out pressure relief valve (65), the two associated springs and shim (78);

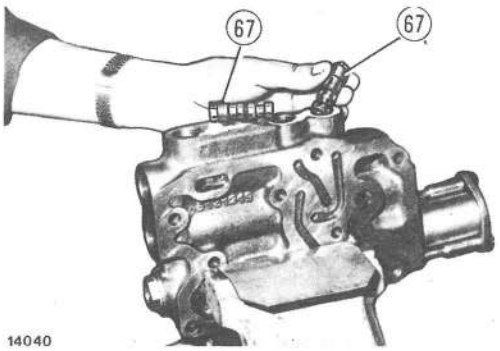
— remove the two 3-way valves (67), retrieving washer and valve balls from inside control valve body;



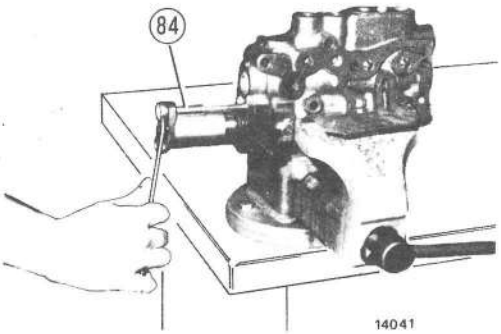
a



b

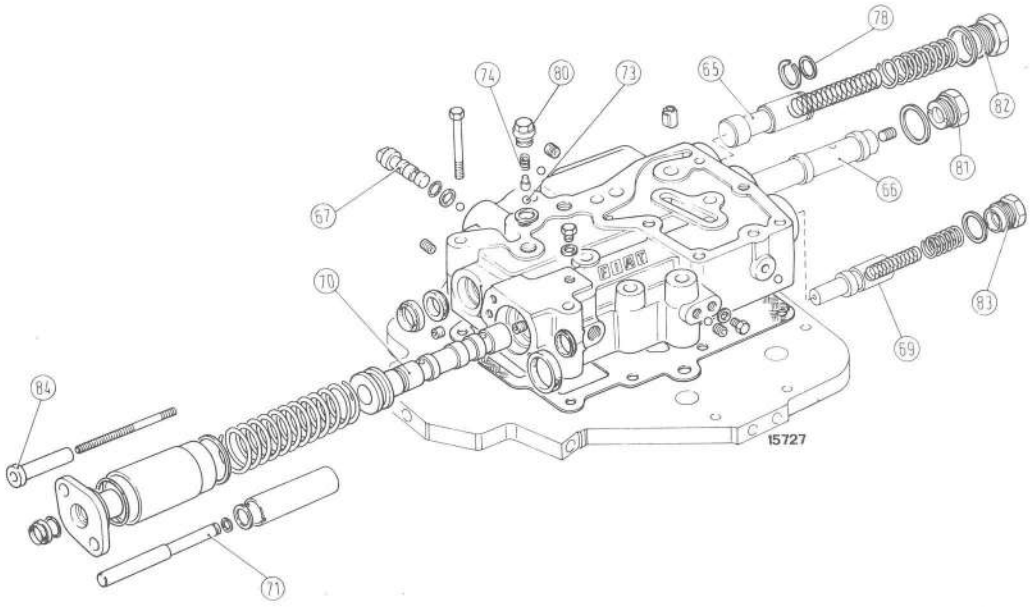


c



d

Control valve overhaul.
a. Removing (installing) gear selector spindle - b. Removing (installing) pressure relief valve - c. Removing (installing) 3-way delivery valve - d. Removing (installing) inching control - 65. Pressure relief valve - 66. Gear selector spindle - 67. 3-way delivery valve - 81 and 82. Plugs - 84. Capscrews.



Control valve components.

65. Pressure relief valve - 66. Gear selector spindle - 67. 3-way valve - 69. Inching valve - 70. Band brake valve spool - 71. Inching valve plunger - 73 and 74. Gear selector shaft detent ball and spring - 78. Pressure relief valve shim - 80, 81, 82 and 83. Plugs - 84. Capscrew.

— remove capscrews (84) and retrieve inching valve plunger (71) and band brake valve spool (70) together with associated spring;

— remove plug (83) and disassemble inching valve (69) together with associated springs.

Remove plug (85) and retrieve retarder valve pilot cup (64) together with spring (62), plunger (61) and spring (63).

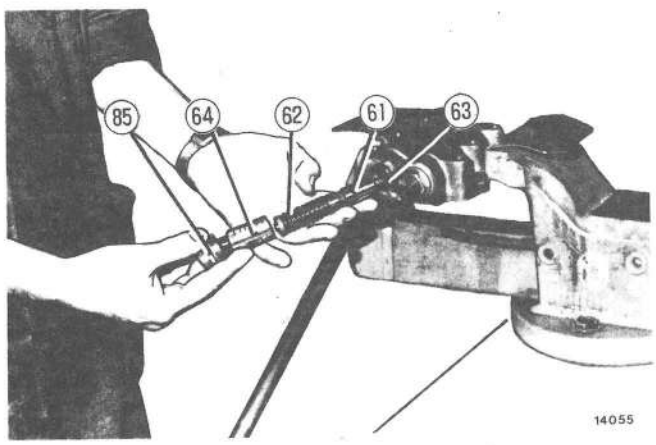
Remove plug (94) and retrieve dump valve (54) with associated spring from clutch C and D oil delivery manifold (46). Remove retaining ring (95) and retrieve band brake piston (51).

ACCUMULATOR OVERHAUL

Proceed as follows:

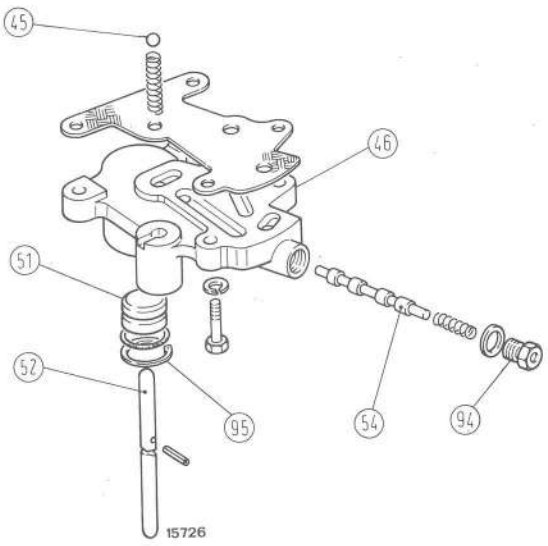
— install accumulators on tool **292534** (1, page 26).

— tighten screw of tool (1) to compress accumulator spring (93).



Disassembling retarder valves.

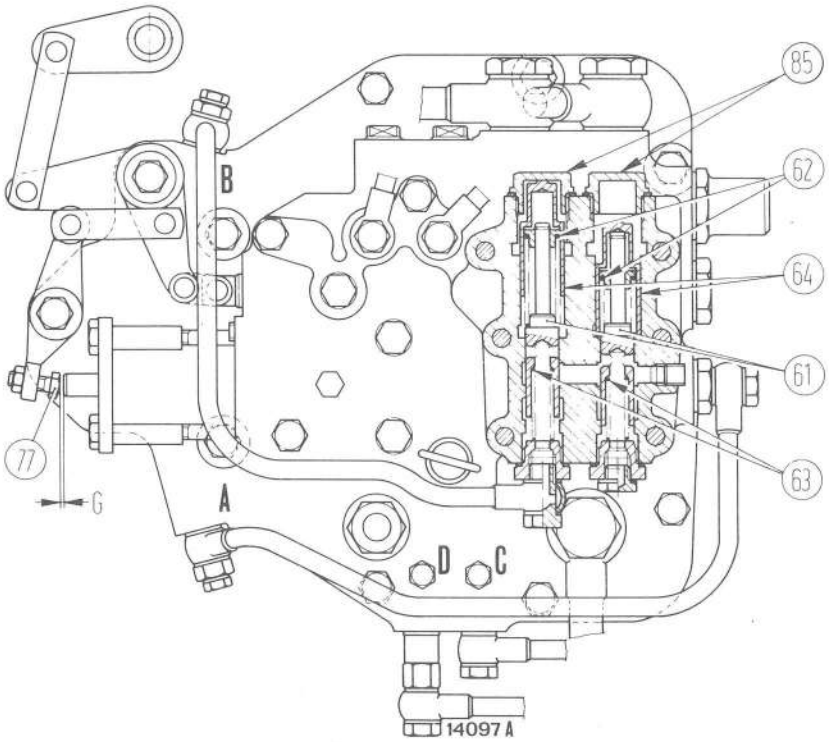
61. Plunger - 62 and 63. Springs - 64. Pilot cup - 85. Plug.

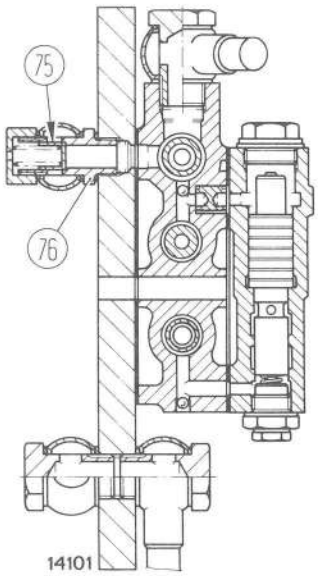


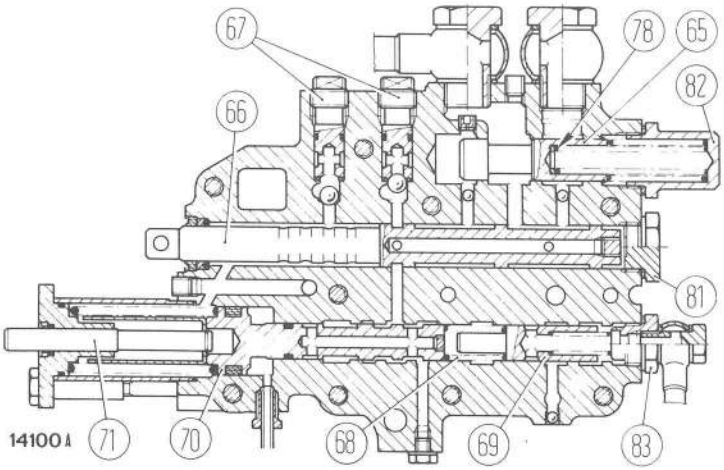
Components of clutch C and D oil delivery manifold.

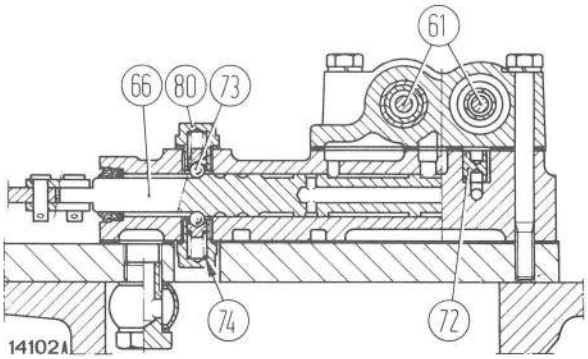
45. Lube pressure regulating valve - 51. Band brake piston - 52. Band brake lever push rod - 54. Dump valve - 94. Plug - 95. Retaining ring.

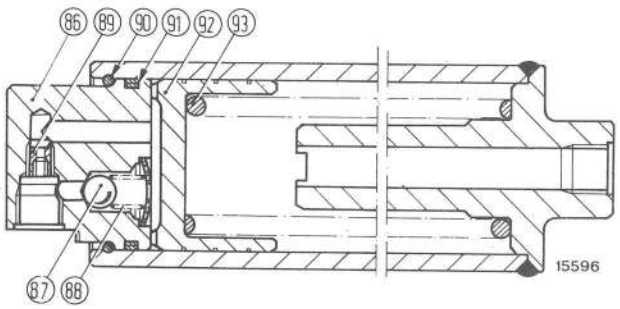
POWER TRAIN:
POWER SHIFT transmission





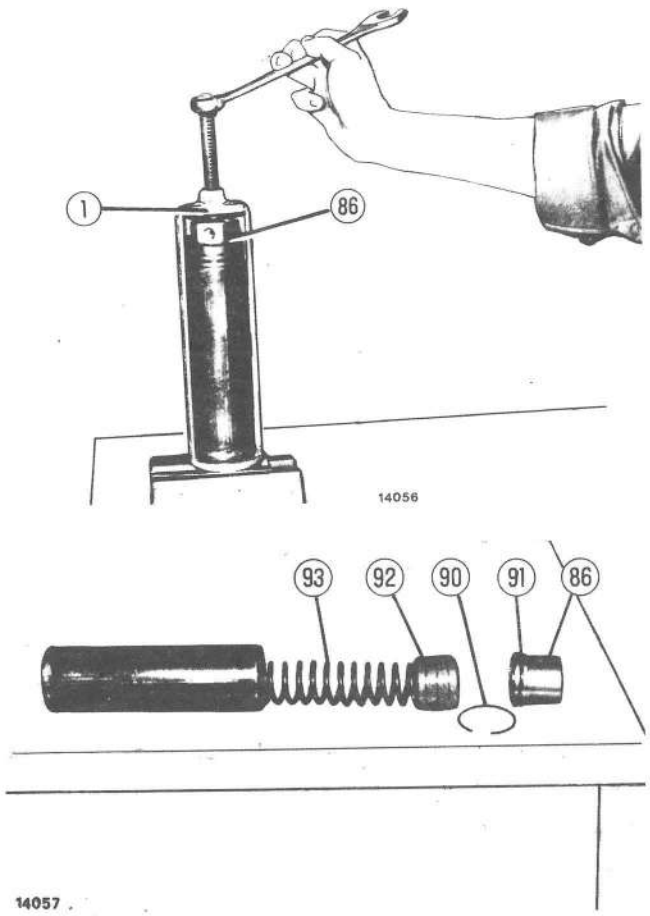






Sections through control valve, retarder valves, top cover and accumulators.

G = 0.5 to 1 mm (0.020 to 0.039 in). Clearance - 61. Retarder valve plunger - 62 and 63. Retarder valve springs - 65. Pressure relief valve - 66. Gear selector spindle - 67. 3-way valve - 68. Inching valve spring - 69. Inching valve - 70. Band brake valve spool - 71. Inching valve plunger - 72. Retarder valve nozzle - 73 and 74. Gear selector spindle detent balls and springs - 75. By-pass valve - 76. By-pass valve body - 77. Inching adjustment screw - 78. Shim - 80, 81, 82, 83. 85. Plugs - 86. Accumulator cap - 87. Check valve - 88. Spring - 89. Accumulator restriction - 90. Retaining ring - 91. Seal - 92. Piston - 93. Spring.



Overhauling accumulators.

1. Tool **292534** - 86. Cap - 90. Retaining ring - 91. Seal - 92. Piston - 93. Spring.

— Remove retaining ring (90), back off screw of tool (1) to release load on spring (93) and retrieve accumulator components as shown above.

POWER SHIFT TRANSMISSION ASSEMBLY

Note the following points when assembling POWER SHIFT transmission.

⚠ WARNING ⚠

Lift and handle all heavy components using a suitable hoist. Ensure that units or parts are supported by suitable slings or hooks. Ensure that no one is in the vicinity of load to be lifted.

⚠ WARNING ⚠

Use suitable tools to align holes. DO NOT USE HANDS OR FINGERS.

⚠ WARNING ⚠

Handle all parts carefully. Do not put hands or fingers between parts. Wear safety equipment such as goggles, gloves and safety shoes.

— Install clutches C and D, front reduction unit housing (7, page 22) and all components shown in figure on page 28.

— Install tool **293805** (page 28) on transmission housing to maintain drive shaft in position.

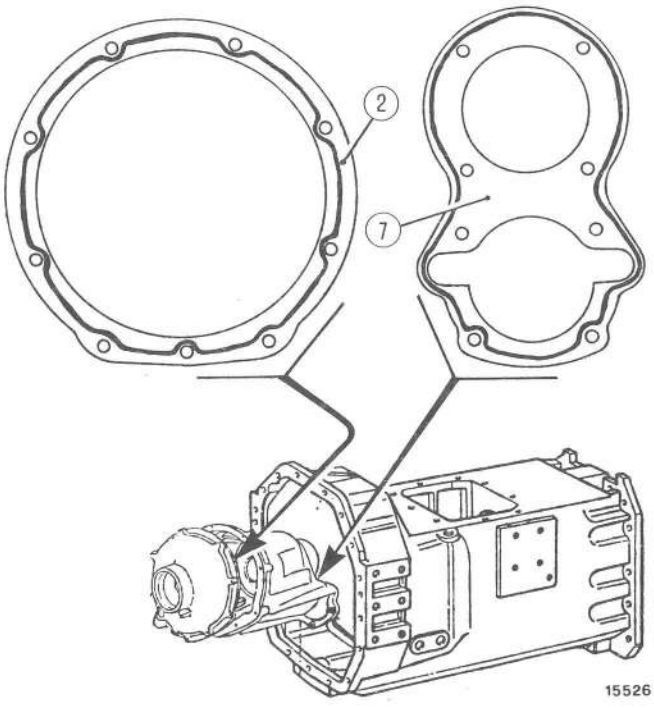
— Move planet carrier (1) by hand alternately in the two directions indicated by black arrows on page 28 and, using a dial gauge.

— Install a shim (79, page 22) to produce an end play (G_1, page 22) of .3 to .5 mm (.01 to .02 in).

— With shim installed (79, page 22), re-check end play.

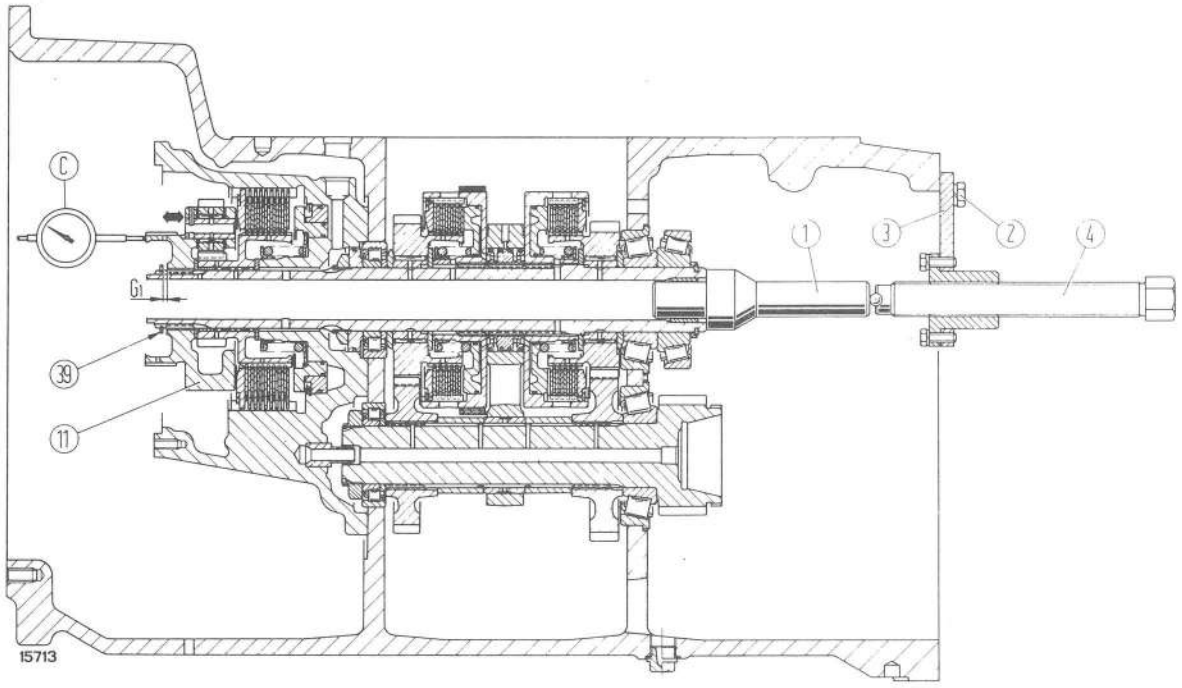
NOTE - If splitter is installed, it is not necessary to install tool **293805** (page 28) on housing, as the transmission drive shaft (48, page 22) is held in place by the splitter.

— Complete assembly referring to illustrations on pages 22 and 26.



Applying jointing compound for front reduction unit cover (2) and housing (7) installation.

Jointing compound types are indicated on page 6, section A.



Adjusting transmission drive shaft end play.

C. Dial gauge - G_1 = .3 to .5 mm (.01 to .02 in). Drive shaft end play. 1 Tool **293805** shaft - 2. Plate screws - 3. Tool **293805** plate - 4 Tool forcing screw - 11. Planet carrier - 35. Retaining ring.

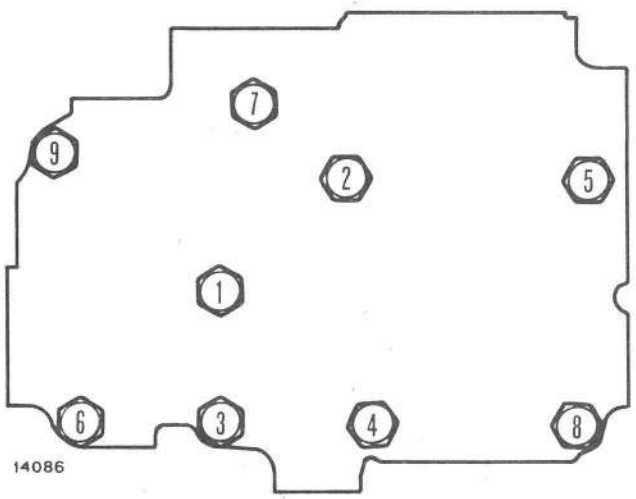
Note - Direction of carrier movement arrowed.

— Before installing front reduction unit housing (7, page 27) and cover (2), throughly clean and degrease mating surfaces and apply a 2 mm (.08 in) dia. bead of jointing compound as shown on page 27. Jointing compound types are indicated on page 6, section A.

CONTROL VALVE INSTALLATION

To install control valve on transmission housing cover proceed as follows:

— Position control valve body complete with retarder valve block on transmission top cover.



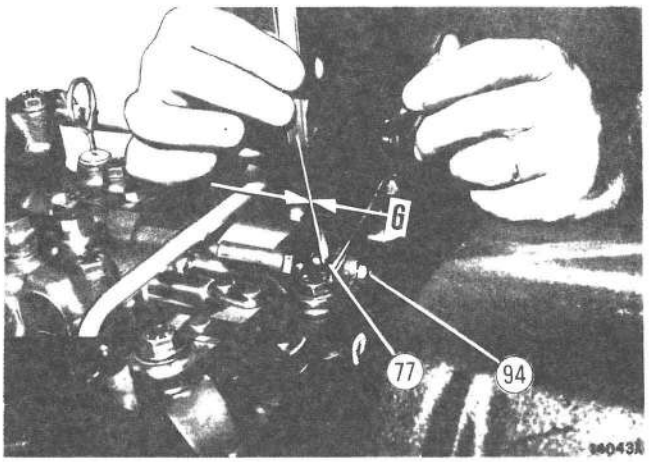
Control valve retaining screw tightening sequence.

— Tighten retaining screws to 20 Nm (2 kgm or 14.75 ft.lb) in the sequence shown.

— Further tighten screws to 49 Nm (5 kgm or 36.2 ft.lb).

CONTROL LINKAGE INSTALLATION

When installing control linkage, check that clearance (G) between adjustment screw (77) and inching valve plunger (71, page 26) is .5 to 1 mm (.020 to .039 in).



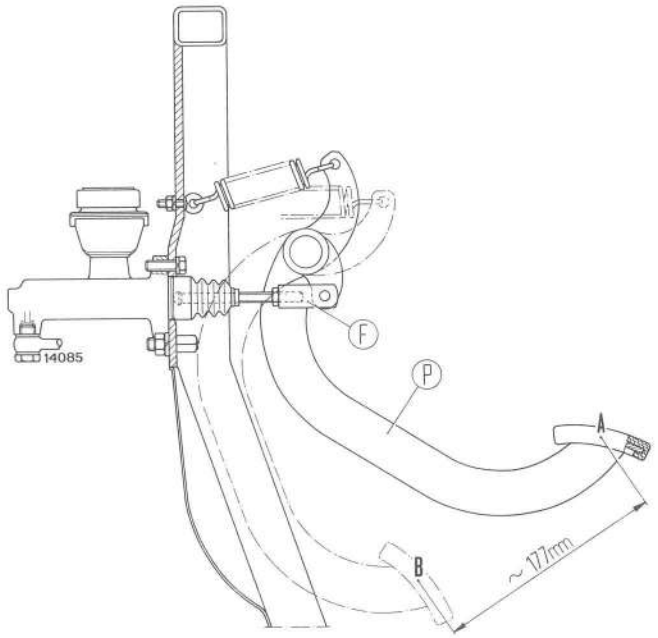
Adjusting inching pedal.

G = .5 to 1 mm (.020 to .039 in). Clearance - 77. Inching adjustment screw - 94. Lock nut.

If not, slacken lock nut (94, page 28) and tighten or slacken adjustment screw as necessary. Then tighten lock nut (94).

INCHING PEDAL ADJUSTMENT

Check that inching pedal (P) stroke between rest position A and position B (pedal in contact with mechanical stop) is approximately 177 mm or 7 in.
If necessary adjust through yoke (F).



Inching pedal assembly.

A. Pedal rest position - B. Pedal (P) in end of stroke position - F. Yoke - P. Inching pedal.

TRANSMISSION HOUSING INSTALLATION

⚠ WARNING ⚠

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings or hooks.
Watch out for people in the vicinity.

⚠ WARNING ⚠

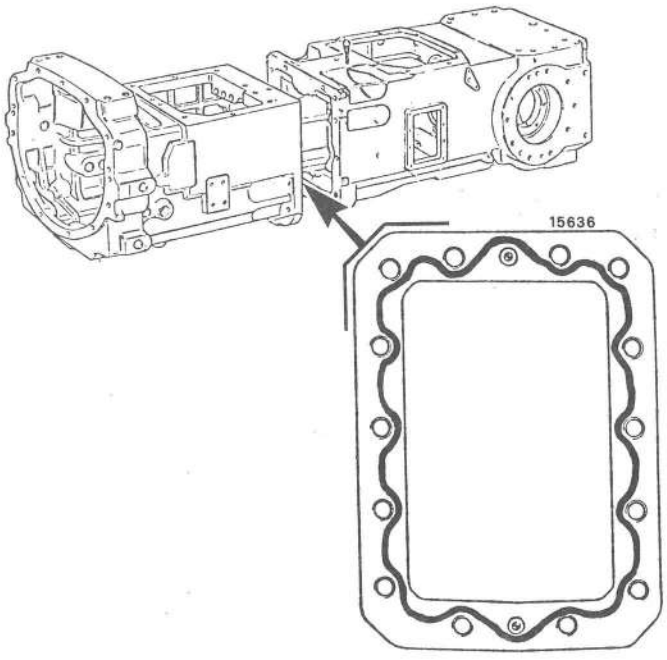
Use proper tools to bring holes into alignment.
DO NOT USE FINGERS OR HANDS.

⚠ WARNING ⚠

Handle all parts with extreme care. Keep hands and fingers from between parts.
Wear authorized protective equipment such as safety glasses, gloves and shoes.

Before mounting the transmission housing back onto the rear drive housing, accurately clean and degrease their mating surfaces, then apply a bead of jointing compound about 2 mm in diameter, following the pattern shown.

Join the two housings, mount and secure the units and parts removed during the disconnection operations; take particular care in introducing the PTO drive shaft correctly into the splitter/transmission drive shafts.



Applying jointing compound on transmission and rear drive housing mating faces.

Jointing compound types are indicated on Sect. A, page 6.

HYDRAULIC TESTS ON POWER SHIFT TRANSMISSION

After servicing and installing POWER-SHIFT transmission, check hydraulic leakage on bench as follows:

a. Checking clutches A, B, C, and D with transmission housing on bench and control valve removed.

Proceed as follows:

— Install transmission housing without control valve on revolving stand.

— Install top cover (P) complete with clutch C and D delivery manifold.

— Install fixture **292511** on transmission housing, applying jointing compound on surfaces **X**.

— Establish connections as shown in diagram below.

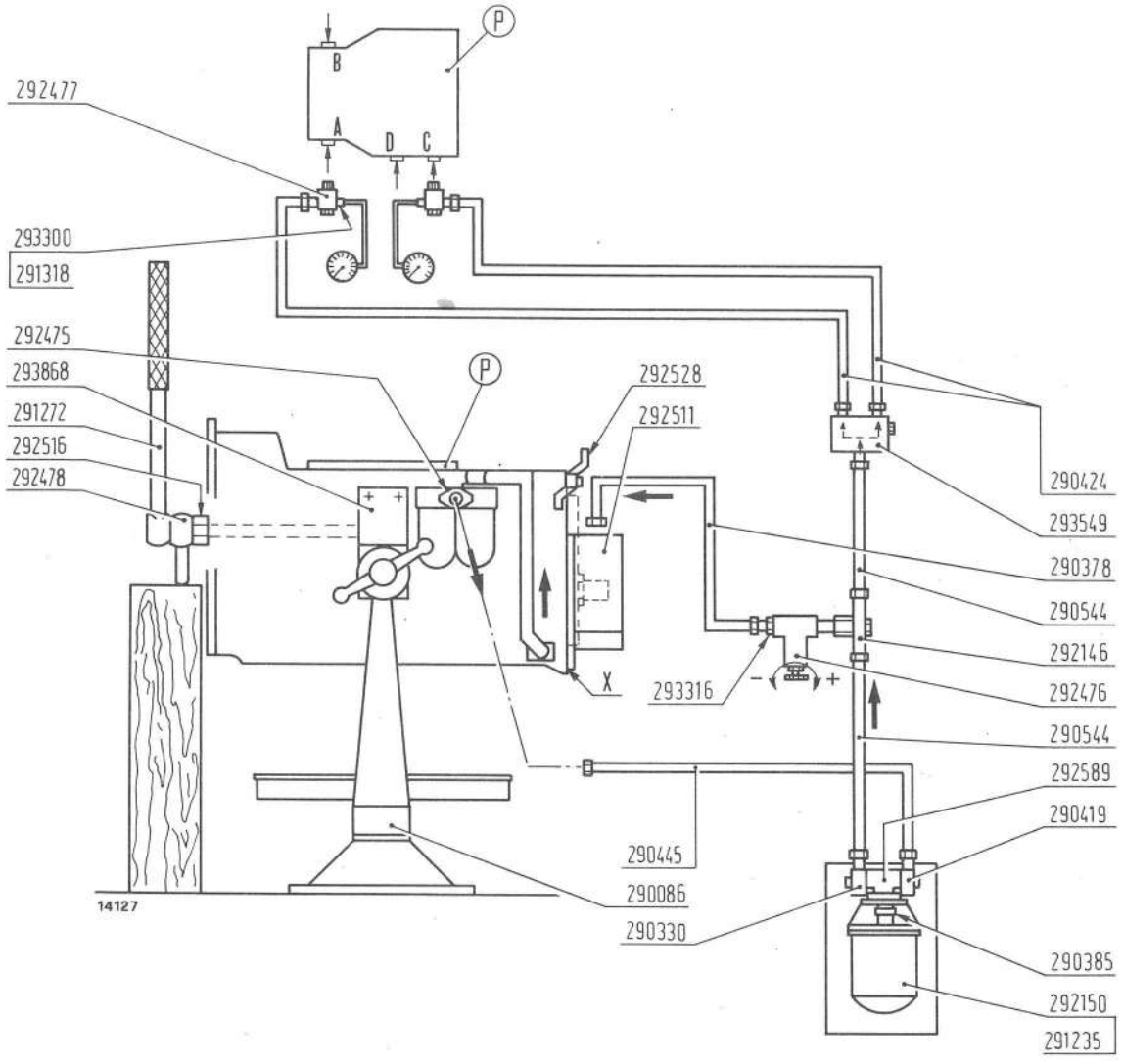
NOTE - When installing transmission housing on tractor, both filters used during hydraulic bench tests should be replaced.

— Fill transmission housing with **oliofiat TUTELA GI/M** oil through fixture **292511**. Oil level should reach centerline of splitter driven shaft.

— Install tool **292528** on splitter driven shaft and engage splitter high range.

— Connect adapters **292477** to clutches A and C (these connections correspond to first gear).

— Activate pump and adjust valve **292476** so that pressure is gradually increased to 8 bar-kg/cm^2 (113.78 psi) as read off pressure gauges for each clutch connected to adapters **292477** as shown in diagram below.



Checking clutches A, B, C and D with transmission housing on bench and control valve removed.

— apply a 98 da Nm (100 kgm or 723 ft.lb) torque to transmission input shaft and check that clutches A and C do not slip or slip only slightly;

— direct 8 kg/cm^2 or 113.78 psi pressure to each clutch pair in turn following the gear shift sequence, i.e. to clutches A and D (corresponding to second gear), clutches B and C (corresponding to third gear) and to clutches B and D (corresponding to fourth gear). At the same time, check that clutches in question do not slip or slip only slightly when a 98 da Nm (100 kgm or 723, ft.lb) torque is applied to transmission input shaft;

— clutches which slip at torques below 78 da Nm (80 kgm or 575 ft.lb) at 8 kg/cm^2 (113.7 psi) pressure must be overhauled.

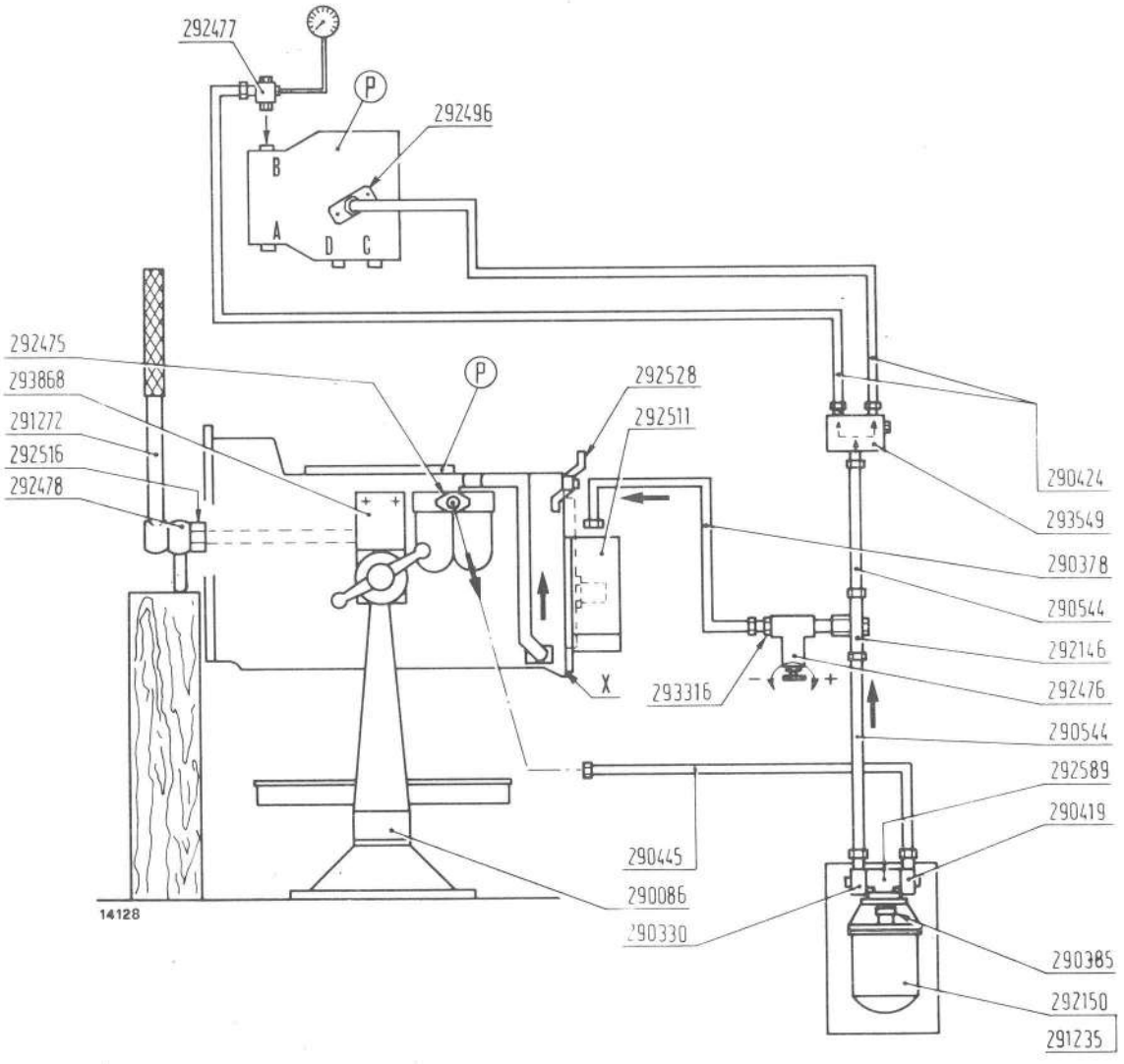
— to determine which clutch is slipping, cross-check three gears (first, second and third) as follows:

- slippage in first but not in second = overhaul clutch C.
- slippage in first and second but not in third = overhaul clutch A.
- slippage in second but not in first = overhaul clutch D.
- slippage in third but not in first and second = overhaul clutch B.

b. Checking band brake torque with transmission housing on bench and control valve removed.

Proceed as follows:

— with top cover (P) installed on transmission housing, connect adapter **292477** to clutch B and adapter **292496** to band brake supply port;



Checking band brake torque with transmission housing on bench and control valve removed.

— activate pump and gradually increase pressure through regulating valve **292476** (see diagram on page 31) until pressure gauge connected to adapter **292477** reads 16 kg/cm^2 or 227.5 psi;

— in these conditions, check that transmission drive shaft rotates upon application of a torque between 8 and 15 kgm (114 to 213 ft.lb);

c. Checking pressure relief valve calibration with transmission housing on bench and control valve installed.

Proceed as follows:

— install control valve complete with retarder valve block on transmission housing cover;

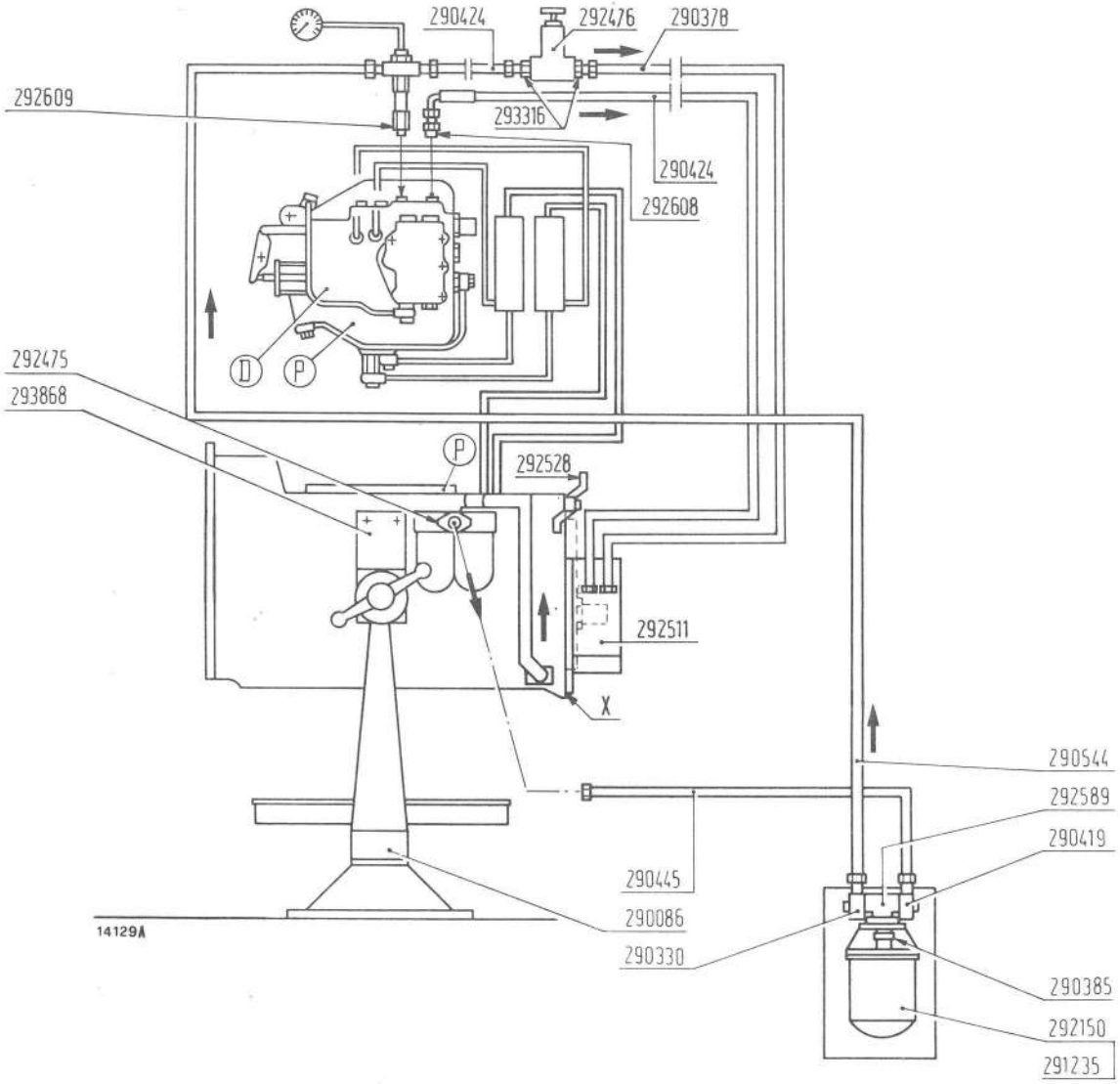
— install accumulators and connect pipes as shown in diagram below;

— activate pump, gradually increase pressure through regulator valve **292476** and check that pressure relief valve (65, page 26) couts in at 15.5 to 16.5 bar-kg/cm^2 or 220.46 to 234.68 psi. If not, adjust through shims (78, page 26) increasing shim thickness if pressure reading is below specified value and increasing thickness if above.

d. Checking clutches A, B, C and D with transmission housing on bench and control valve installed.

Proceed as follows:

— maintain connections as shown below for pressure relief valve calibration check.



Checking pressure relief valve calibration with transmission housing on bench and control valve installed. Checking clutches A, B, C and D.

— activate pump and gradually increase pressure through regulator valve **292476** (see diagram on page 32) until pressure relief valve cuts in;

— cut off exhaust through regulator valve **292476** (see page 32);

— engage first through fourth gears in succession through gear selector spindle (66, page 26). For each gear, check that pressure gauge reading stabilizes at 15.5 to 16.5 bar-kg/cm^2 or 220.46 to 234.68 psi (apply clutches A and C for first gear, A and D for second, B and C for third, and B and D for fourth).

Checking clutches A,B,C, and D and band brake with transmission housing installed on tractor.

With transmission housing on tractor, pressure gauge set **293110** can be used to check clutches A,B,C,D and band brake.
Proceed as follows:

— run tractor to bring transmission oil temperature to 30 to 35°C;

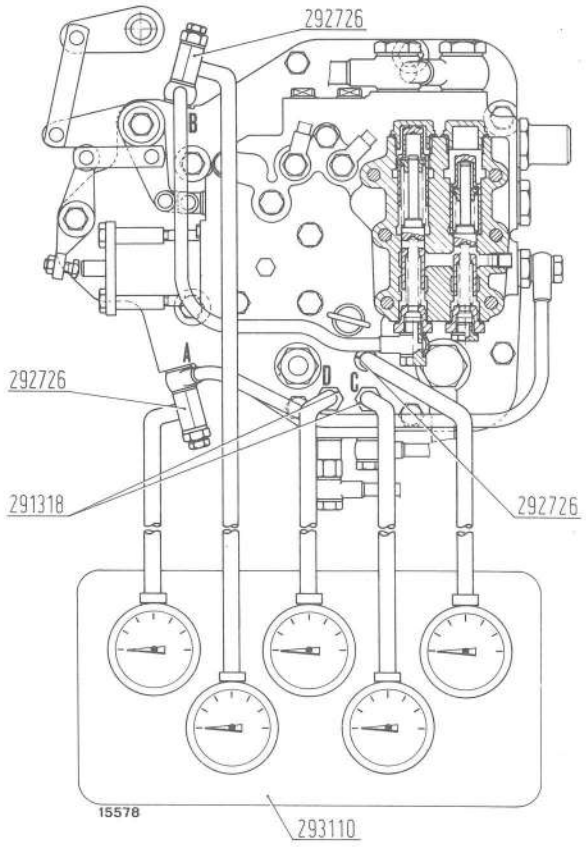
— shut off engine and establish connections shown in diagram alongside, noting thath pressure gauges of kit **293110** are to be connected to clutches C and D through adapters **291318** and to clutches A,B, and band brake through adapters **292726**;

— start tractor and run at part throttle. Engage first through fourth gears in succession and check that pressure gauge reading for each gear stabilizes at 15.5 to 16.5 kg/cm^2 or 220.46 to 234.68 psi. To engage gears, apply clutches as follows:

1st gear = clutches A and C;
2nd gear = clutches A and D;
3rd gear = clutches B and C;
4th gear = clutches B and D.

To check band brake operation, depress inching pedal (P, page 29). If pressure readings for the four clutches and band brake are not as specified, adjust through shims (78, page 26). Increase shim thickness if pressure reading is lower than specified value, and decrease shim thickness if it is higher.
If pressure readings for one or two clutches or for the band brake alone are not as specified, overhaul the components concerned.

NOTE - Clutch and band brake inspection may also be carried out using gauge kit **293300** or **292870** (ex **293300**).



Checking clutches A, B, C and D and band brake with transmission housing installed on tractor.
293110 Pressure gauge kit.

With the above tool check each gear connecting two gauges at a time to two clutches using fittings **292726** (new) and **291318**, adhering to the sequence specified (1st gear = clutches A and C, 2nd gear = clutches A and D, etc.).

Tools to be made in the workshop

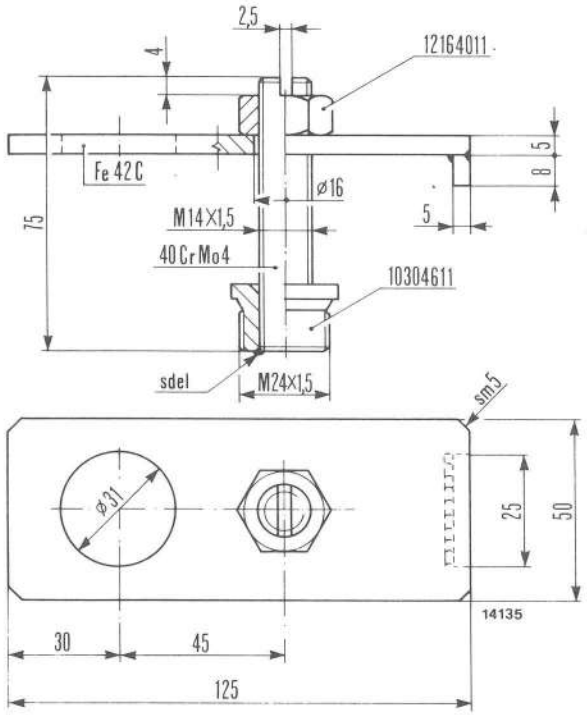
Tools **50036** and **50034** as shown on page 34 should be made in the workshop to facilitate pressure relief valve cap removal and splitter shifter fork roll pin removal.

Transmission drive shaft bearing replacement

To facilitate transmission drive shaft taper roller bearing replacement, make tool **50035** as shown on page 34.

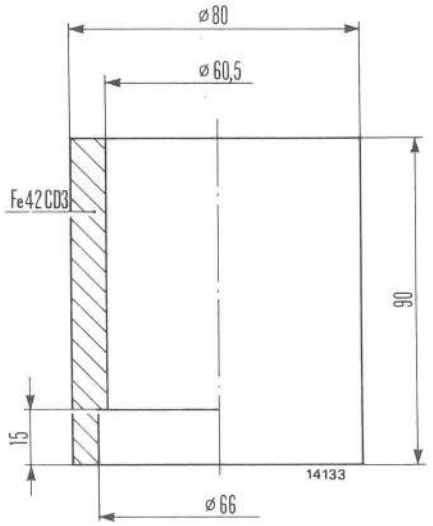
Then proceed as follows:

— using tool **50035** (1) push bearing cones (3 and 4) and thrust washer (5) inwards along shaft;



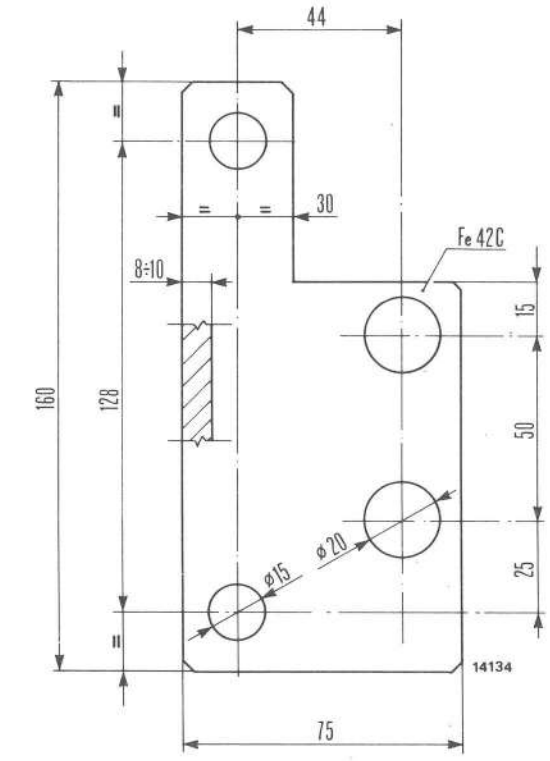
Pressure relief valve cap remover/replacer - dimensions in mm (Mark tool with number 50036).

— remove two split rings (6), retaining ring (7) and bearing cones (3 and 4);

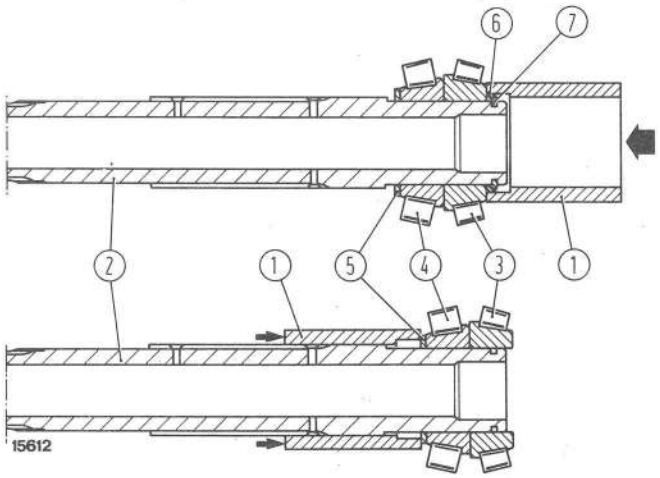


Transmission drive shaft bearing remover/replacer - dimensions in mm (Mark tool with number 50035).

— when installing new bearings, heat bearing cones and ensure that upon completion of assembly cones are in full contact with split rings (6).

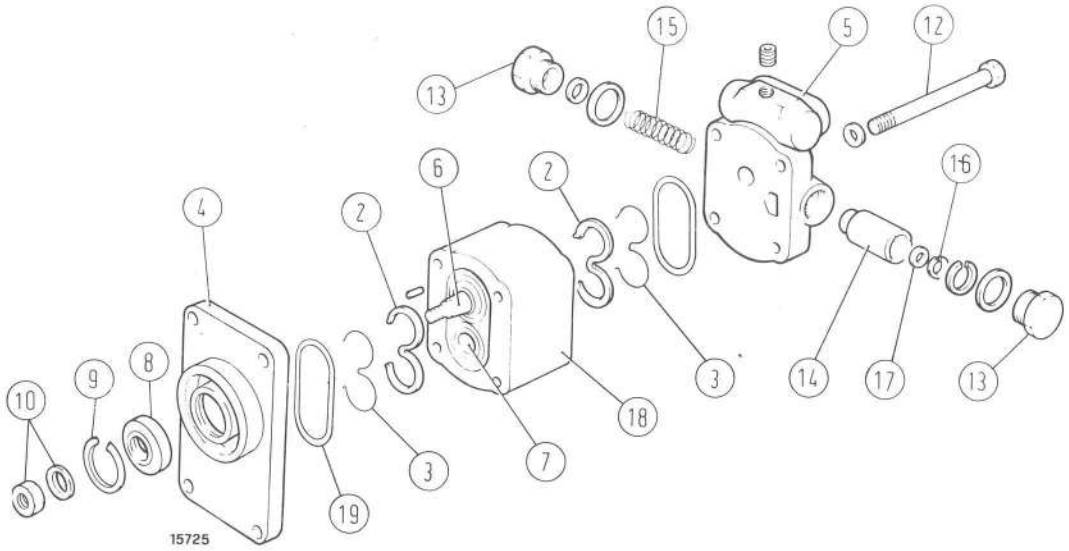


Retainer for splitter shifter fork roll pin removal - dimensions in mm (Mark tool with number 50034).



Removing transmission drive shaft bearings.

1. Tool **50035** - 2. Transmission drive shaft - 3 and 4. Bearing cones - 5. Thrust washer - 6. Split rings - 7. Retaining ring.

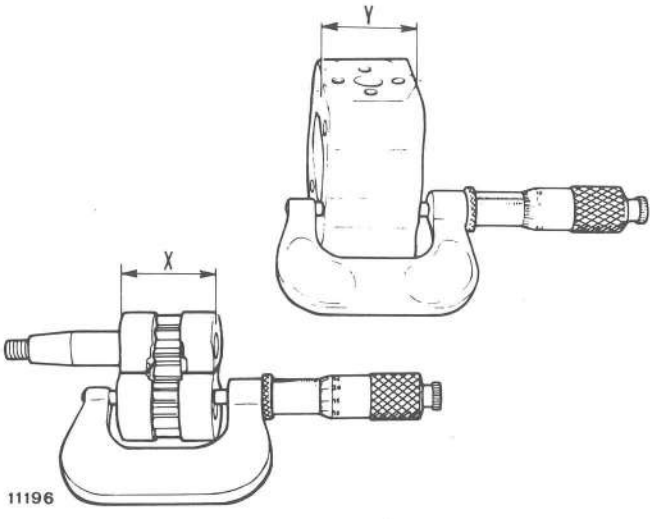


POWER SHIFT transmission and power steering pump components

2. Seals - 3. Anti-extrusion rings - 4. Front cover - 5. Flow proportioning valve body - 6. Drive gear shaft - 7. Driven gear shaft - 8. Seal - 9. Retaining ring - 10. Nut securing sleeve to pump drive shaft and associated lock washer - 12. Capscrew - 13. Plugs - 14. Flow proportioning valve - 15. Spring - 16. Retaining ring - 17. Calibration orifice - 18. Pump body - 19. Cover seal.

POWER SHIFT TRANSMISSION AND POWER STEERING PUMP

Pump is valve gear driven through a dog clutch.
To gain access to drive gear, remove valve gear cover.
Oil circulating in pump automatically lubricates and restores gear end float.

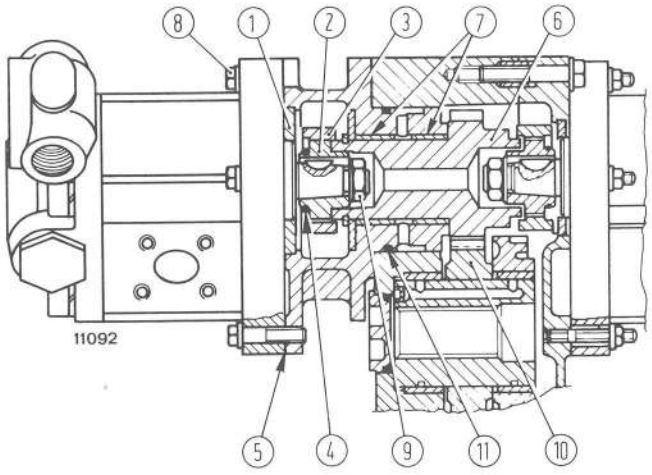


Checking gear end clearance in pump body.

NOTE - Dimension X to be smaller than dimension Y by 0.10 to 0.17 mm (0.004 to 0.007 in).

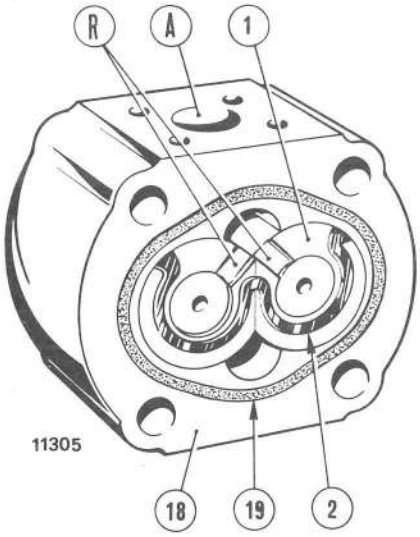
Overhaul

Refer to figure above when disassembling pump.
Mark the position of internal parts in order to restore them to their original position on assembly.
Check gear side face flatness and squareness relative to bearings, smearing the surfaces in question with carbon black.
Small defects may be rectified using wet zero-grade emery cloth.



Section through pump drive (160-90 Turbo and 180-90 Turbo).

1.Centralizer - 2. Pump drive sleeve - 3. Sleeve drive ring - 4. Retaining ring - 5. Seal - 6. Driven gear - 7. Gear bushings - 8. Pump capscrews - 9. Sleeve nut - 10. Drive gear - 11. O-rings.



Installing seals on bearings.
A. Suction port - R. Lube fillets - 1. Bearings - 2. Seals - 18. Pump body - 19. Seals.

Check gear end clearance in the pump body with bearings in position. The correct end float is 0.10 to 0.17 mm (0.004 to 0.007 in). Any pump body face dressing, with a view to restoring the specified end clearance, should be carried out using wet zero-grade emery cloth, removing as little material as possible.

Liberally lubricate all pump parts using service oil, then assemble noting the following points:

— ensure that reference marks applied on disassembly are in register;

— the bearings, which should slide into position by hand, must be introduced so that lube fillets (R) face towards suction port (A) as shown, and with front surfaces carrying seals (2) and anti-extrusion ring (3) in contact with flow proportioning unit (5, page 35) or front cover (4);

— install cover (4) and flow proportioning unit (5) on pump body, apply LOCTITE 648 jointing compound to threads of capscrews (12) and tighten capscrews to contact;

— install pump on centralizer plate **291756** (1) and tighten four bolts (2);

Note - This operation ensures that drive shaft is centered with respect to cover (4, page 35) and seal (8).

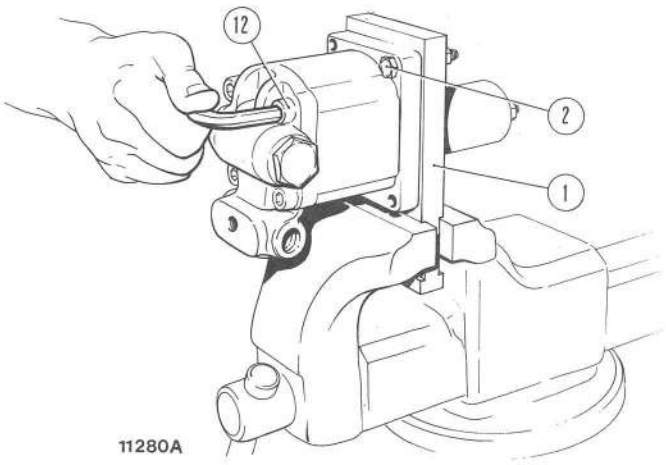
— progressively tighten cover capscrews (12) to 39 Nm (4 kgm or 288 ft.lb) in alternating sequence;

— back off four bolts (2), remove pump from centralizer plate and install seal (8, page 35) and retaining ring (9);

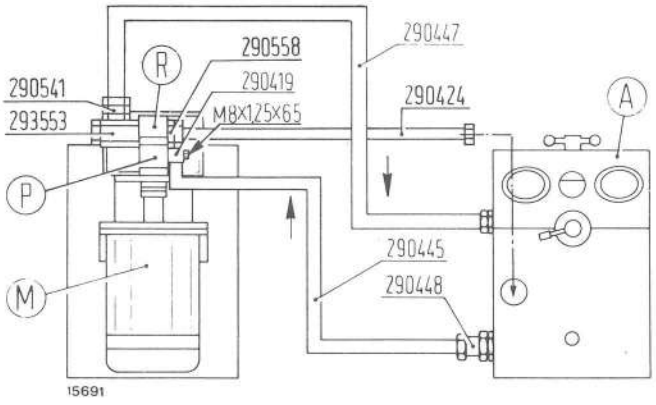
Output test

Couple the pump complete with flow proportioning unit to the drive motor and connect to output test machine using the equipment shown in figure.
Use **oliofiat IDRAULICAR AP51** (SAE 20) oil supplied with the test machine and carry out the output test at the specified temperature and pressure settings.

Note - Constant 17 to 21 litre/minute (30 to 37 pints/minute) output from flow proportioning unit R which supplies tractor power steering system must be exhausted on tester **291231** through line **290424** as shown below.



Assembling hydraulic pump.
1. Centralizer plate **291756** - 2. Plate bolts - 12. Pump body capscrews.

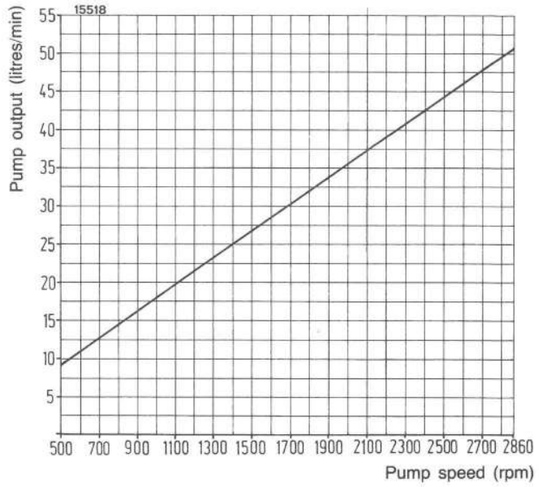


Pump output test set-up.
A. Output tester **291231** - M. Motor **291235** - P. POWER SHIFT transmission and power steering pump under test with flow proportioning valve - R. Flow proportioning valve.

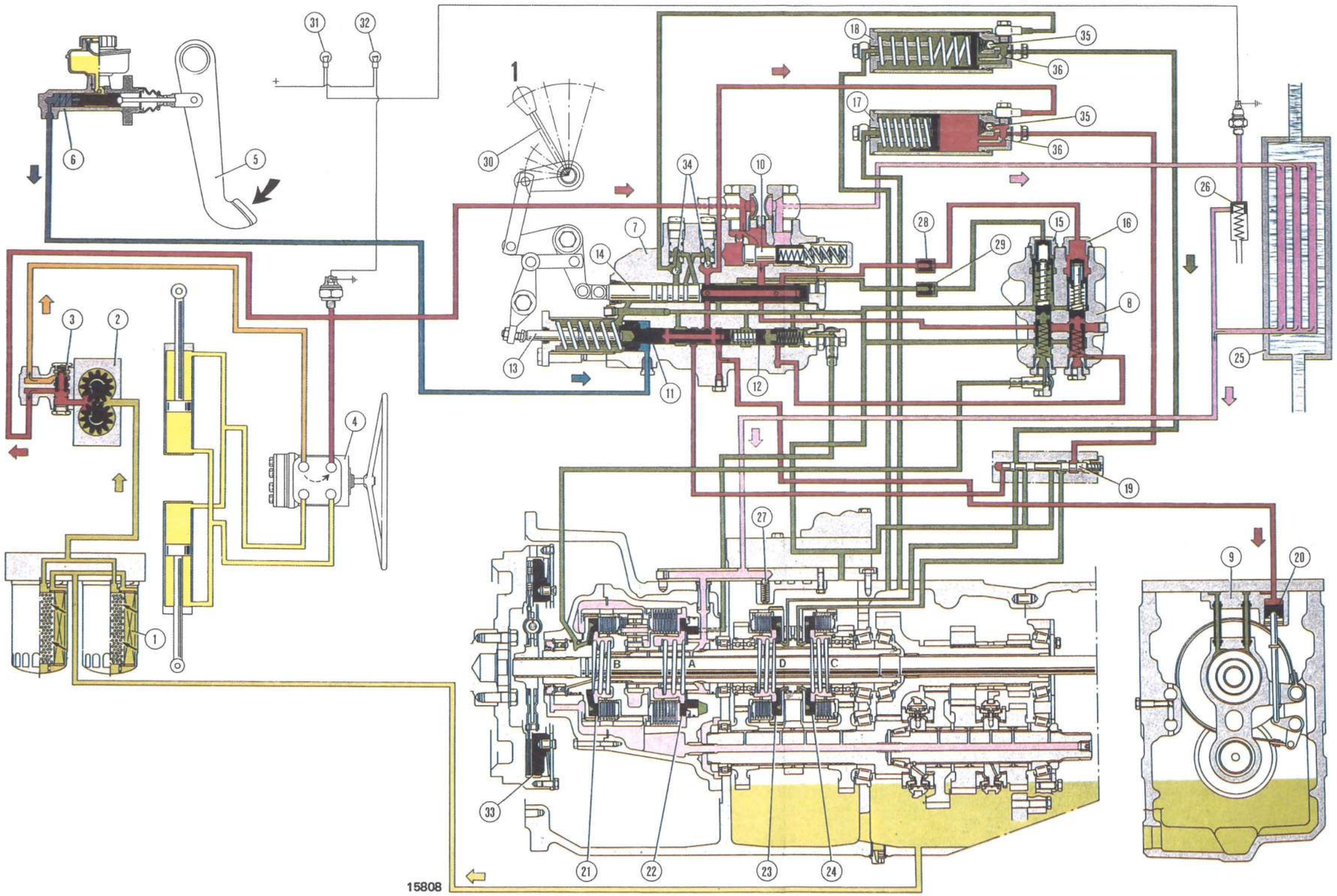
Remaining output from flow proportioning unit R (which supplies POWER SHIFT transmission) is conveyed to tester **291231** through line **290424** and is measured by tester flowmeter.
Total output of new or overhauled pumps is shown alongside, and consists of the sum of constant 17 to 21 litre/min (30 to 37 pint min) flow plus flow measured on tester **291231**.

OIL FILTERS

Two oil filters are located in parallel on the pump suction line. Filter elements consist of two paper cartridges which must be changed every 400 hours.



Speed-output chart of new or overhauled power shift transmission and power steering pump.
Test pressure 125 bar (127 kg/cm^2 or 1813 psi) - Oil temperature 55° to 65°C - Pump drive ratio 1.300 to 1.



Stopping the tractor.

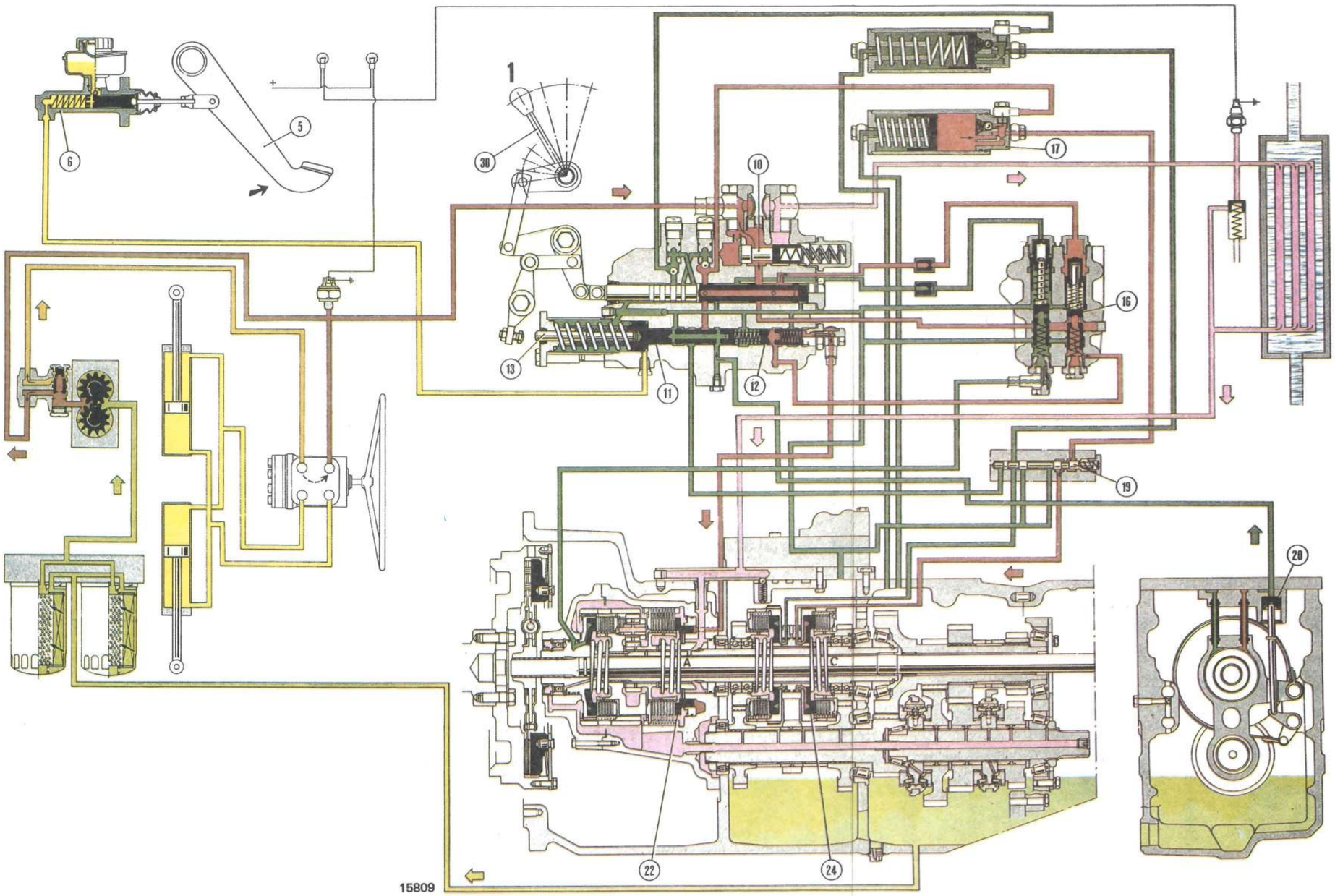
1. Filters - 2. Hydraulic pump - 3. Flow proportioning unit - 4. Power steering control valve - 5. Inching pedal - 6. Inching pump - 7. Control valve - 8. Retarder valve body - 9. Clutch C and D delivery manifold - 10. Pressure regulating valve - 11. Brake valve - 12. Inching valve - 13. Inching valve plunger - 14. Gear selector spindle - 15 and 16. Retarder valves - 17. Clutch C accumulator - 18. Clutch D accumulator - 19. Dump valve - 20. Brake piston - 21. Clutch B piston - 22. Clutch A piston - 23. Clutch D piston - 24. Clutch C piston - 25. Oil cooler - 26. Cooler by-pass valve - 27. Pressure relief valve - 28 and 29. Retarder valve nozzles - 30. Gear lever - 31. Low lube pressure indicator - 32. Low clutch pressure indicator - 33. Coupling - 34. Block valve - 35. Check valve - 36. Accumulator restriction.

- Suction oil
- Pressure oil to clutches and brake
- Power steering circuit oil
- Trapped oil
- Pressure oil to inching circuit
- Exhaust oil
- Lube pressure oil

STOPPING THE TRACTOR

Depressing pedal (5) activates pump (6), which increases inching circuit pressure to move brake valve (11) and plunger (13) to the left. Under the action of plunger (13), lever (30) moves to first gear position, and selector spindle (14) takes up position shown.

Circuit pressure, which is maintained at approximaltely 16 bar-kg/cm^2 or 228 psi by valve (10), acts on brake piston (20), dump valve (19) retarder valve (16) and clutch C accumulator (17). The four clutches (B,A,D and C) are connected to exhaust, and are thus disengaged.

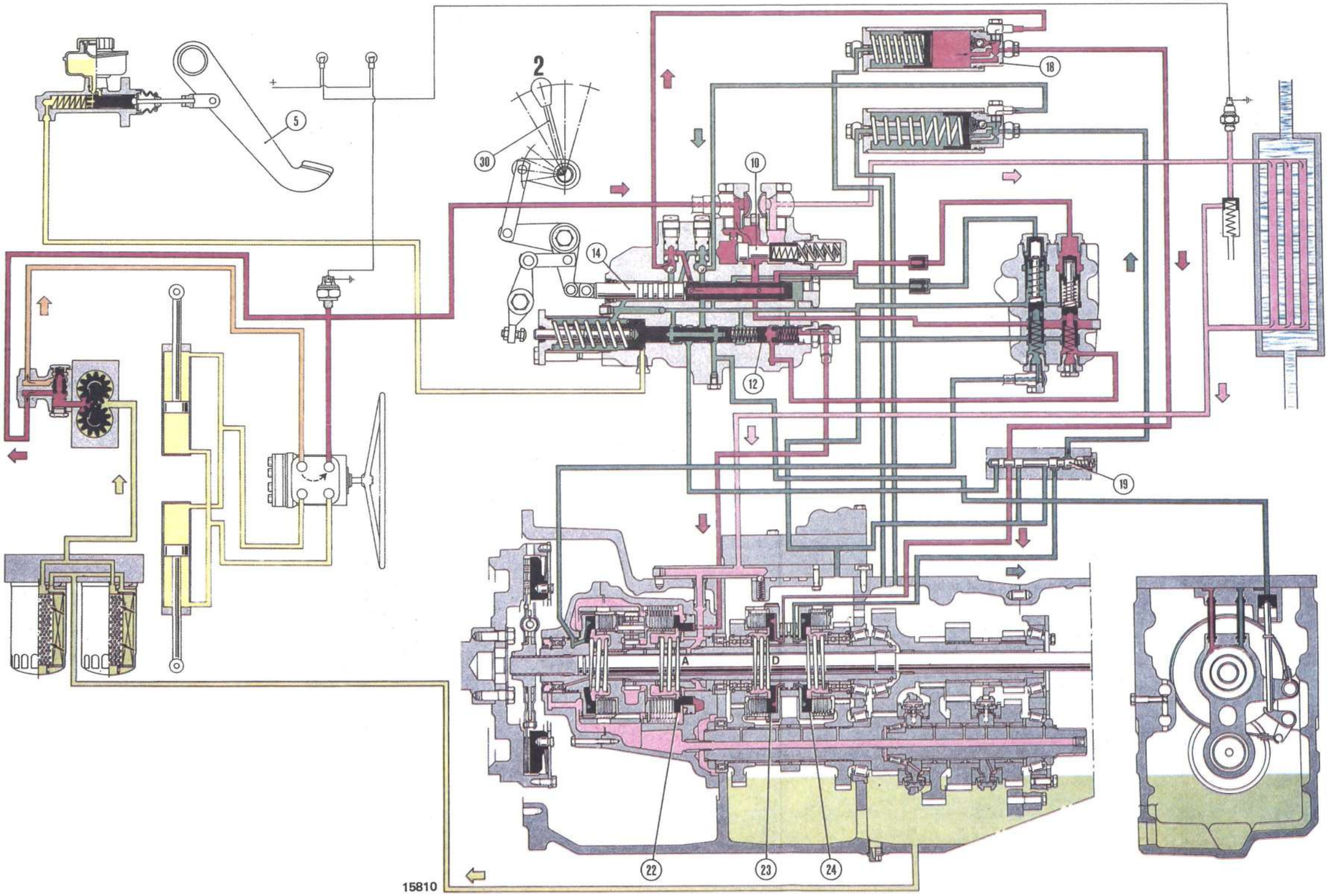


First gear (clutches A and C).

5. Inching pedal - 6. Inching pump - 10. Pressure regulating valve - 11. Brake valve - 12. Inching valve - 13. Inching valve plunger - 16. Retarder valve - 17. Clutch C accumulator - 20. Brake piston - 22. Clutch A piston - 24. Clutch C piston - 30. Gear lever.

FIRST GEAR (CLUTCHES A AND C)

When pedal (5) is released, pump (6) piston returns to rest position under spring load, thus exhausting inching circuit oil pressure to associated reservori.
Brake valve (11) and plunger (13) are pushed by the associated springs into the positions shown, thus connecting brake piston (20) to exhaust. Circuit pressure, which is maintained at approximately 16 bar-kg/cm^2 or 228 psi by valve (10), acts on clutch A piston (22) through retarder valve (16). Clutches (B and D, page 38) are connected to exhaust and are thus disengaged.



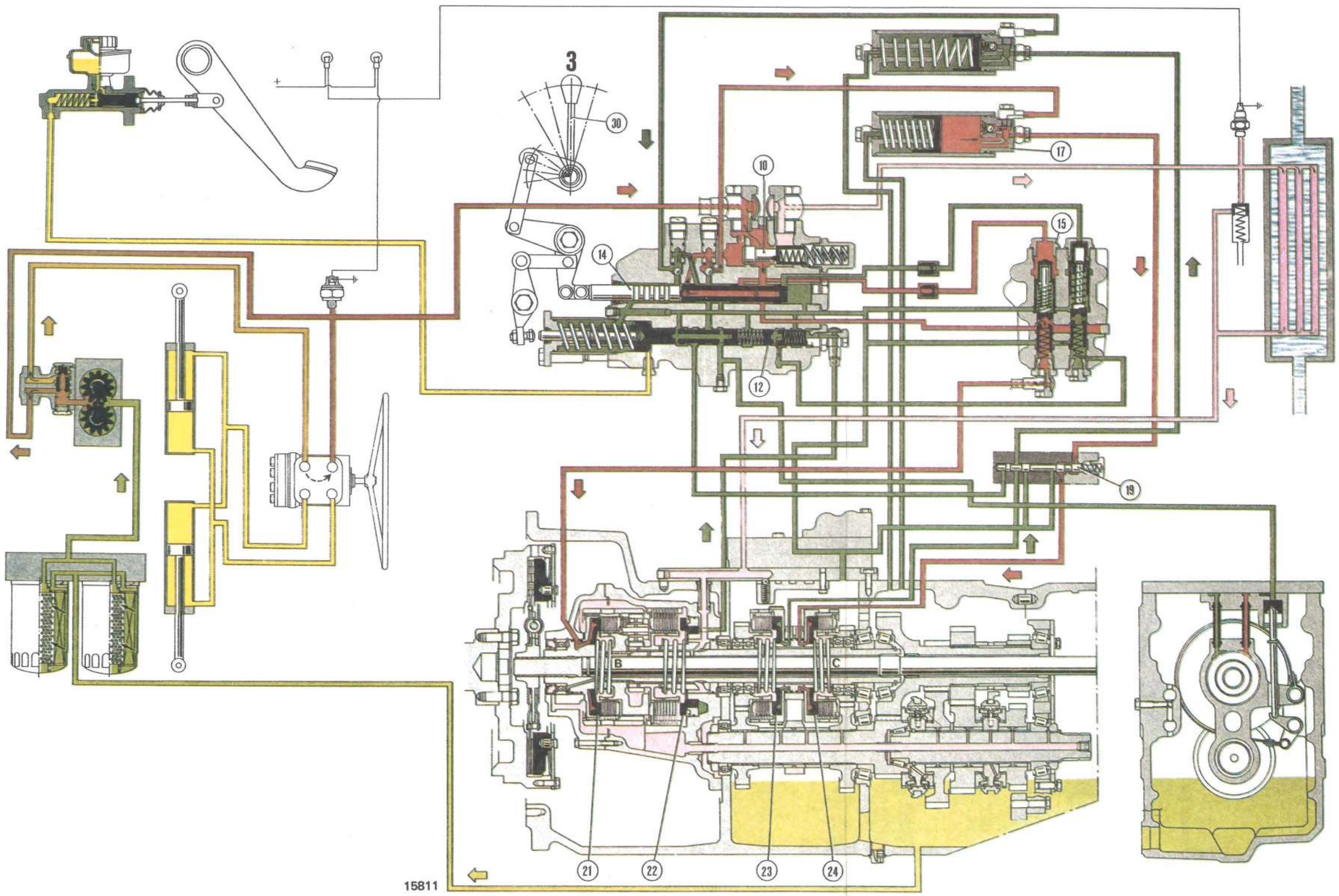
Second gear (clutches A and D).

5. Inching pedal - 10. Pressure regulating valve - 12. Inching valve - 14. Gear selector spindle - 18. Clutch D spindle - 19. Dump valve - 22. Clutch A piston - 23. Clutch D piston - 24. Clutch C piston - 30. Gear lever.

SECOND GEAR (CLUTCHES A AND D)

When gear lever (30) is shifted to second, spindle (14) takes up position shown to connect clutch C piston (24) with exhaust through dump valve (19) and accumulator (17, page 38). At the same time, 16 bar-kg/cm^2 (228 psi) pressure oil acts on clutch D piston (23), passing through pressure regulating valve (10), gear selector spindle (14), clutch D piston (18) and valve (19).

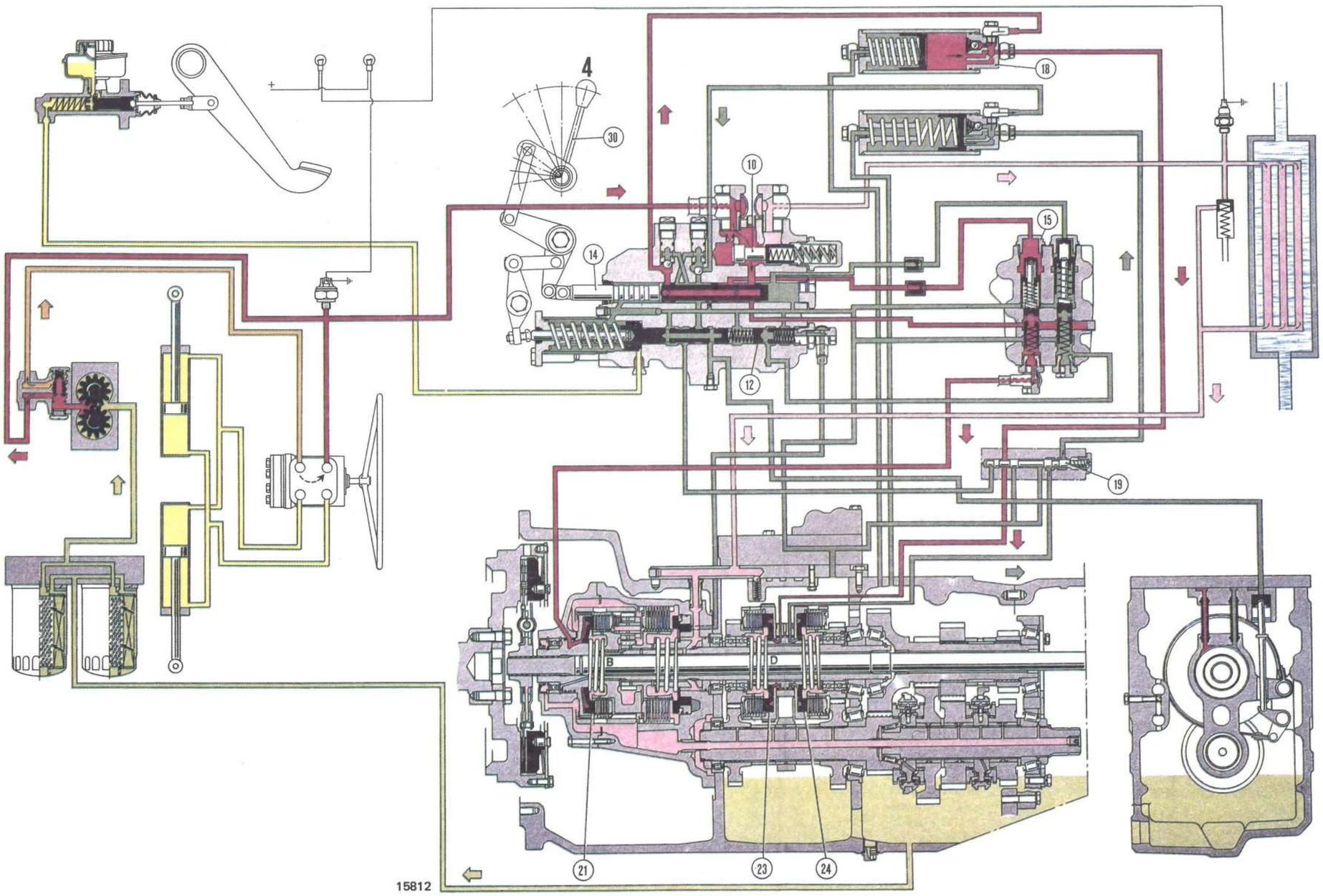
Clutch A is still engaged as in first gear (see page 39), while clutch B (page 38) is connected with exhaust and is thus disengaged.



Third gear (clutches B and C).
10. Pressure regulating valve - 12. Inching valve - 14. Gear selector spindle - 15. Retarder valve - 17. Clutch C accumulator - 19. Dump valve - 21. Clutch B piston - 22. Clutch A piston - 23. Clutch D piston - 24. Clutch C piston - 30. Gear lever.

THIRD GEAR (CLUTCHES B AND C)

When gear lever (30) is shifted to third, spindle (14) takes up position shown to connect clutch piston D (23) to exhaust through dump valve (19) and accumulator (18, page 38) and to connect top chamber of retarder valve (16, page 38) to exhaust through moving nozzle (28). Consequently, clutch A piston (22) is connected to exhaust through inching valve (12) and retarder valve (16, page 38).
At the same time, pressure oil at 16 bar-kg/cm^2 or 228 psi acts on clutch B piston (21) through spindle (14) and retarder valve (15) and on clutch C piston (24) through spindle (14), accumulator (17) and valve (19).



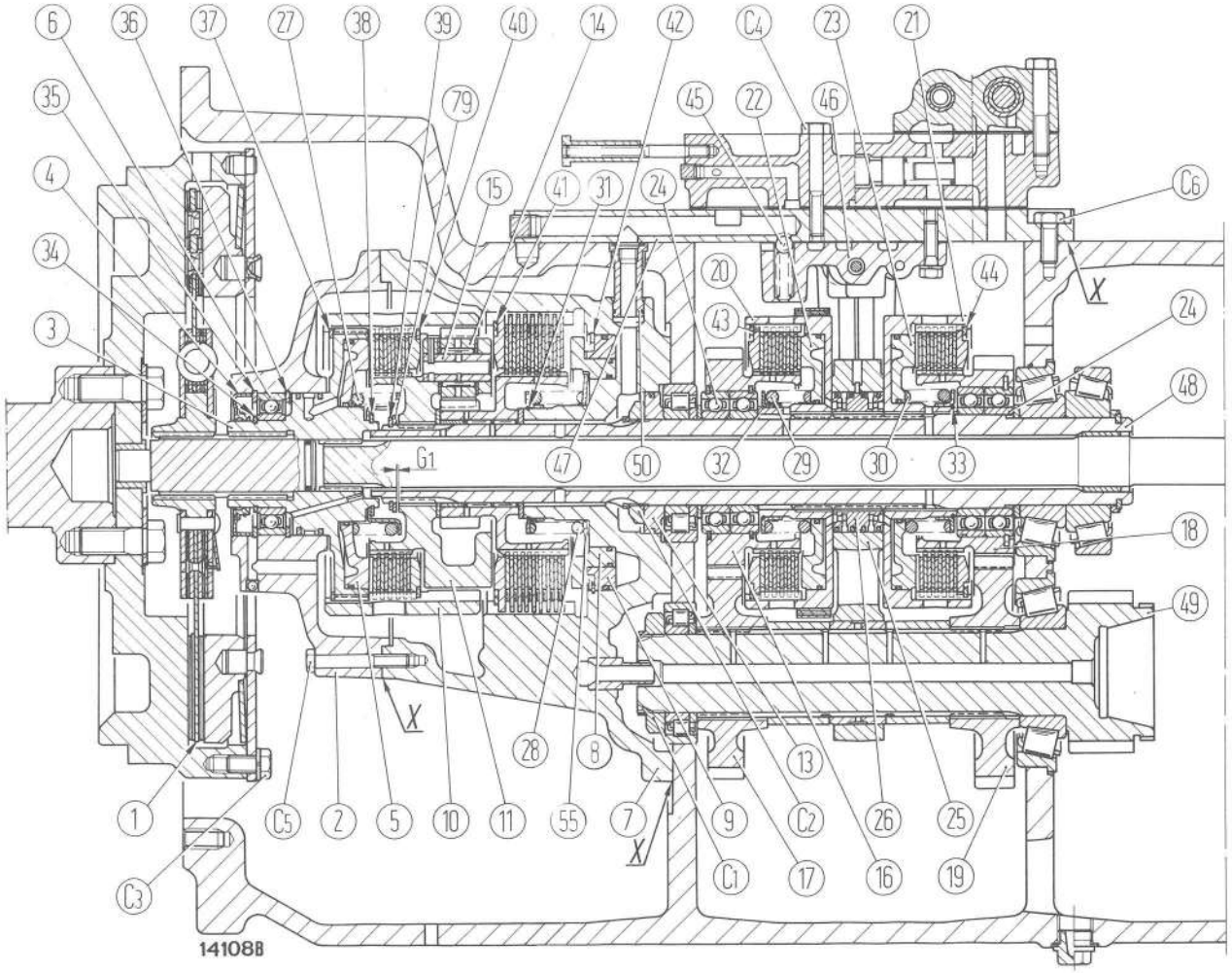
Fourth gear (clutches B and D).

10. Pressure regulating valve - 12. Inching valve - 14. Gear selector spindle - 15. Retarder valve - 18. Clutch D piston - 19. Dump valve - 21. Clutch B piston - 23. Clutch D piston - 24. Clutch C piston - 30. Gear lever.

Note - In all five transmission operation phases, hydraulic pump output passes through a flow proportioning unit (3, page 38), which provides constant pressure for the power steering circuit, and directs the rest of pump output to the POWER SHIFT transmission.
Lubrication oil is cooled by oil cooler (25, page 38) protected by-pass valve (26), while entire lube circuit is protected by pressure relief valve (27).
When inching pedal (5, page 38) is depressed with tractor in any gear, transmission returns automatically to first.

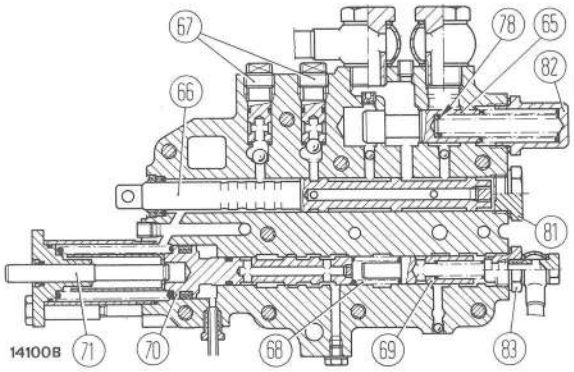
FOURTH GEAR (CLUTCHES B AND D)

When gear lever (30) is shifted to fourth, spindle (14) takes up the position shown to connect clutch C piston (24) with exhaust through dump valve (19) and accumulator (17, page 38). At the same time, pressure oil at 16 bar-kg/cm^2 or 228 psi acts on clutch D piston (23) through accumulator (18) and valve (19).
As in the preceding phase, clutch B is engaged and clutch A is disengaged.

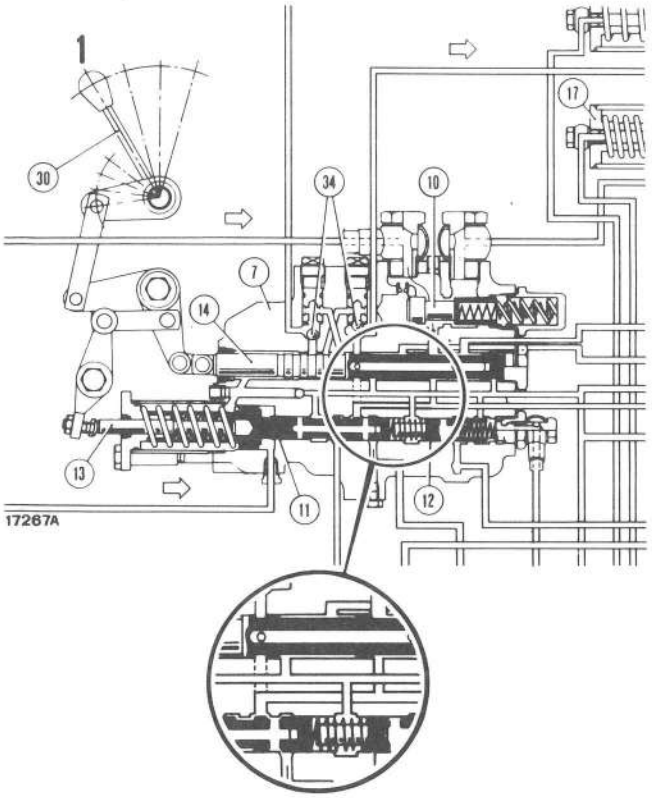


Late Models: Section through POWER SHIFT Transmission (w/ pilot bushing on flywheel and oversize input shaft) and hydraulic control valve

C_1. Driven gear shaft nut - C_2. Drive gear shaft nut - C_3. Drive coupling screws - C_4. Control valve retaining screws - C_5. Front reduction gear cover screws - C_6. Transmission housing top cover screws - G_1 = .3 to .5 mm (.0118 to .0197 in). Transmission drive shaft clearance - 1. Damper plate - 2. Front reduction gear cover - 3. Epicyclic final drive ring gear shaft - 4. Seal - 5. Clutch B piston - 6. Bearing - 7. Front reduction gear housing - 8. Clutch A piston - 9. Piston adapter ring - 10. Epicyclic ring gear - 11. Epicyclic planet gear carrier - 13. Bearing thrust washers - 14. Epicyclic planet gear - 15. Planet gear journal - 16. and 18. Drive gears - 17. and 19. Driven gears - 20. Clutch D bell housing - 21. Clutch C bell housing - 22. Clutch D piston - 23. Clutch C piston - 24. Transmission drive gear bearings - 25. External header, oil delivery to clutches C and D - 26. Internal header, oil delivery to clutches C and D - 27, 28, 29, 30. Clutch discs return springs - 31, 32, 33. Spring retaining rings - 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44. Retaining rings - 45. Lube oil pressure regulating valve - 46. Header, oil delivery to clutches C and D - 47. Transmission top cover - 48. Transmission drive shaft - 49. Transmission driven shaft - 50. Oil delivery fitting - 55. Dish spring - 65. Maximum pressure valve - 66. Gear selector shaft - 67. Oil delivery 3-way valve - 68. Inching pedal valve spring - 69. Inching pedal control valve - 70. Band brake control valve - 71. Inching pedal valve control link rod - 78. Pressure valve setting shim - 79. Transmission drive shaft bearing shims - 81, 82, 83. Plugs.



Note
On assembly, thoroughly clean and degrease mating surfaces **X** and apply one of the jointing compounds indicated on page 6, Sect. A.



Late Model hydraulic control valve

7, 10, 11, 12, 13, 14, 17, 30, 34. Refer to legend on page 38. Late and early Model ducts are shown in black and shaded, respectively.

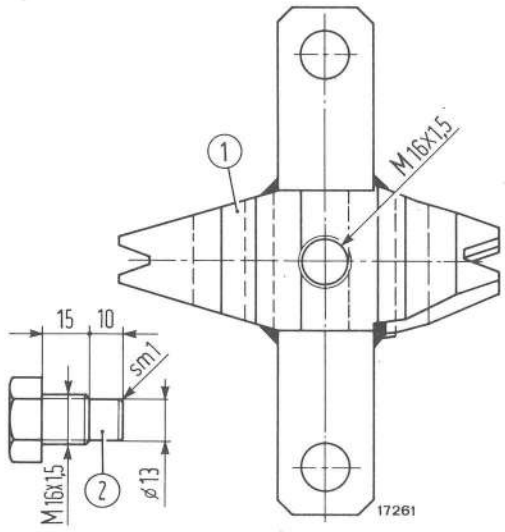
Two important changes were introduced lately in the POWER SHIFT Transmission:

— Oversizing of the transmission input shaft whose end is now carried in a special pilot bushing press-fitted in the flywheel. Consequently, the PTO hydraulic clutch shaft is no longer in one piece but divided in two parts as shown in the longitudinal section on page 43 (This modification was released to production starting from the following frame Nos.: 343774 for Mod. 130-90 Turbo, 260660 for Mod. 140-90 Turbo, 317471 for Mod. 160-90 Turbo and 264976 for 180-90 Turbo).

— Variation of a duct inside the control valve to provide a different feeding of the fast discharge valve for clutches C and D (19, page 41) thus ensuring the immediate stopping of the tractor in any and all gears as well as improve safety (This modification was released to production starting from the following frame Nos.: 344007 for Mod. 130-90 Turbo, 260752 for Mod. 140-90 Turbo, 317595 for Mod. 160-90 Turbo and 265042 for Mod. 180-90 Turbo).

The illustration alongside is provided to show the new hydraulic control valve and the different feed duct of the fast discharge valve for clutches C and D (the old type control valve still is the same as shown in hydraulic schematics on pages 38, 39, 40, 41 and 42).

For better operation it is recommended to drill a hole threaded to M 16 × 1.5 in tool **292528** as shown alongside. The tool so modified, along with screw (2) (also changed as shown) takes new order number **292528/1**.



Changes to be introduced in tool 292528/1 (1).

2. Screw to be modified as shown.