MAINTENANCE SERVICING OF HEWLAND FT 200, FG 400, FGA & FGB TRANSAXLE GEARBOX UNITS

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CONTENTS

ILLUSTRATIONS

INSET ILLUSTRATIONS

FT200, FG400, FGA & FGB TRANSAXLE GEARBOX UNITS

GENERAL NOTES ON MAINTENANCE AND OVERHAUL

Only genuine Hewland **spares should be used as** replacements. These are manufactured in our own **workshops to the fine tolerances necessary, and** rigorously inspected and tested.

New nuts, circlips, oil seals and gaskets should always be used on re-assembly.

When warming the casings, keep the blow lamp moving. Test with a spot of moisture, which will bounce off at correct temperature. Do not overheat.

TORQUE SETTINGS

Pinion Nut (L.H.)	**115** ft/lbs
Layshaft **Nut (R.H.)**	**80** ft/lbs
Crownwheel Bolts	**75** ft/lbs
All 5/16 **in. UNF Nuts**	**20 ft/lbs**

	FT 200	FG 400	FGA	FGB
Dry Weight (approximate)	90 lbs	110 lbs	110 lbs	112 lbs
Oil Capacity	1.75 litres	2 litres	2 litres	2 litres
Type of Oil	**SAE 80 or 90**	**SAE 80 or 90**	**SAE 80 or 90**	**SAE 80 or 90**

Notes: Oil capacity given for transmission without oil cooler etc.

THE GEARBOX UNIT-FT & FG

REMOVING THE UNIT *Refer to Illustration A*

End Cover

1. **Remove the UNF Nyloc nuts (1) and washers (2) securing the end cover. Take off cover and** gasket.

2. Remove the split pins from the castellated pinion and layshaft nuts.

3. Push the heads of the two outside selector rods, thus engaging the gears. This locks the gear box by engaging 2 gears.

4. **Remove the pinion nut, (left hand thread) and slacken off the** layshaft **nut, (conventional right** hand thread),

5. Now withdraw the two outside selector rods, to disengage the gears.

Bearing Carrier

1. **Remove the bearing carrier securing nuts and** washers **(5/16UNF).**

2. Using a plastic mallet, tap the bearing carrier and remove it from the main case, complete with layshaft assembly and gear train. Support the gears, hubs and clutch rings with the hand, as they slide **off the pinion.**

The gearbox unit is now completely removed.

To re-fit, assemble in reverse order to above.

CHANGING GEAR RATIOS

When changing a gear ratio, take off the slackened layshaft nut and remove the layshaft from the bearing carrier. Gears are exchanged in pairs – one from the layshaft **and one from the pinion shaft. Each gear is** etched with two sets of numbers.

It is essential that gears should be correctly paired according to these numbers.

GEAR TRAIN DISASSEMBLY

1. Remove hubs, clutch rings and gears. Wash and inspect for wear and cracks, particularly to the clutch rings.

2. **Examine forks for heavy or uneven wear, and** test for excessive play between forks and clutch rings.

3. **If forks are not to be dismantled, check that** self-locking nuts are tight. Continue disassembly as follows:

To Remove Selector Finger Housing (5)

4. Remove selector finger housing as follows:

   (1) Remove bung, spring and plunger (18, 19, 20) from the selector finger housing and withdraw selector finger (35).

   (2) Slacken and remove UNC Allen cap screw (5/16 **in).**

   (3) Slacken and remove UNF Nyloc nut inside housing (9/16 in) (51).

5. Remove gasket from bearing carrier.

6. **To remove forks, remove nut (50). Remove all** three sets and lift off forks **(47,46,48).**

7. Slacken and remove all three cap screws (40) and **take out the top selector rod springs and balls** (38 & 39). Then take out the three selector rods, **one at a time, collecting the bottom balls and** springs.

8. **Remove the UNC cap screw** (3/8 **in.) and push** out the locking slugs (41).

9. Inspect pinion and layshaft tail bearings and renew if necessary. To remove, warm up surround area. Bearings are located by cap screws (13).

Re-assemble in reverse order to above, noting the following:

10. When replacing bottom balls and springs, set up **to correct height. About one-third of the balls** should be exposed. Continue by inserting locking slugs and selector rods, then top balls and springs.

11. **Any hub replaced should be identical in length with the original. If replacing all hubs, or main bearing carrier, check that overall length of** pinion assembly has not been altered. Clearance is essential to avoid overheating and seizure, but too much clearance will cause excessive wear. **(See Setting the Selector Forks-page 5, para 4)**

SETTING UP THE SELECTOR FORKS

Extreme accuracy in setting up is imperative to ensure that gears engage freely, and to avoid uneven or excessive wear. The use of a Hewland Forksetting Jig is strongly recommended. Designed specifically **for FT/FGT will save costly setting-up time and** vastly reduce the possibility of error. (Fig. 1)

Note that when two layshaft gears run together, their chamfered sides must face each other (see diagram A).

1. Warm the bearing carrier and drop in the pinion tail bearing as described above.

2. **Place the jig in a vice. Slide the hubs with top** gear and thrust washer, on to the dummy pinion.

3. **Attach the bearing carrier to the jig, using** temporary nuts.

4. **Tighten the pinion nut. Then check for correct clearance on top gear.** (.008 **in. to** .010 **in.). (For** FGB see page 31)

5. **Remove from jig. Fit selector forks to rods** together with nuts and washers.

6. **Build up the hubs, gears and clutch rings, and** slide them back on to the setting jig.

7. Adjust the forks individually. Correct positioning requires that:

   (a) The **clutch ring should be** centred **on its hub,** between the two gears.

   (b) The **clutch ring should engage fully with** either gear.

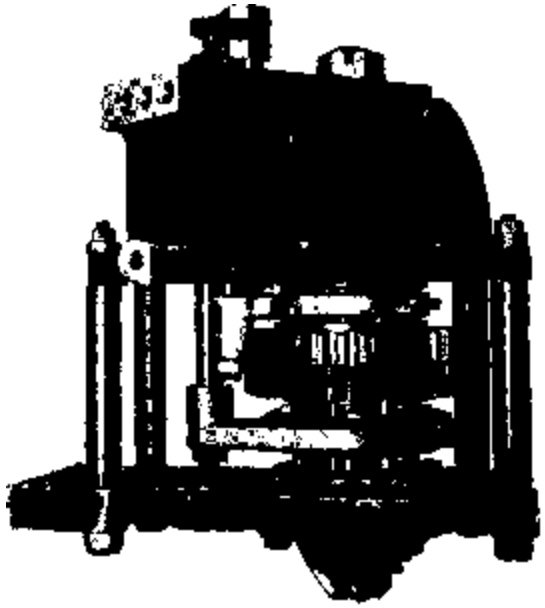


Fig. 1 Hewland **Forksetting Jig**

   (c) When fully engaged with either gear there should still be 0.005 in. clearance between the gear and clutch-ring faces.

   (d) If clutch-ring is over engaged it could result in gears overheating and seizing up or cause excessive wear on selector fork.

8. Tighten all three selector rods using new nuts and tabs, at the same time, make sure that the selector rod heads are correctly aligned, and that there is **clearance between them (but not excessive.**

Remove From Jig

9. **Warm up surrounding area and fit** layshaft bearing. Build up the complete layshaft assembly with gears, spacers and thrust washer. Replace in bearing carrier.

10. Put the complete assembly back into the jig. Re-check all clearances. Test all movements. When satisfied, remove the assembly from jig and bolt **it into the gearbox, using a jointing compound.**

11. **Tighten the nyloc nuts around the bearing carrier. Replace nuts on pinion,** layshaft **and tighten to the correct torque (See note). Put in** split pins.

12. Replace the selector finger housing and selector **finger, renewing gasket (6). Fit new gasket (4)** and replace the end cover.

Note: The correct torque is 115 ft/lbs for pinion nut, and 80 ft/lbs for nut.

THE GEARBOX UNIT—FT 200,FG 400 & FGA

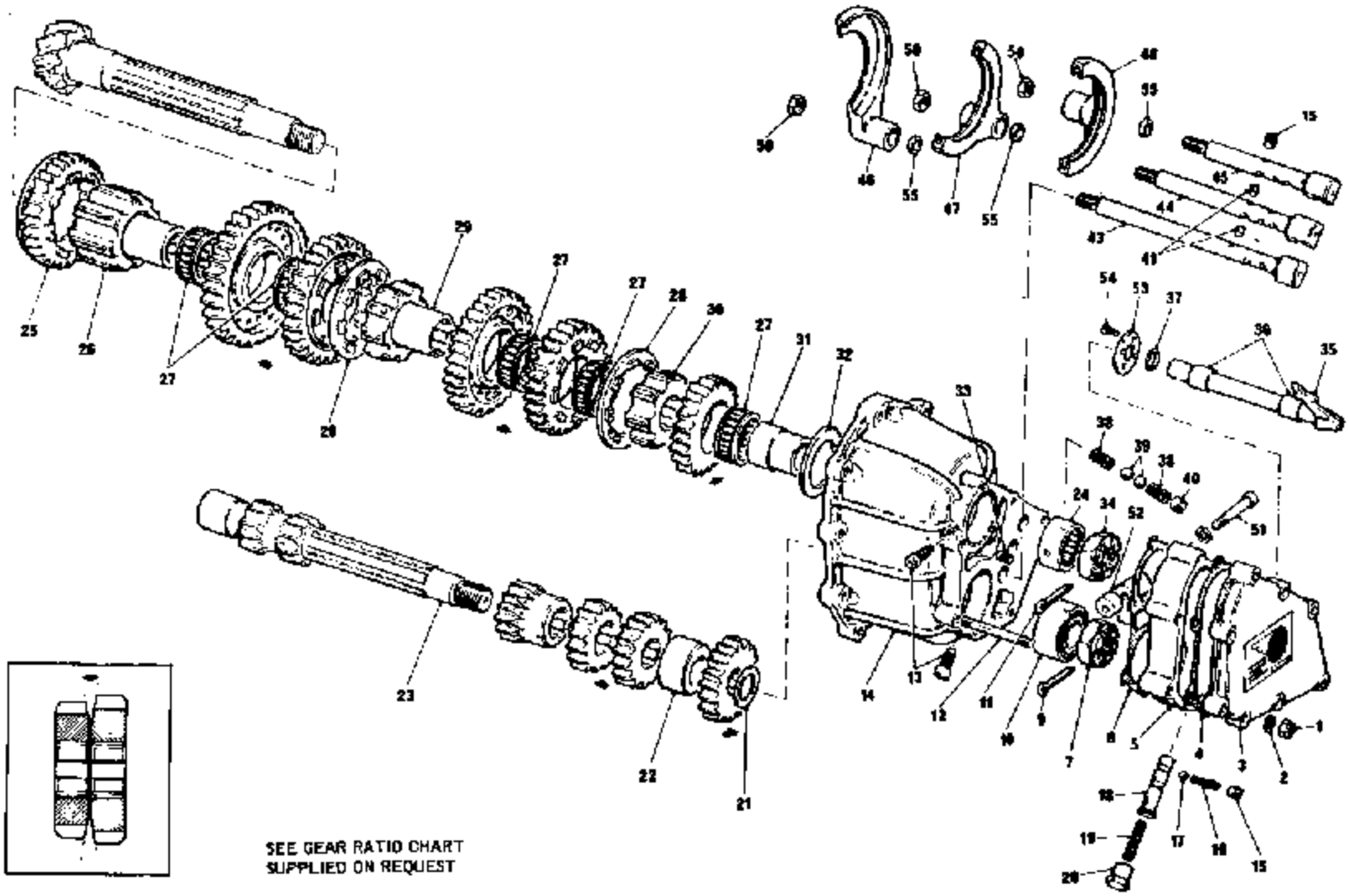


Illustration A

GEARBOX UNIT PARTS LIST

Illus. No.	Description	Part No.	Qty.
A1	**Nut** 5/16 **in. UNF Nyloc**	**FT 2013**	36
A2	Washer 5/16 in. Chamfered flat	**FT 2027**	36
A3	End Cover – Standard	**FT 204**	1
A4	Gasket, End Cover	**FT 260**	1
A5	Selector Finger Housing	**FT 203**	1
A6	Gasket, Selector Finger Housing	FT 261	1
A7	**Nut,** Layshaft **(R.H.)**	**FT** 236	1
A0			
A9	Split Pin	FT 2301	2
A10	Bearing, Layshaft	**FT 2343**	1
A11			
A12	Stud	**FT 2026**	7
A13	Screw, Bearing Retaining	**FT 2293**	2
A14	Bearing Carrier	**FT 202**	1
A15	Screw	**FT 2026**	2
A16	Spring	**FT 2034**	1
A17	Ball	**FT 2033**	1
A18	Plunger	**FT 2030**	1
A19	Spring ,	**FT 2032**	1
A20	Plug	FT 2035	1
A21	Thrust Washer	**FT 2345**	1
A22	Spacer	**FT 2346**	1
A23	Layshaft (see ratio chart)	**FT 234**	1
A24	Bearing	FT 2291	2
A25	First and Reverse Sliding Gear	FT 231	1
A26	**Hub Front (FT only)**	**FT 226**	1
A26	**Hub Front (Length 3 1/16 in.)**	**FG 226**	1
A26	**Hub Front (Length 2** 15/16 **in.)**	**FGA226**	1
A27	Needle Bearing	FT 2261	5
A28	**Clutch Ring (FT only)**	**FT 232**	2

Illus. No.	Description	Part No.	Qty.
A28	**Clutch Ring (FG/FGA)**	**DG 232**	2
A29	**Hub Centre (FT only)**	**FT 227**	1
A29	Hub Centre **(FG/FGA)**	**FG 227**	1
A30	**Hub Rear (FT only)**	**FT 228**	1
A30	**Hub Rear (FG/FGA)**	**FG 228**	1
A31	Inner Track 8th Gear	**FT 229**	1
A32	Thrust Washer	**FT 2294**	1
A33	Stud	**FT 2025**	1
A34	**Nut, Pinion (L.H.)**	**FT 230**	1
A35	Selector Finger	**FT 252**	1
A36	Bush	**FT 2036**	2
A37	**'O' Ring**	**FT 2037**	1
A38	Spring	**FT 2022**	6
A39	Ball	FT 2021	6
A40	Screw	**FT 2023**	3
A41	Plunger	**FT 2024**	2
A42	Screw (not illus.)	FT 2031	1
A43	Selector Rod 1st/Rev.	**FT 246**	1
A44	Selector Rod 2nd/3rd	**FT 247**	1
A45	Selector Rod **4th/5th**	**FT 248**	1
A46	Selector Fork **lst/Rev.**	**FT 249**	1
A 47	Selector Fork 2nd/3rd	**FT 250**	1
A48	Selector Fork **4th/5th**	FT 251	1
A50	**Nut**	**FT 2462**	3
A51	Screw	**FT20311**	**1**
A52	Spacer	**FT20310**	**1**
A53	Plate	**FT 2030**	1
A54	Screw	**FT 2039**	4
A55	Spacer (various sizes)	**FT 2463**	3

THE MAIN CASE & DIFFERENTIAL COMPARTMENT-FT 200

Removal and replacement of units and assemblies. Refer to Illustration 5.

DIFFERENTIAL AND DRIVE

1. Remove the slave cylinder securing bolts and washers and take off cylinder (18) complete with clutch push-rod.

   N.B. unhook spring attached to side plate.

2. Take off the left-hand side plate, having first removed the UNF Nyloc nuts and washers and UNF nuts (5/16 in.) on the tie bars. Loosen with light blows from a plastic mallet, and remove differential assembly.
3. Remove the right-hand side-plate.

Reassemble in reverse order to above.

CLUTCH SHAFT

1. Slacken the top and bottom swivel pins (25) and slide off, the thrust bearing (36) and bearing carrier (35) from the end of the clutch shaft.
2. Remove the clutch fork split pin (39) and clevis pin (26) and detach clutch fork (24).
3. Remove the cap screws (34). Tap out complete clutch shaft assembly.
4. Remove circlip (29) from clutch shaft, press out clutch shaft. Remove circlip (30) from spigot housing (33) and withdraw bearing and oil seal.

Re-assemble in reverse order to above, noting the following:

5. Fit a new oil seal (32). Replace circlips if required, and pay particular attention to bearings.
6. When bolting the spigot to its housing, put a smear of locking fluid on the three cap screws and jointing compound on spigot face.
7. Check that the bearing carrier rotates freely after tightening down the two swivel pins (25).

PINION REMOVAL

To remove the pinion, proceed as follows:

1. Knock back tab washers (4) and remove bolts (3).
2. Remove clamp plate (7).
3. Warm up outside area of main case sufficiently to remove pinion bearing,
4. Particular attention should be given to the shim or shims under pinion bearing.

LAYSHAFT BEARING

1. To remove the layshaft bearing, first remove the reverse idler gear by taking out the split pin (40) from the castellated nut (14). Check the gear and bearing for wear and re-assemble in the reverse order.
2. Remove the locating bolt (38) on under side of the main case. Warm up the main case surrounding the bearing area, until sufficiently watm to allow the end bearing to be lightly tapped out.
3. Remove all drain plugs. Wash out the main case to remove any sludge.
4. Warm up main case and re-assemble in reverse order. When inserting bearing (42) care should be taken to ensure that the locating hole on bearing (42) is in line with bolt (38).

DISMANTLING THE SUB-ASSEMBLIES

DIFFERENTIAL *(Illustration D)*

The following instructions apply to the cam and pawl **type differential FT 200 Gearbox.**

1. **Bend back the tabs (18). remove the bolts (19)** and take off the crown wheel (17).

2. **Remove in turn the outer housing** (15), **outer** cam track (14) and inner cam track (12).

3. Remove the eight plungers (pawls) (13) from the plunger carrier (11).

4. **Wash and examine for wear or damage with** particular attention to pawls, and profiles of the cam tracks. Ensure that

5. The splines of the inner cam track are towards the drive shaft (3).

6. New bolts and tabs are used for the crown wheel. **Tighten with a torque spanner to 75 ft/lbs** Smear bolts with locking fluid.

N.B. On reassembly use a good quality grease to lubricate the inner cam track bearing surfaces. We recommend the use of "Molyslip" grease for this purpose.

Reassemble in reverse order to above.

FINAL DRIVE -OUTBOARD BRAKES

Left Hand Side Plate *(Illustration D)*

1. **Remove the drive shaft circlip (20) and knock** out the shaft (3).

2. Support the side plate on fire bricks and warm it, having first covered the oil seal (6) with a block **of metal for protection. The outer track of the** differential bearing (10) and the shims (9) should now drop out.

3. **Remove the large circlip (6) which retains the side plate bearing (7) and oil seal (6). so that** both can be withdrawn.

Right Hand Side Plate

Follow the same procedure as above.

Reassemble in reverse order to above, fitting new oil seals if necessary.

FINAL DRIVE – INBOARD BRAKES

Left Hand Side Plate *(Illustration E)*

1. Remove the drive shaft circlip (4) and knock out shaft.

2. Support the side plate on fire bricks and warm it, having first covered the oil seal (2) with a block **of metal for protection. The outer track of the** differential bearing (7), the shims **(6),** the spacer **(5) and the drive shaft bearing (3) should now drop out**.

Right Hand Side Plate

Follow same procedure as above.

Re-assemble in reverse order to above, fitting new oil seals if necessary.

THE MAIN CASE & DIFFERENTIAL COMPARTMENT—FT 200

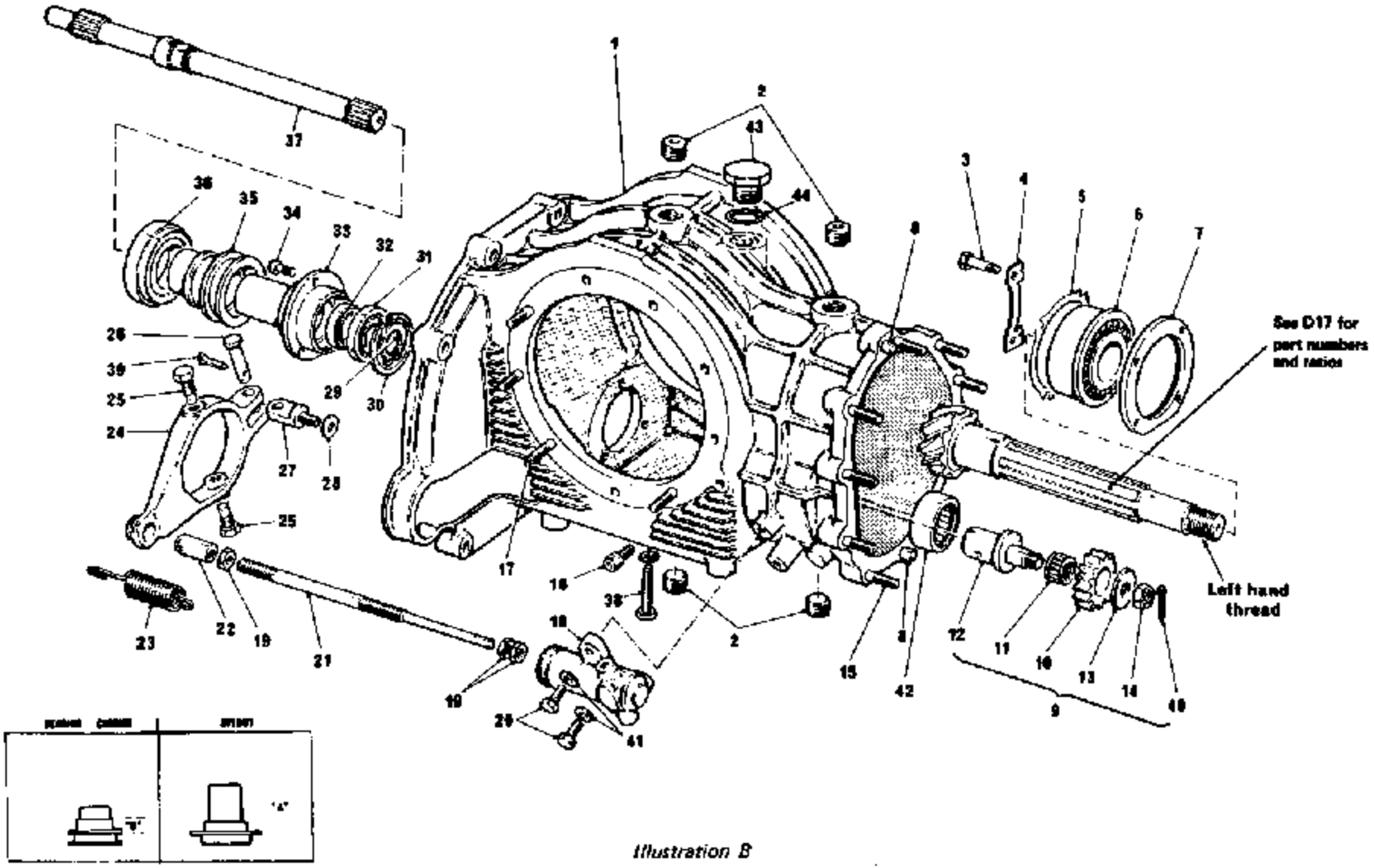


Illustration B

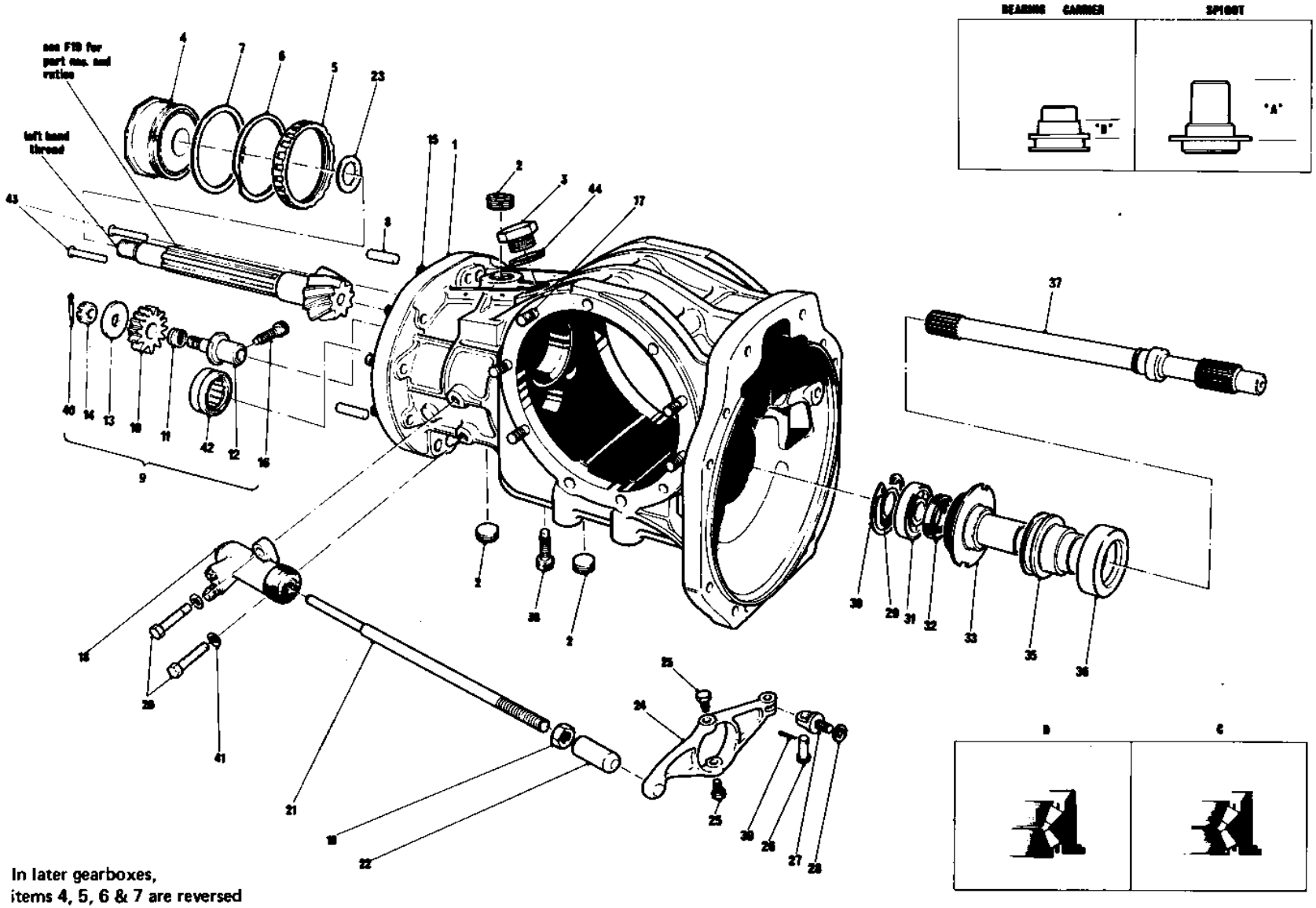
MAIN CASE PARTS LIST-FT 200

Illustration B

Illus. **No.**	Description	**Part No.**	**Qty.**
B1	Main Case	**FT** 201	1
B 2	Drain Plug	**FT** 2011	4
B3	**Bolt, 5/16 in. UNF**	**FT** 2251	4
B4	Tab Washer	**FT** 2252	2
B5	Shims 3-5-10-15-25 Thou.	**FT** 2253	
B 6	Bearing	**FT** 2221	1
B7	Clamp Plate	**FT** 225	1
B8	Dowel	**FT** 2015	2
B9	Reverse Idler Complete	**FT** 237	1
B10	Reverse Idler Gear	**FT** 237 1	1
B11	Bearing	**FT** 237 2	1
B12	Spigot	**FT** 237 3	1
B13	Washer	**FT** 237 4	1
B14	**Nut**	**FT** 237 5	1
B 15	Studs	**FT** 2014	9
B 16	Retainer Reverse	**FT** 237 6	1
B17	Stud (outboard brakes)	**FT** 2012	12
B17	Stud (inboard brakes)	**FT** 2012A	8
Not illus.	Screw (inboard brakes)	**FT 20128**	4
B18	Cylinder	**FT** 2582	1
B19	**Nut**	**FT** 2581	3
B20	Bolt	**FT** 2583	2
B21	Rod	**FT** 258	1
B22	Nosepiece	**FT** 259	1

Illus. **No.**	Description	Part No.	**Qty.**
B23	Spring	**FT** 2584	1
B24	**Clutch Fork**	**FT** 254	1
B25	Swivel Bolt	**FT** 256	2
B 26	Clevis Pin	**FT** 257	1
B27	Pivot	**FT** 255	1
B28	Washer	**FT** 2551	1
B29	Circlip	**FT** 2390	1
B30	Circlip	**FT** 24410	1
B29	Bearing	**FT** 24412	1
B32	Oil Seal	**FT** 24411	1
B33	Spigot (state length 'A' when ordering)	**FT 244-**	1
B34	Screws, Cap, 1/4 in. UNC	**FT** 24413	3
B35	Bearing Carrier (state length 'B' when ordering)	**FT 245-**	1
B36	Bearing	**FT 245A**	1
B37	Clutch Shaft (state engine/adaptor etc. when ordering)	**FT**	**1**
B38	Screw Retaining	**FT 2342**	1
B39	Split Pin	DG 2571	1
B40	Split Pin	**FT 2377**	1
B41	Washers	**FT 2585**	**2**
B42	**Bearing**	FT 2291	**2**
B43	Inspection Plug	TL 2011	1
B44	Washer	**FGB 2018**	1

THE MAIN CASE–FG 400 & FGA



Note: In later gearboxes, items 4, 5, 6 & 7 are reversed and item 23 is omitted.

Illustration C

MAIN CASE PARTS LIST-FG 400 & FGA

illustration C

Illus. No.	Description	Part No.	Qty.
C1	Main Case	FG 201	1
c2	Drain Plug	FT 2011	3
c3	Inspection Plug	TL 2011	1
c4	Bearing (Inset C)	HC8.2221	1
c4	Bearing (Inset D)	FGA.2221	1
c5	Nut (Inset C)	HC8.2221 A	1
c5	Nut (Inset D)	FGA.2221 A	1
C6	Spacer Pinion Bearing	HC8.2222A	1
c7	Shims	HC8.2222	
C8	Dowel	FT 2015	2
C9	Reverse Idler Complete	FT 237	1
C10	Reverse Idler Gear	FT 2371	1
C11	Bearing	FT 2372	1
C12	Spigot	FT 2373	1
C13	Washer	FT 2374	1
C14	Nut	FT 2375	1
C15	Stud	FT 2014	9
C16	Retainer Reverse	FT 2376	1
C17	Stud	FT 2012A	11
Not Illus.	Screw	FT 20126	1
Not Illus.	Stud (FGA only)	FGA.2012	2
C18	Cylinder	FG 2582	1
C19	Nut	FT 2581	1
C20	Bolt	FT 2583	2
c21	Rod	LG 258	1

Illus. No.	Description	Part No.	Qty.
c22	Nosepiece	FT 259	1
C23	Spacer Pinion Head	FG 2222	1
C24	Clutch Fork	DG 254	1
C25	Swivel Bolt	FT 256	2
C26	Clevis Pin	FG 257	1
C27	Pivot	FG 255	1
C28	Washer	FT 2551	1
c29	Circlip	FT 2390	1
C30	Circlip	FT 24410	1
c31	Bearing	FT 24412	1
C32	Oil Seal	FT 24411	1
c33	Spigot (state length 'A' when ordering)	FG 244-S	1
c34			
c35	Bearing Carrier (state length 'B' when ordering)	FT 245-	1
C36	Bearing	FT 245A	1
c37	Clutch Shaft (state engine/adaptor etc. when ordering)	FG 239-	1
C38	Screw Retaining	FT 2342	1
c39	Split Pin	DG 2571	1
C40	Split Pin	FT 2377	1
c41	Washer	FT 2585	2
C42	Bearing	FT 2291	2
c43	Roll Pin (reversed pinion bearing)	FG 2222E	2
c44	Washer	RGB 2018	1

GEARBOX COMPONENTS—FGB

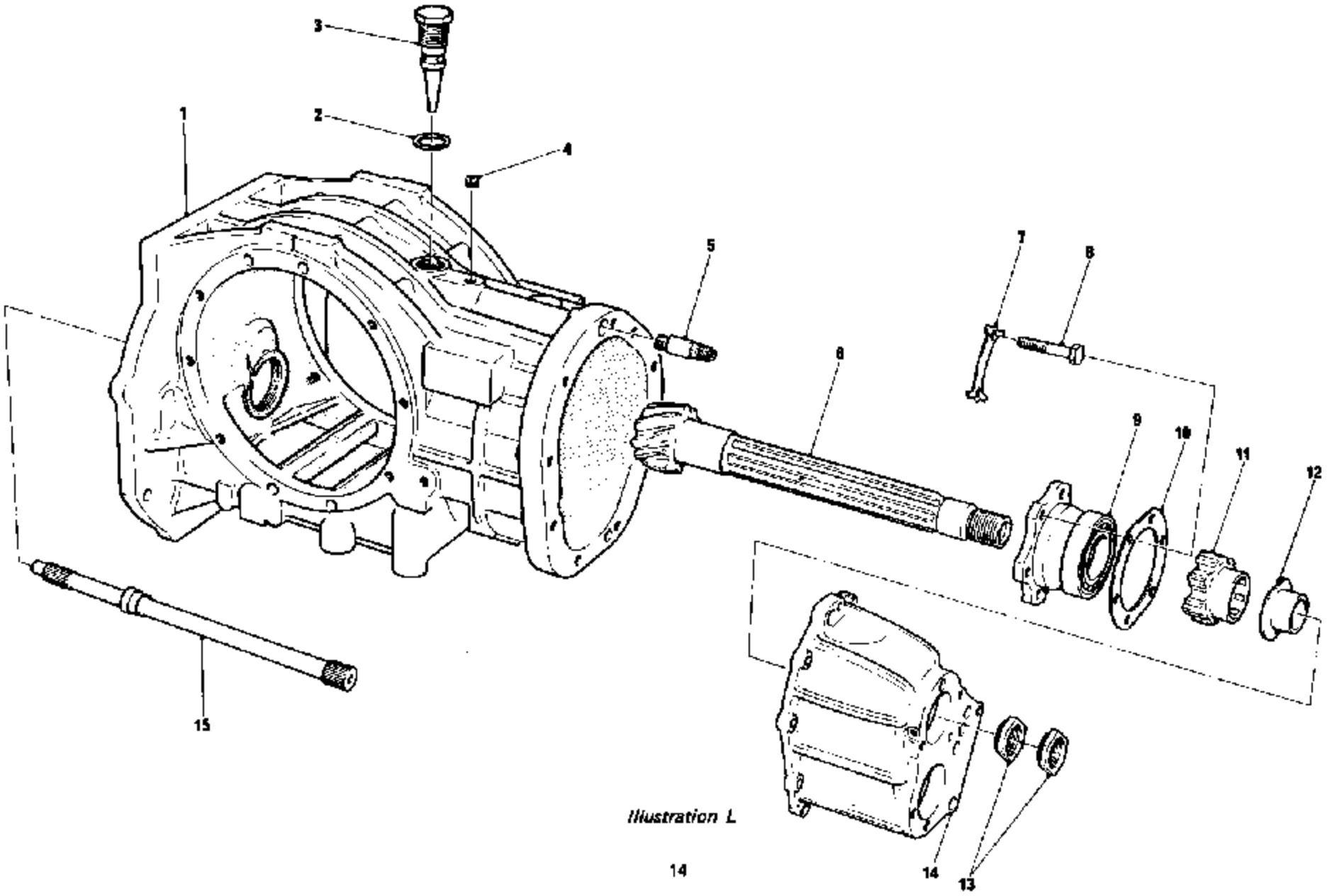


Illustration L

GEARBOX COMPONENTS PARTS LIST-FGB

Illustration L

Illus. No.	Description	Part No.	Qty.	Replaces Parts on FGA	
				Part No.	Ill/Item No.
LI	Main Case	FGB 201	1	**FG** 201	**CI**
L2	Washer	**FGB 2018**	1		
L3	Oil Feed	**FGB 2017**	1	**TL** 2011	
L4	Plug	FT 2031	1		
L5	**Dowel/Oil Union**	**FGB 2015**	1	**FT** 2015	C8
L6	Crown Wheel & Pinion 8/31	FGB 221 B	1	**FG** 221 B	F19
	Crown Wheel & Pinion 8/35	**FGB 221D**	1	**FG** 221D	**F19**
L7	Tab Washer	**TL2.2233**	3		
L8	**Bolt**	TL 2251	6		
L9	Pinion Bearing	TL2.2221	1	**FGA 2221**	**c4**
L10	Shim (various sizes)	**FGB 2232**	**AR**	HC8.2222	c7
LII	Hub, Rear	**FGB 228**	1	**FG** 228	**A30**
				FT 229	A31
L12	Inner Track	**FGB 229**	1	**FT** 2294	A32
L13	**Nut, Pinion LH**	**FGA6230**	2	**FT 230**	**A34**
L14	Bearing Carrier	**FGB 202**	1	**FT** 202	**A14**
L15	**Clutch Shaft.**	**FGB 239-**	1	**FG 239-**	c37
	. Note: State engine/adaptor etc. when ordering.				

THE MAIN CASE & DIFFERENTIAL COMPARTMENT-FG 400,FGA & FGB

Removal and Replacement of Units and Assemblies *(Refer to Illus. C)*

DIFFERENTIAL AND DRIVE

1. **Remove the slave cylinder securing bolts and** washers and take off slave cylinder (18) complete with clutch push-rod.

2. **Take off the left hand side plate, having first** removed the nuts and washers **(5/16** in. UNF) and **nuts** (3/8 **in. UNF) on the four tie bars. Loosen with light blows from a plastic mallet, and** remove differential assembly.

3. Remove the right hand side plate.

Reassemble in reverse order to above.

CLUTCH SHAFT

1. Slacken off the top and bottom swivel pins (25) and slide the thrust bearing (36) and carrier (35) off the end of the clutch shaft.

2. Remove the clutch fork (24), after taking out the split pin and clevis pin.

3. Unscrew spigot from case and remove complete assembly.

Alternate method without removal of spigot:

3(a) Remove clutch shaft circlip (29) and knock shaft out through front of spigot.

4. Remove circlip (30) and knock bearing out of spigot, into differential compartment. Remove oil seal.

Reassemble in reverse order to above, noting the following:

5. Check spigot is tight in case.

6. Fit a new oil seal (32). Renew circlips if required, and pay particular attention to bearings.

7. Check that the bearing carrier rotates freely after tightening down the two swivel pins (25).

PINION REMOVAL

To remove pinion, proceed as follows:

1. Remove bearing retaining nut (5).

2. Warm up outside area of main case sufficiently to remove pinion bearing.

3. Particular attention should be given to the shims under pinion bearing.

LAYSHAFT BEARING

1. To remove the layshaft **bearing first remove** the reverse idler gear by taking out the split pin **(40) from the castellated nut** (14), **remove nut** and washer. Check gear and bearing for wear.

2. **Remove the locating bolt (38) on underside of** the main case. Warm up the main case surround-**ing the bearing area, until sufficiently warm to** allow bearing to be lightly tapped out.

3. Remove all drain plugs. Wash out the main case to remove any sludge.

4. Warm up main case and reassemble in reverse order. When inserting bearing (42) care should be taken to ensure that the locating hole on bearing **is in line with bolt**

DISMANTLING THE SUB-ASSEMBLIES

Refer to Illustrations F, G or H

DIFFERENTIAL

The following are general instructions that cover the cam and pawl type differential. Minor differences do however occur between FG 400 and FGA gearboxes. Reference to parts list may be required.

1. **Bend back the tabs** (20) **remove the bolts** (21), take off crown wheel (19).

2. **Remove in turn the outer housing** (17), **outer** and inner cam tracks (16-14).

3. Remove the eight plungers (pawls) (15) from the plunger carrier (13).

4. **Wash and examine for wear or damage, with** particular attention to pawls, and profiles of the cam tracks.

5. Assemble in reverse order, making certain that **splines of the inner** cam track are towards the left hand drive shaft.

6. Always use new bolts and tabs for crown wheel. **Tighten to** 75 ft/lbs **Smear bolts with locking fluid.**

N.B. On reassembly use a good quality grease to lubricate cam lobes and bearing faces. "Moly-slip" is recommended.

FINAL DRIVE – FG 400 SIDE PLATES FOR OUTBOARD BRAKES. (Illus. *F)*

1. **Remove drive shaft circlip (22) and knock out** shaft.

2. Support the side plate on fire bricks, and warm **it, having first covered the oil seal (7) with a block of metal for protection. The outer track of the differential bearing (11) and the shims** (10) should now drop out.

3. **Remove the large circlip (9) which retains the** side plate bearing (8) and oil seal (7) so that both can be withdrawn.

Re-assemble in reverse order to above, fitting new oil seals if necessary.

FINAL DRIVE – FG 400 SIDE PLATES FOR INBOARD BRAKES. (Illus. G)

1. **Remove drive shaft circlip (7) and knock out** shaft.

2. **Remove six cap screws (1) from oil seal re-**tainer (8) and take off retainer.

3. **Support side plate on fire bricks and warm it. The outer track of the differential bearing (II), the shims (10) and drive shaft bearing should** now drop out.

Re-assemble in reverse order to above, fitting new oil seals if necessary.

FINAL DRIVE – FGA. (Illus. *H)*

1. **Remove drive shaft circlip (22) and knock out** shaft.

2. Support the side plate on fire bricks, and warm **it, having first covered the oil seal (7) with a** block of metal for protection. The outer track of the differential bearing (1 the shims (10). the **spacer (9) and the drive shaft bearing should** drop out.

Re-assemble in reverse order to above, fitting new oil seals if necessary.

DIFFERENTIAL & FINAL DRIVE FT 200—OUTBOARD BRAKES

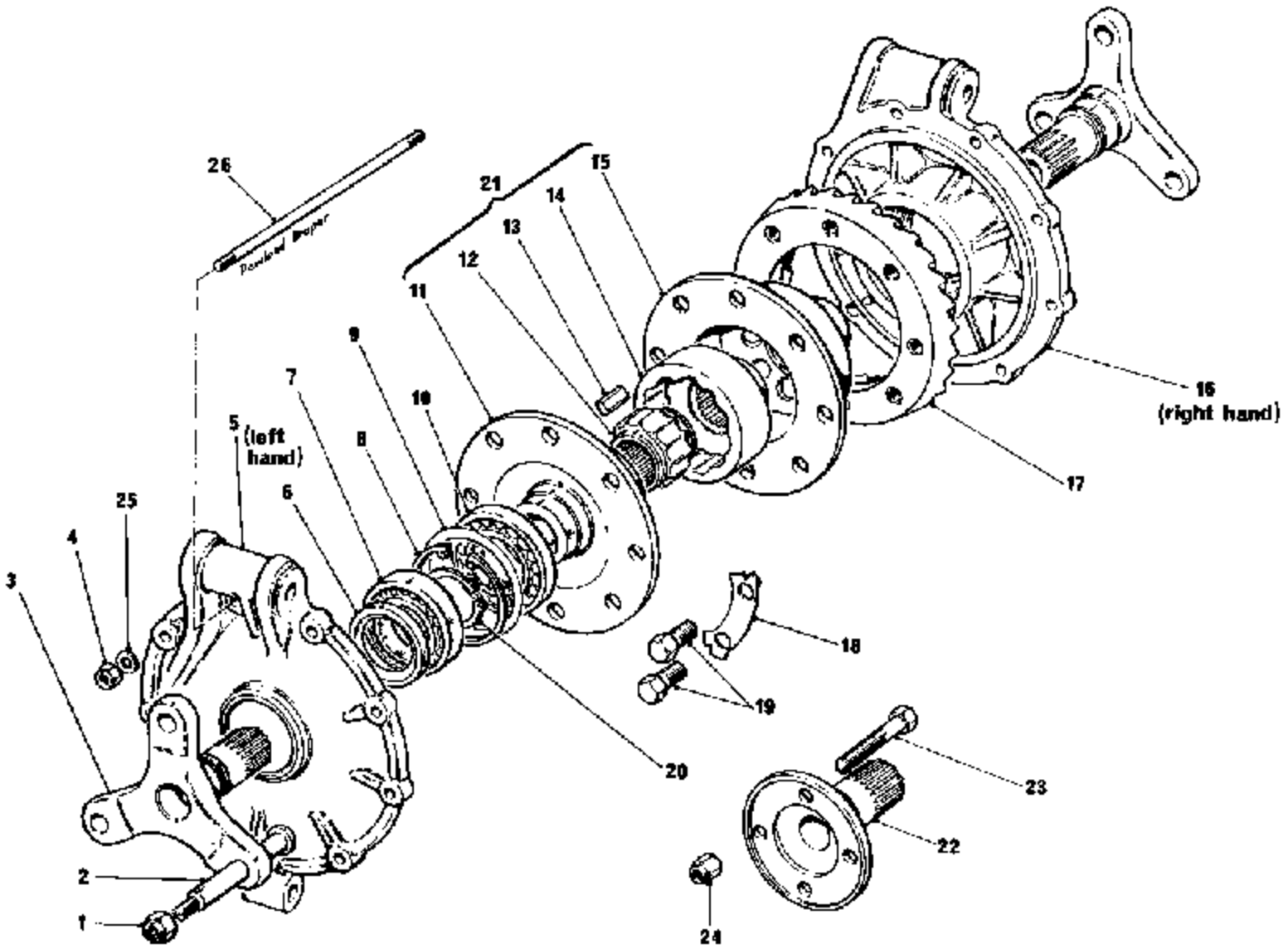


Illustration D

DIFFERENTIAL & FINAL DRIVE PARTS LIST-FT 200-OUTBOARD BRAKES

Illustration D

Illus. **No.**	Description	Part No.	**Qty.**
D1	**Nut 7/16 in. UNF Nyloc**	**FT** 2195	6
D2	**Bolt Drive Shaft 5¼ in. p.c.d.**	**FT 2192**	6
D2	**Bolt Drive Shaft 4 7/16 in. p.c.d.**	**FT 2192A**	6
D3	**Drive Shaft 5¼ in. p.c.d.**	**FT 219**	2
D3	**Drive Shaft 4 7/16 in. p.c.d.**	**FT 219A**	2
D4	**Nut 5/16 in. UNF Nyloc**	**FT** 2013	36
D5	Side Plate	**FT** 205	1
D6	Oil Seal	**FT** 2054	2
D7	Bearing	**FT** 2053	2
DB	Circlip	**FT** 2052	2
D9	Shims 3-5-10-15-20 thou.	**FT** 2061	
D10	Bearing	**FT** 2051	2
D11	Plunger Carrier	**FT** 214	1
D12	inner Cam Track	**FT** 216	1
D13	Plungers	**FT** 217	8
D14	Outer Cam Track	**FT** 215	1

Illus. **No.**	Description	Part No.	
D15	Outer Housing	**FT** 213	1
D16	Side Plate	**FT** 206	1
D17	Crown Wheel & Pinion 7:31	**FT** 221	1
D17	Crown Wheel & Pinion 9:31	**FT** 221A	1
D17	Crown Wheel & Pinion 8:31	**FT** 221B	1
D17	Crown Wheel & Pinion **10:31**	**FT 221C**	1
D17	Crown Wheel & Pinion 13:36	**FT** 221M	1
D18	Tab Washer	**FT** 2212	4
D19	Bolt	**FT** 2211	8
D20	Circlip	**FT** 2191	2
D21	Limited Slip Differential	**FT** 212	1
D22	Drive Shaft H.S. 1300	**FT** 218	2
D23	Bolt	**FT** 2193	8
D24	**Nut 3/8 in. UNF Nyloc**	**FT** 2196	8
D25	Washer	**FT** 2027	36
D26	Tie Bar	**FT** 262	3

DIFFERENTIAL & FINAL DRIVE FT 200—INBOARD BRAKES

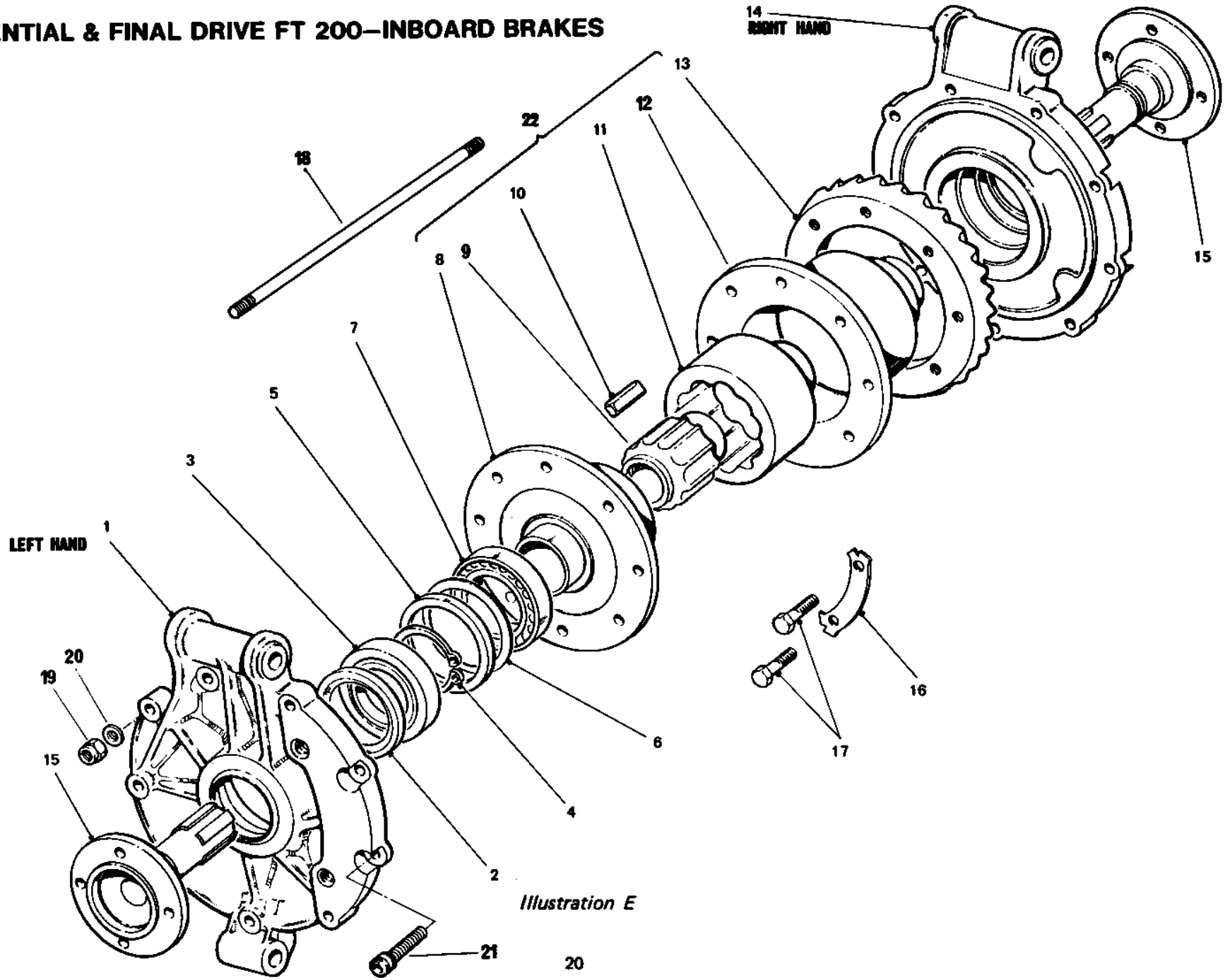


Illustration E

DIFFERENTIAL & FINAL DRIVE PARTS LIST-FT 200-INBOARD BRAKES

Illustration E

Illus. **No.**	Description	Part No.	**Qty.**
E1	Side Plate	**FT 205B**	1
E2	Oil Seal	**FT** 2054	2
E3	Bearing	**FT** 2053A	**2**
E4	Circlip	**FT2191A**	**2**
E5	Spacer L/H	**FT 2052A**	I
E5	**Spacer R/H (not** illus.)	**FT 2062A**	**1**
E6	Shim 3-5-10-15-20 thou.	**FT** 2061	
E7	Bearing	**FT** 2051	2
E8	Plunger Carrier	**FT** 214	1
E9	Inner Cam Track	**FT 216**	1
E10	Plungers	**FT** 217	8
E11	Outer Cam Track	**FT** 215	1
E12	Outer Housing	**FT** 213	1
E13	Crown Wheel & Pinion 7:31	**FT** 221	1

Illus. **No.**	Description	Part No.	**Qty.**
E13	Crown Wheel & Pinion 9:31	**FT 221A**	1
E13	Crown Wheel **&** Pinion 8:31	**FT** 2218	1
E13	Crown Wheel & Pinion **10:31**	**FT 221C**	1
E13	Crown Wheel & Pinion 13:36	**FT 221M**	1
E14	Side Plate	**FT 206B**	1
E15	Drive Shaft H.S. 1300	**FT 218A**	2
E15	**Drive Shaft H.S. C.V. Joint**	**FT 2188**	2
E15	Drive Shaft V.W. C.V. Joint	**FT 218F**	2
E16	Tab Washer	**FT** 2212	4
E17	Bolt	**FT** 2211	8
E18	Tie Bar	**FT 262A**	3
E19	**Nut 5/16 in. UNF Nyloc**	**FT** 2013	32
E20	Washer	**FT** 2027	36
E21	Screw	**FT** 20128	4
E22	Limited Slip Differential	**FT** 212	1

DIFFERENTIAL & FINAL DRIVE FG 400—OUTBOARD BRAKES

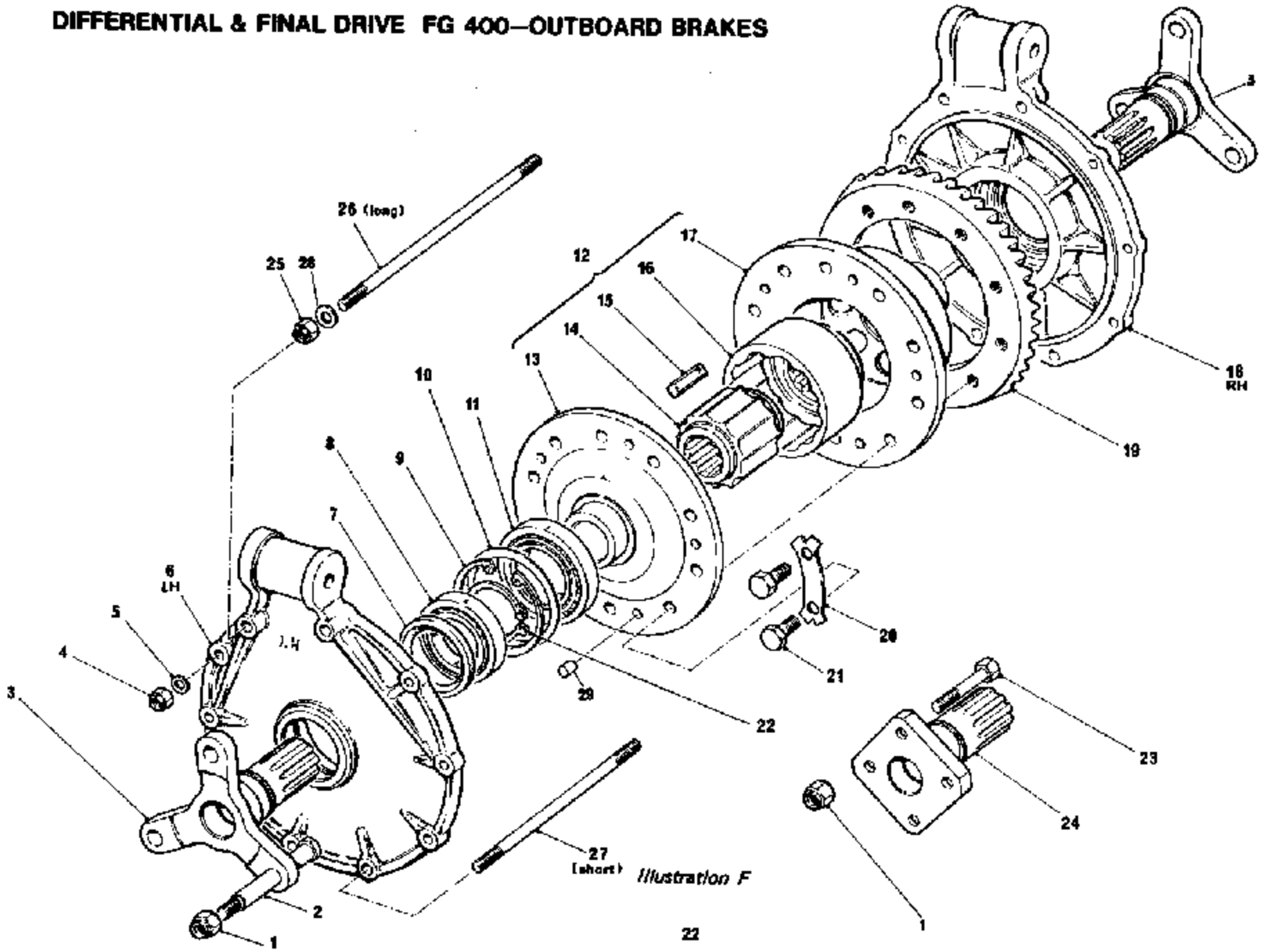


Illustration F

DIFFERENTIAL & FINAL DRIVE PARTS LIST-FG 400-OUTBOARD BRAKES

Illustration F

Illus. **No.**	Description	Part No.	Qty.
F1	**Nut 7/16 in. UNF Nyloc**	**FT** 2195	68
F2	Bolt	**FT** 2192	6
F3	Drive Shaft 5% in. p.c.d.	**DG** 219	2
F4	**Nut 5/16 in. UNF Nyloc**	**FT** 2013	36
F5	Washer	**FT** 2027	36
F6	Side Plate	**FG** 205	1
F7	Oil Seal	**LG** 2054	2
F8	Bearing	**LG** 2053	2
F9	Circlip	LG 2052	2
F10	Shim 35-10-15-25 thou.	**DG** 2061	
F11	Bearing	**DG** 2051	2
F12	Limited Slip Differential	**DG** 212	1
F13	Plunger Carrier	**DG** 214	1
F14	Inner Cam Track	**LG** 216	1
F15	Plunger	**LG** 217	8
F16	Outer Cam Track	**LG** 215	1

Illus. **No.**	Description	Part No.	**Qty.**
F17	Outer Housing	**DG** 213	1
F18	Side Plate	**FG** 206	1
F19	Crown Wheel & Pinion 7:31	**FG** 221	1
F19	Crown Wheel & Pinion 9:31	**FG 221A**	1
F19	Crown Wheel & Pinion 8:31	**FG** 221 B	1
F19	Crown Wheel & Pinion 10:31	**FG 221C**	1
F20	Tab Washer	**FT** 2212	5
F21	Bolt	**FT** 2211	10
F22	Circlip	**LG** 2191	2
F23	**Bolt**	**LG** 2193	8
F24	Drive Shaft HS 1400	**DG** 218	2
F25	**Nut 3/8 in. UNF Nyloc**	**FT 2196**	8
F26	Tie Bar	LG 262	2
F27	Tie Bar	**DG** 262	2
F28	Washer	**FT** 2585	6
F29	Dowel	**DG 213A**	5

DIFFERENTIAL & FINAL DRIVE FG 400–INBOARD BRAKES

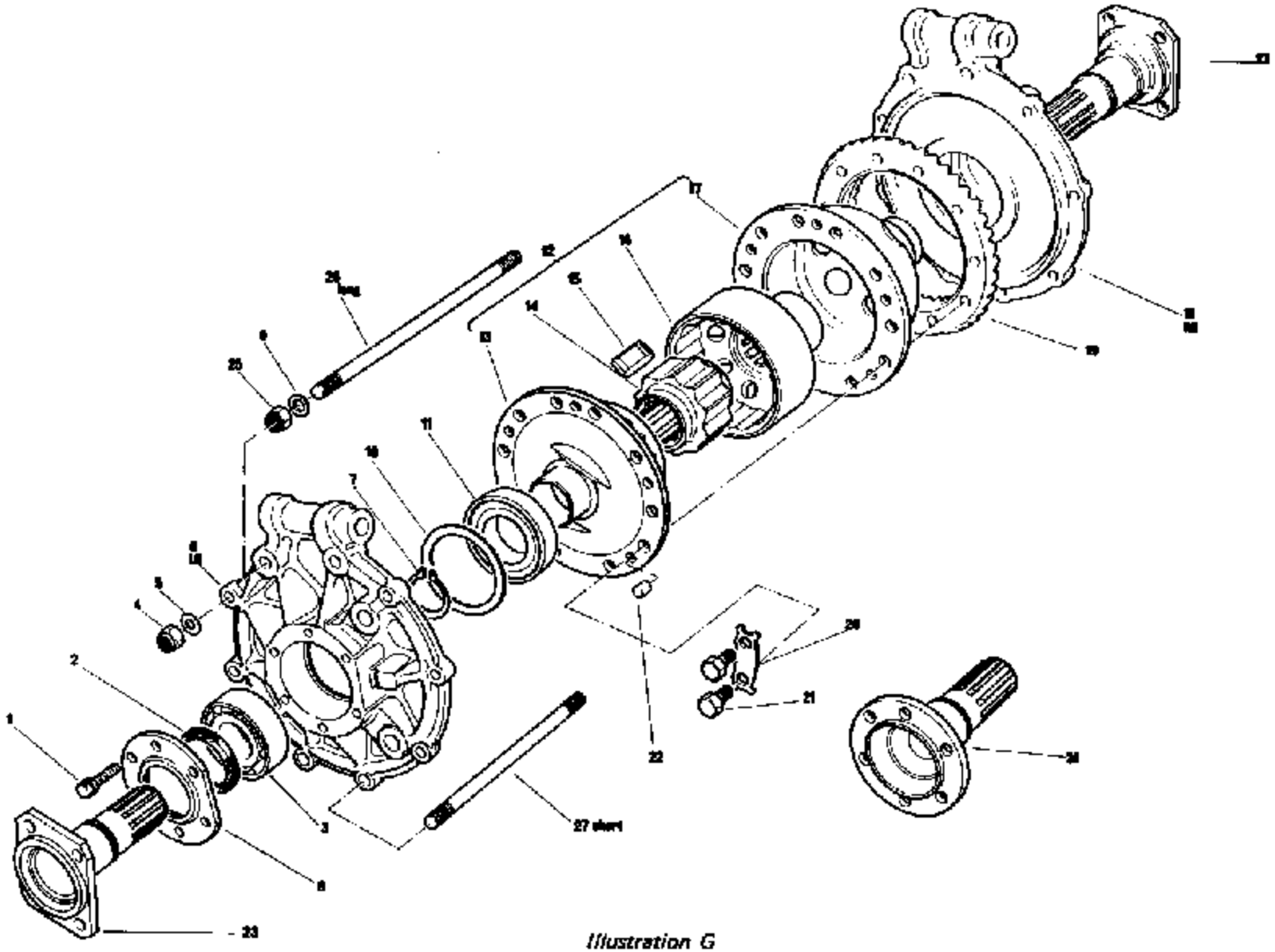


Illustration G

DIFFERENTIAL & FINAL DRIVE PARTS LIST-FG 400-INBOARD BRAKES

Illustration G

Illus. No.	Description	Part No.	Qty.
G1	Screw, Cap, ¼ in. UNC	**FG 2233**	12
G2	Oil Seal	LG 2054	2
G3	Bearing	**DG 2053A**	2
G4	**Nut 5/16 in. UNF Nyloc**	**FT** 2013	36
G5	Washer	**FT** 2027	36
G6	Side Plate	**FG** 2058	1
G7	Circlip	**DG 2191A**	2
G8	Retaining Plate	**DG 206AI**	2
G9	Washer	**FT** 2585	8
G10	Shim 3-5-10-15-20 thou.	**DG** 2061	
G11	Bearing	**DG** 2051	2
G12	Limited Slip Differential	**DG** 212	1
G13	Plunger Carrier	**DG** 214	1
G14	Inner Cam Track	LG 216	1
G15	Plunger	LG 217	8
G16	Outer Cam Track	LG 215	1

Illus. **No.**	Description	Part No.	Qty.
G17	Outer Housing	**DG** 213	1
G18	Side Plate	**FG** 2068	1
G19	Crown Wheel & Pinion 7:31	**FG** 221	1
G19	Crown Wheel & Pinion 9:31	**FG 221A**	1
G19	Crown Wheel & Pinion 8:31	**FG** 221 B	1
G19	Crown Wheel & Pinion **10:31**	**FG 221 C**	1
G20	Tab Washer	**FT** 2212	5
G21	Bolt	**FT** 2211	10
G22	Dowel	**DG 213A**	5
G23	Drive Shaft H.S. 1400	**DG 218A**	2
G24	Drive Shaft 100 ST	**DG** 2188	2
G24	Drive Shaft 89 ST	**DG 218D**	2
G24	Drive Shaft V.W. C.V.	**FG 218A**	2
G25	**Nut** 3/8 **in. UNF Nyloc**	**FT** 2196	8
G26	Tie Bar	LG 262	2
G27	Tie Bar	**DG 262A**	2

DIFFERENTIAL & FINAL DRIVE—FGA

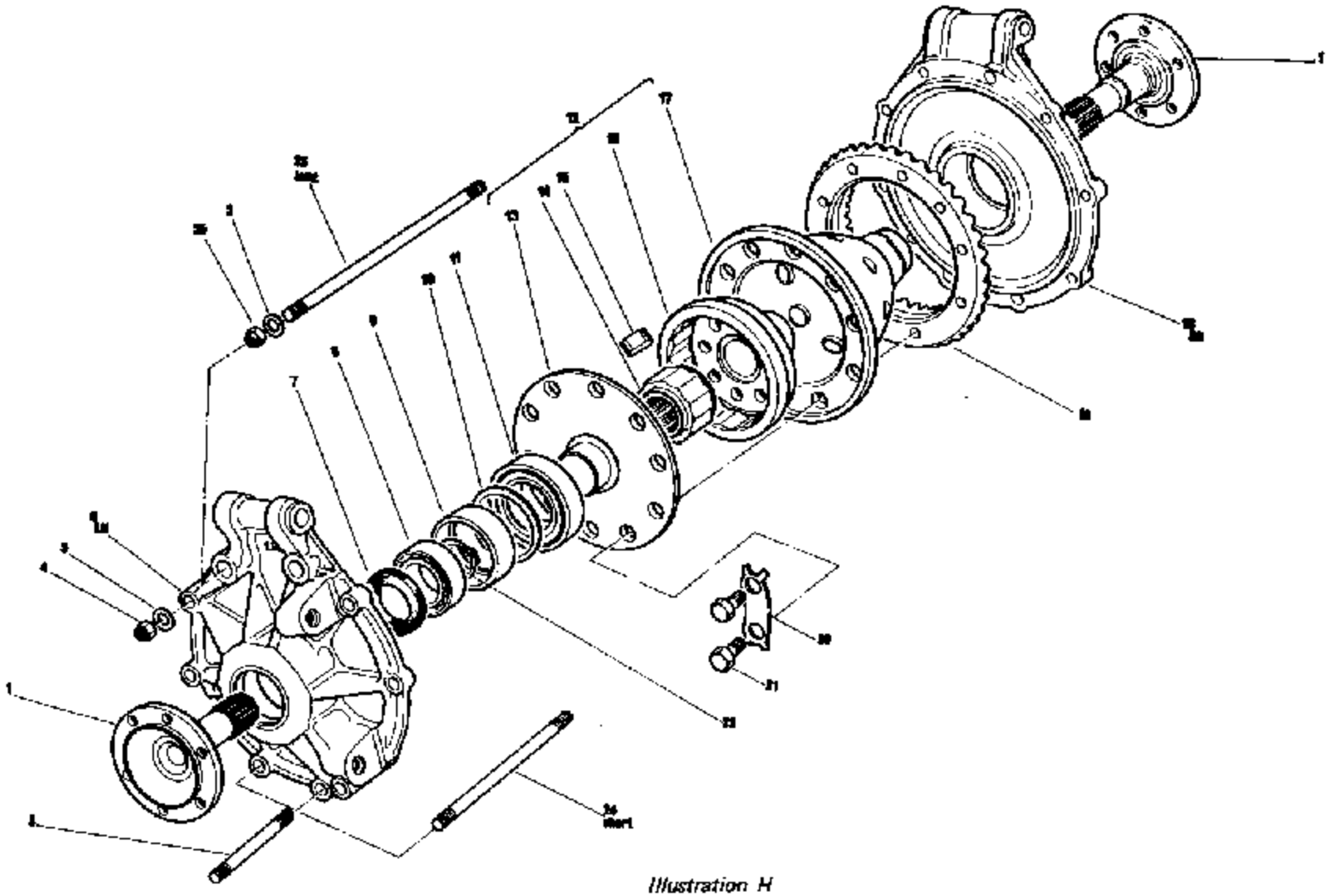


Illustration H

DIFFERENTIAL & FINAL DRIVE PARTS LIST-FGA

Illustration H

Illus. No.	Description	Part No.	Qty.
HI	Drive Shaft 12 holes	**FGA 218A**	2
HI	Drive Shaft 100 ST	**FGA 2188**	2
HI	Drive Shaft H.S. 1400	**FGA 218C**	2
H2	Washer	**FT 2585**	8
H3	Stud	**FGA 2012**	2
H4	**Nut 5/16 in. UNF Nyloc**	**FT 2013**	36
H5	Washer	**FT 2027**	36
H6	Side Plate	**FGA** 205C	1
H7	Oil Seal	**FT 2054**	2
H8	Bearing	**TL 2053**	2
H9	Spacer L/H	**FGA 2052A**	**1**
H9	**Spacer R/H (not** illus.)	**FGA 2062A**	**1**
H10	Shim **3-5-10-15-20** thou.	FT 2061	
HII	Bearing	FT 2051	2
H12	Limited Slip Differential	**TL 212**	1

Illus. No.	Description	Part No.	Qty.
H13	Plunger Carrier	**TL** 214	1
H14	Inner Cam Track	**TL** 216	1
H15	Plungers (thickness **5/16** in.)	**TL** 217	8
H16	Outer Cam Track	**TL** 215	1
H17	Outer Housing	**TL** 213	1
H18	Side Plate	**FGA 206A**	1
H19	Crown Wheel & Pinion 7:31	**FG** 221	1
H19	Crown Wheel & Pinion 9:31	**FG 221A**	1
H19	Crown Wheel & Pinion 8:31	**FG** 221 B	1
H19	Crown Wheel & Pinion **10:31**	**FG 221C**	1
H20	Tab Washer	**FT** 2212	5
H21	Bolt	**FT** 2211	10
H22	Circlip	**FT 2191A**	2
H23	Tie Bar	LG 262	2
H24	Tie Bar	**DG 262A**	2
H25	**Nut 3/8 in. UNF Nyloc**	**FT** 2196	8

DIFFERENTIAL ASSEMBLY—FGB & DGB

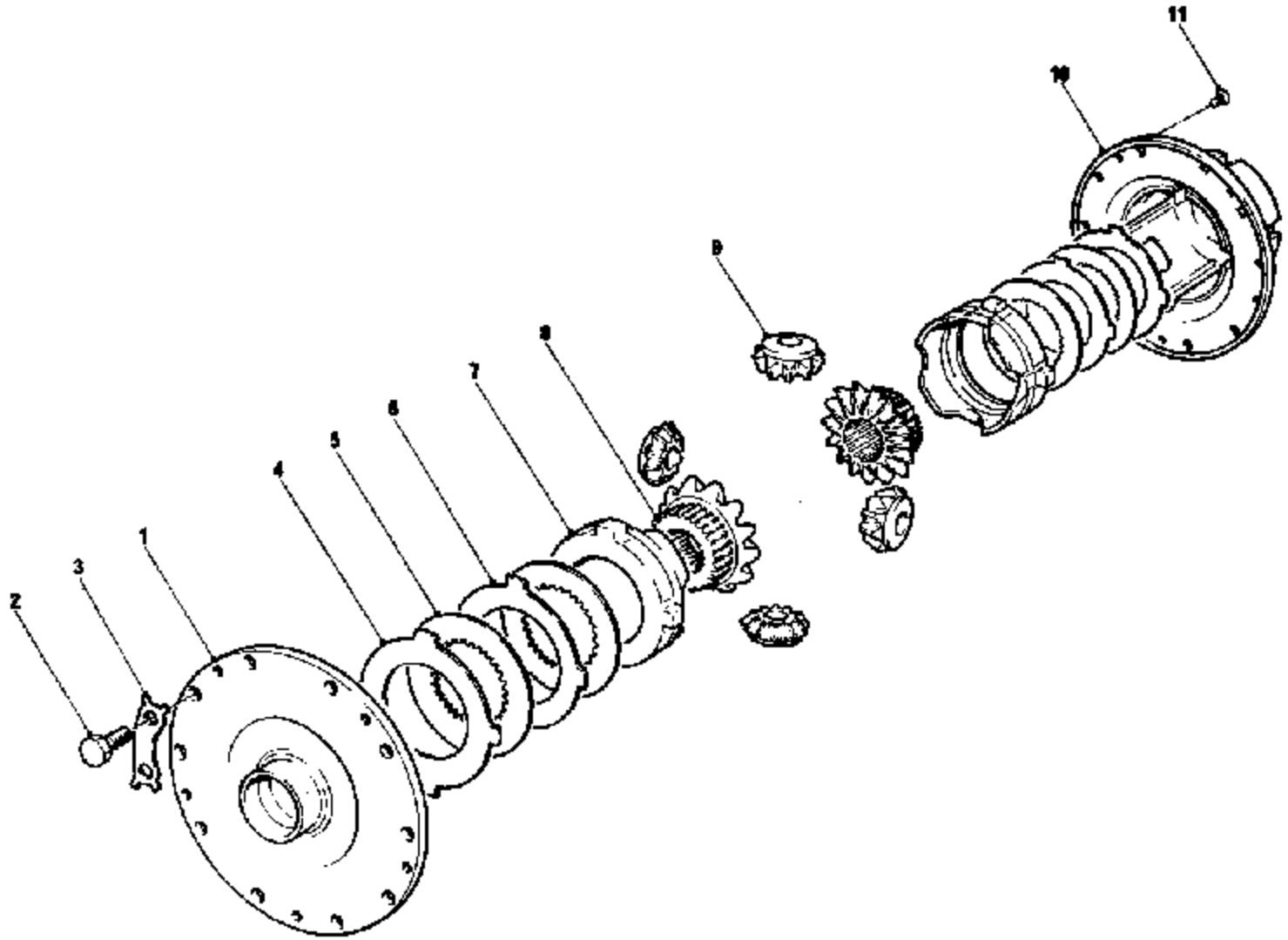


Illustration M

DIFFERENTIAL ASSEMBLY PARTS LIST-FGB &DGB

Illustration M

FGB 212 DIFFERENTIAL ASSEMBLY (AS ILLUSTRATED)

Illus. No.	Description	Part No.	Qty.
M1	End Plate	FGB 214	1
M2	Bolt	FGB 2211	10
M3	Tab Washer	FT 2212	5
M4	Clutch Plate, Belville	LG 2139	2
M5	Disc	LG 2138	4
M6	Clutch Plate	LG 21310	2
M7	Ring, Side Gear	FGB 2137	2
M8	Side Gear	TL2.2136	2
M8	Pinion Gear	LG 2135	4
M10	Differential Case	FGB213	1
M11	Screw	FGB 21312	5

DGB 212 DIFFERENTIAL ASSEMBLY (NOT ILLUSTRATED)

Illus. No.	Description	Part No.	Qty.
M1	End Plate	DGB 214	1
M2	Bolt	FGB 2211	10
M3	Tab Washer	FT 2212	5
M4	Clutch Plate, Belville	LG 2139	2
M5	Disc	LG 2138	4
M6	Clutch Plate	LG 21310	2
M7	Ring, Side Gear	FGB 2137	2
M8	Side Gear	LG 2136	2
M9	Pinion Gear	LG 2135	4
M10	Differential Case	DGB 213	1
M11	Screw	FGB 21312	5

Fig. 2 **Using the Dial Recording Micrometer to measure backlash**

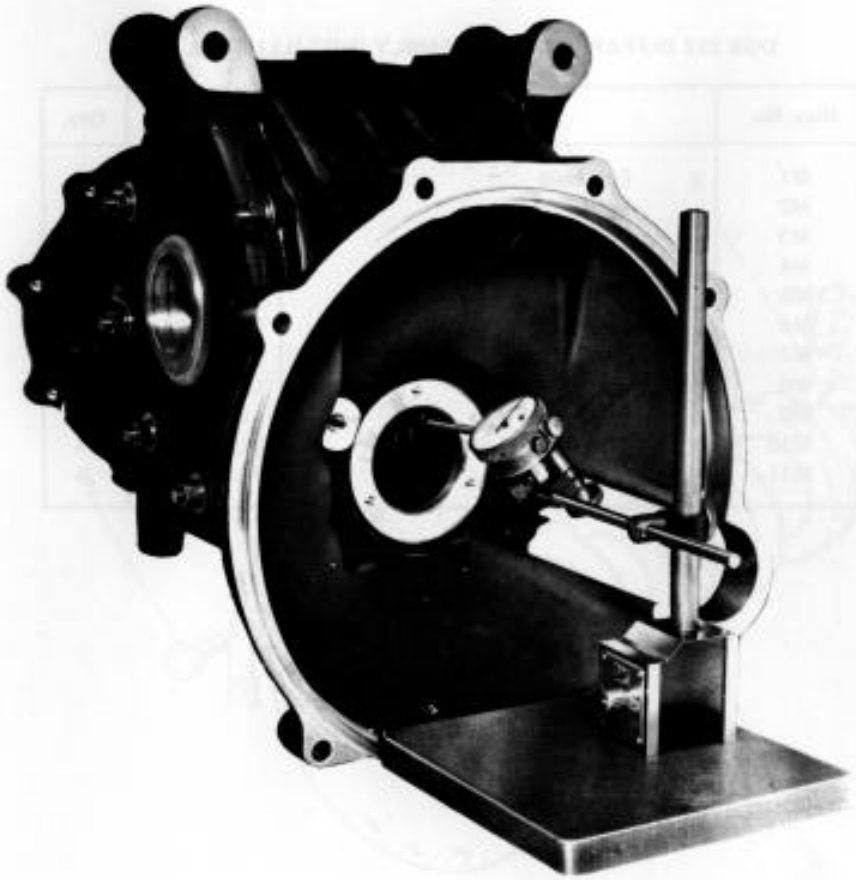


Fig. 3 **Hewland Setting Gauge in Position**

SETTING-UP THE CROWN WHEEL & PINION

Crown wheel and pinion sets are supplied as matched and lapped pairs, tested and passed before leaving the factory, and therefore should only be fitted to run as a pair, marked with a "HE" number on each part.

Setting up is possible with the use of engineers blue, **but the faster and more positive method is to use a** Hewland pinion depth gauge. Procedure is as follows:

SETTING PINION ON FT 200

Refer to illustration B.

1. **When fitting a new pinion it is also advisable to** fit a new pinion bearing (6).
2. **Press bearing (6) onto pinion shaft, ensuring** flanged shoulder is correct way round.
3. **Select a shim** (5), **i.e. used undamaged shims from removed pinion. Warm up the outside of** main case.
4. **Insert shim in correct position and drop pinion** and bearing into the main case.
5. **Fit clamp plate (7), insert four bolts (3). tighten** into clamp plate.
6. Allow main case to cool.

USING THE HEWLAND SETTING GAUGE TO CHECK PINION DEPTH

7. **Place setting gauge in position in place of side** plate of main case, Bolt across face.
8. **Using a feeler gauge, determine the clearance between the setting gauge and the pinion. The correct clearance is marked on the pinion and** should be achieved using shims (5).
9. When pinion clearance is correct, remove clamp **bolts (3), put on clamp plate tab washers** (4) **smear Locktite on threads, re-fit bolts (3) and tighten into clamp plate (7). Knock ever tab** washers.

SETTING PINION OF FG400 & FGA

Refer to Illustration C.

1. **When fitting a new pinion it is also advisable to** fit a new pinion bearing.

All FGA gearboxes are fitted with a larger pinion bearing (4-FGA2221). and to some FG 400 gearboxes up to 1976. The pinion bearing is fitted re-versed in some FG gearbox main cases prior to 1976, and in all FG gearboxes subsequently.

When separating the pinion from the main case, make special note of order and location of pinion bearing, **shims, and any spacers that might be present, to** ensure correct re-assembly.

2. **Press bearing (4) onto pinion shaft, ensuring** flanged shoulder is correct way round.
3. Select a shim **(7),** i.e. used shims from removed pinion. Warm up the outside of main case.
4. Insert shim (7) in correct position and fit pinion and bearing into the main case.
5. **Using old nut (5), and spacer (6), if fitted lock** bearing into main case.
6. Allow main case to cool.

USING THE HEWLAND SETTING GAUGE TO CHECK PINION DEPTH

7. Put setting gauge in position in place of side plate of main case, bolt across face.
8. **Using a feeler gauge, determine the clearance between the setting gauge and** the **pinion. The** correct clearance is marked on the pinion, and should be achieved using shims (7).
9. When pinion clearance is correct, remove old nut **(5) and fit new nut. Use a little Locktite and** tighten to a torque of 200 **ft/lbs**
10. **Using round-nosed punch, knock the grooved part of nut into the cut in thread of bearing.**

SETTING PINION OF FGB

Refer to Illustration L

1. **When fitting a new pinion it is also advisable** to fit a new pinion bearing.
2. **Press bearing (9) onto pinion shaft, making sure flanged shoulder is correct way round.**
3. **Select a shim** (10). **i.e. used undamaged shims from removed pinion. Warm up outside of** main case.
4. **Insert shim (10) in correct position and fit** pinion and bearing into main case.
5. Insert 6 bolts (8) (with plain washers to protect magnesium face), and tighten.
6. Allow main case to cool.

7. **Use the** Hewland **setting gauge to check pinion depth, as for FG400 or FGA.**

8. Adjust shimming as required until correct clearance is obtained.

9. **Finally re-assemble 6 bolts (8) with new tab** washers and tighten.

10. Tab over washers.

11. Check the position of Hubs as this may vary with new setting of pinion, as described on page 36 and adjust if required.

ADJUSTING PRE-LOAD OF DIFFERENTIAL FT200, FG400, FGA, FGB

1. Although differences exist between the method **of retaining the drive shaft bearing in the side** plate, the method of setting the crown wheel up is the same in all cases.

2. **Assemble the drive shaft bearings in the side plates, where they take the differential thrust (FT inboard, FGA), together with spacers. With** other gearboxes, this can be accomplished at a later stage.

3. Assemble differential unit, and fit crown wheel. **Use solid dummy bearings in place of the two differential taper bearings. The thickness of shims is critical. If they have to be replaced,** make sure it is with shims of the same thickness.

4. **Fit the differential unit and side plates to the** main case. Bolt up, including tie bars, to normal tension.

5. **Turn the pinion shaft by hand to test the** pre-load. Adjust by means of shims until satisfactory.

N.B. Turn the pinion with hubs removed. Using reasonable effort, it should be possible to turn ***it by gripping the splines by hand, but more effort will be needed with dummy bearings*** *than with real ones. Make sure there is some evidence of backlash. Absence of backlash will give a false impression of pre-load.*

TO ADJUST THE BACKLASH

For this operation you will require a post-mounted dial indicator with an extended probe. (Fig.2 page 30)

1. Remove **the** solid **dummy bearings from the differential unit and replace them with dummy** bearings. (Real bearing with increased tolerances for easy substitution).

2. **Insert the probe of the dial indicator through spigot housing until it touches one of the teeth** of the crown wheel. Note the reading on the dial **indicator. Turn pinion by hand to rotate crown** wheel, and take at least 12 readings. (14 readings **are standard practice in our workshops.) Mini-**mum reading should be .004 in.

3. To increase or decrease backlash, change shims **from one side of differential to the other, but** remember that once the pre-load has been set, **you can use only the shims that are already** there.

Re-assemble as follows:

4. Press inner bearings onto differential assembly.

5. **Warm up one side plate (FT outboard, FG 400)** and fit oil seal, drive shaft bearing and circlip or plate.

6. Press the drive shaft into the bearing and retain with circlip.

7. **Insert shim or shims, and bearing outer track. Place heavy weight on bearing track to flatten** shimming. Allow to cool.

8. **Repeat for other side plate. After cooling,** assemble one side to the main case. Complete the **assembly of the differential and drive unit as** described above.

N.B. If renewing the differential bearings, make certain that the width of the new bearings, also when using dummy bearings, are the same as ***old bearings being replaced. Any differences*** *must be adjusted in final shimming.*

ALTERNATIVE DIFFERENTIAL-FGA

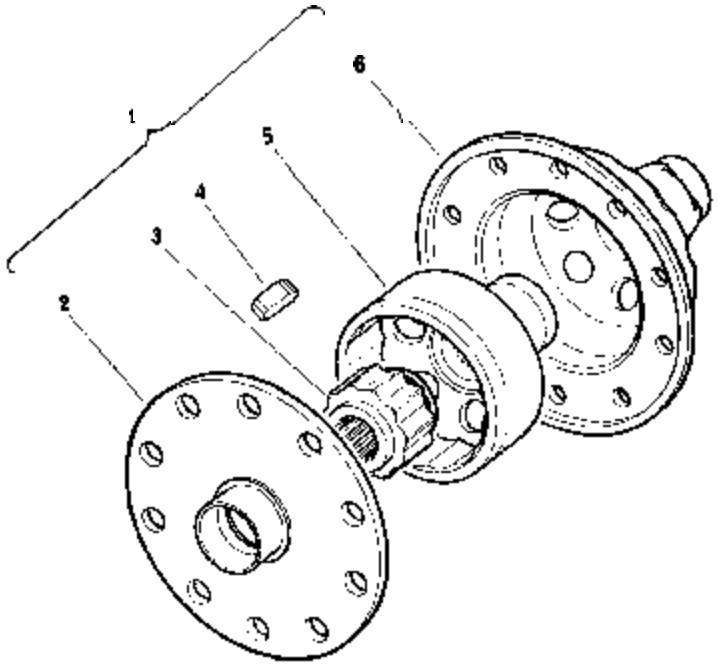


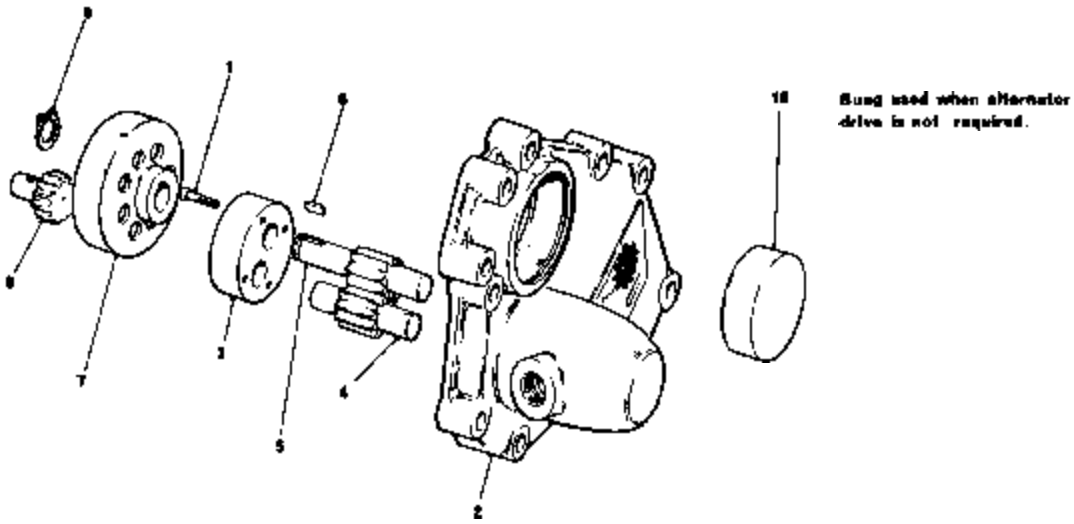
Illustration J

Illus. No.	Description	Part No.	Qty.
J1	Limited Slip Differential	**TL2.212**	**1**
J2	Plunger Carrier	**TL2.214**	**1**
J3	Inner Cam Track	**TL2.216**	**1**
J4	Plungers (thickness 3/8 in.)	LG 217	**8**
J5	Outer Cam Track	**TL2.215**	**1**
J6	Outer Housing	**TL2.213**	**1**

Fitted as standard from gearbox number FGA 169

OIL PUMP

Illustration K



The oil pump is located on the end cover of the gearbox unit. It is extremely strong and unlikely to suffer serious wear.

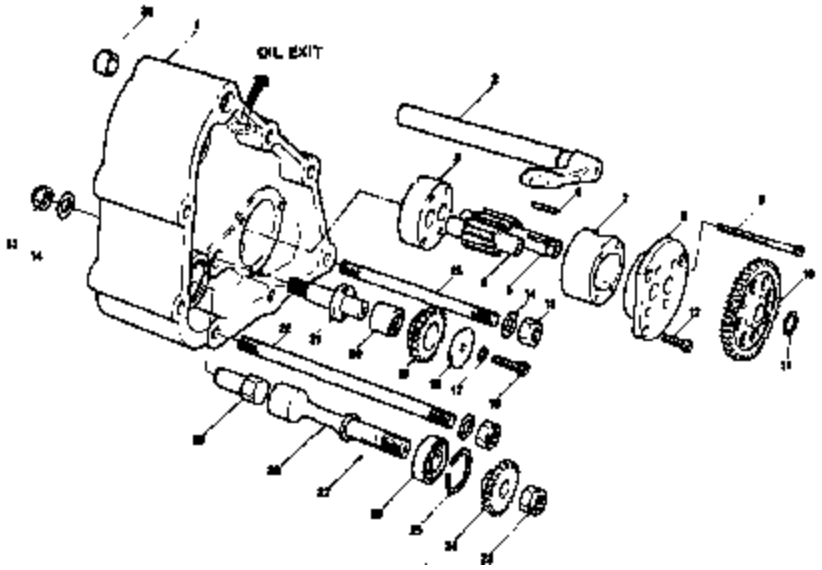
To Remove:

1. **Slacken and remove the** 5/16 **in. UNF nyloc end** cover securing nuts (8 off).
2. **Gently tap the end cover off gearbox housing.**
3. **Remove circlip (8) and pull off gear (7) remov-** ing the key on the shaft.
4. **Remove the cap screws (1) and take off top** cover **(3).**
5. Remove both gears from housing.
6. **Clean and check gears and body for possible** scouring.
7. Re-assemble in reverse order.

Illus. **No.**	Description	Part No.	Qty.
K	Pump	**FT** 265	1
Kl	Screws, **2BA**	**DG** 26510	*4*
K2	Pump *Body (Combined End Cover)*	**FT** 2652	1
K3	Pump Cover	**FT** 2653	1
K4	Gear	**DG** 2654	1
K5	Gear	**DG** 2655	1
K6	**Key**	**DG** 2656	1
K7	Gear, Internal	**FT** 2657	1
K8	Circlip	**DG** 2658	1
K9	Gear	**FT** 2659	1
K18	Plug *(use only when Alternator not required)*	**FT** 26512	1

OIL PUMP-FT & FG

illustration N



Illus No.	Description	Part No.	Qty.
N1	Body, Oil Pump	FT 203P	1
N2	Selector Finger	FGA6.252	1
N3	Pump Cover, End	FGA6.2652A	1
N4	Key	DG 2656	1
N5	Rotor, Driver	DG 2655	1
N6	Rotor, Idler	DG 2654	1
N7	Body, Pump	FGA6.2652	1
N8	Pump Cover, Front	FGA6.2653	1
N9	Screw, 4BA	FGA 26510	4
N10	Gear, Rotor Driver	FGA6.2657	1
N11	Circlip	DG 2656	1
N12	Screw, 2BA	DG 2651	3
N13	Nut, Nyloc 5/16 in.	FT 2013	9
N14	Washer, 5/16 in.	FT 2027	9
N15	Stud, Short	FGA6.20312	1

Illus. No.	Description	Part No.	Qty.
N16	Screw 2BA	FGA6.2651	1
N17	Washer	FGA6.2651A	1
N18	Washer, Fixed	FGA6.2659C	1
N19	Gear, Idler, Oil Pump	FGA6.2659A	1
N20	Bearing, Idler Gear	FGA62659D	1
N21	Shaft, Idler Gear	FT 2651 OB	1
N22	Stud, long	FGA6.2026	7
N23	Nut, Nyloc, 3/8 in.	FT 2196	1
N24	Gear, Drive, Oil Pump	FT 2659A	1
N25	Circlip, Bearing Retaining	HC9.2342	1
N26	Bearing, Drive Shaft	FT 2659D	1
N27	Ball Locating	FT 2659E	1
N28	Drive Shaft, Pump	FT 2659C	1
N29	Drive Insert Layshaft	FT 26598	1
N30	Dowel	FGA6.2029A	2

SETTING GEAR POSITIONS FOR GEARBOXES WITH ROTATING TOP GEAR THRUST WASHER

SETTING GEAR POSITIONS IN MAIN CASE (Fig. 4)

1. **With pinion set-up in main case, slide front hub** onto pinion shaft.

2. Slide spacer next to froht hub.

3. **With the aid of a machined straight-edge check** the level of the spacer relative to main case rear face.
   If lower – Use longer front hub or shim at position X-X.
   If higner (proud) – Use shorter -front hub or grind face of hub at position X-X.
   If level (flush) – Setting is correct.

SETTING GEAR POSITIONS WITH SELECTOR FORK JIG

1. Using methods described above, achieve spacer level with front face of bearing carrier.

2. Set selector forks.

Notes: ***All bearing carriers set by this method are*** *interchangeable on main cases.*

Clearance between top gear thrust bearing and casting is not to a critical tolerance (min. 0.020 in).