SERVICING INSTRUCTIONS AND ILLUSTRATED PARTS LIST FOR HEWLAND NST GEARBOXES

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TECHNICAL SPECIFICATION

The NST gearbox is a transaxle unit, designed for mid-engined, rear wheel drive cars. The unit is produced with five forward gears and reverse. A Powerflow differential is fitted as standard, and a cam & pawl differential is available.

The gear selection mechanism is sequential, with a manually operated reverse lockout mechanism.

The drive is taken from the engine via the clutch shaft, which turns input and pinion gears to drive the final transmission assembly.

Gear changing is effected through non-synchronizing face dogs. An extensive range of gear ratios provides a wide range of gearing requirements. The gear ratios and differential assembly can easily be changed without removing the gearbox from the vehicle.

Heat treated nickel chrome steel is used to manufacture all gears and shafts. The selector forks are also steel. Lubrication is by internal pump with distribution circuit, and the oil is retained by lipped oil seals.
In general configuration, the NST is a high tech racing transaxle unit which achieves the maximum effective use of power, and extremely stiff rear suspension mounting positions.

weight	85 lbs. (38.5 Kg)	gear ratios	from 2.923:1 to .89:1
oil type	SAE 80 or 90	final drive ratios	8/31 9/31 9/35 9/37 10/31 13/36
oil quantity	2.2 pints (1.25 litre)	clutch shaft	made to customer's requirements
max. torque	190 lbs.ft (430 Nm)		

GENERAL NOTES :-

a/ Read these instructions carefully and with reference to the illustrations.

b/ Before dismantling the gearbox, see that a clean tray is available, in which to place the parts.

c/ Thoroughly clean and inspect all parts before reassembly. Discard any worn or damaged components and replace with new ones.

d/ Use only genuine Hewland parts as replacements. These are manufactured in our workshops to the fine tolerances necessary and are rigorously inspected.

e/ Always check that locknuts and oil seals are in good condition when reassembling.

f/ All studs and screws must be Loctited or wirelocked in position, unless stated otherwise

g/ Bearing Replacement :-
Bearings can only be removed or renewed if the casings have been warmed in an oven, or with a blowlamp. In the latter case, keep the blowlamp moving while heating the casing.
Note: Do not overheat. Test with a spot of water which will bounce off at the correct temperature.
Once a casing is heated, all bearings should be pressed into their respective seatings without delay, thus eliminating the need to reheat. At the correct temperature, fitting the bearings should present no difficulty.
During cooling, or when the casings have cooled, it is advisable to once more lightly press the bearings to ensure that they are correctly seated.

h/ Oil:
Fill the gearbox through the plug hole on top of the maincase. The oil will find it's own level within the gearbox.
Note: Too much oil will not directly cause any harm, but is undesirable as it may induce power loss and overheating of internals.

DIFFERENTIAL BEARING PRELOAD

Requires special tool No. SK-119-FT

Assemble the differential case (137) and end cap (138), and bolt the crownwheel (112) to it. Fit the differential unit into the maincase (1) using dummy bearings SK-119-FT, and fit the sideplate (109). Adjust the shims (108) if necessary, to achieve 9-10 lbs.ft of bearing preload torque (to turn the diff assembly in it's bearings).

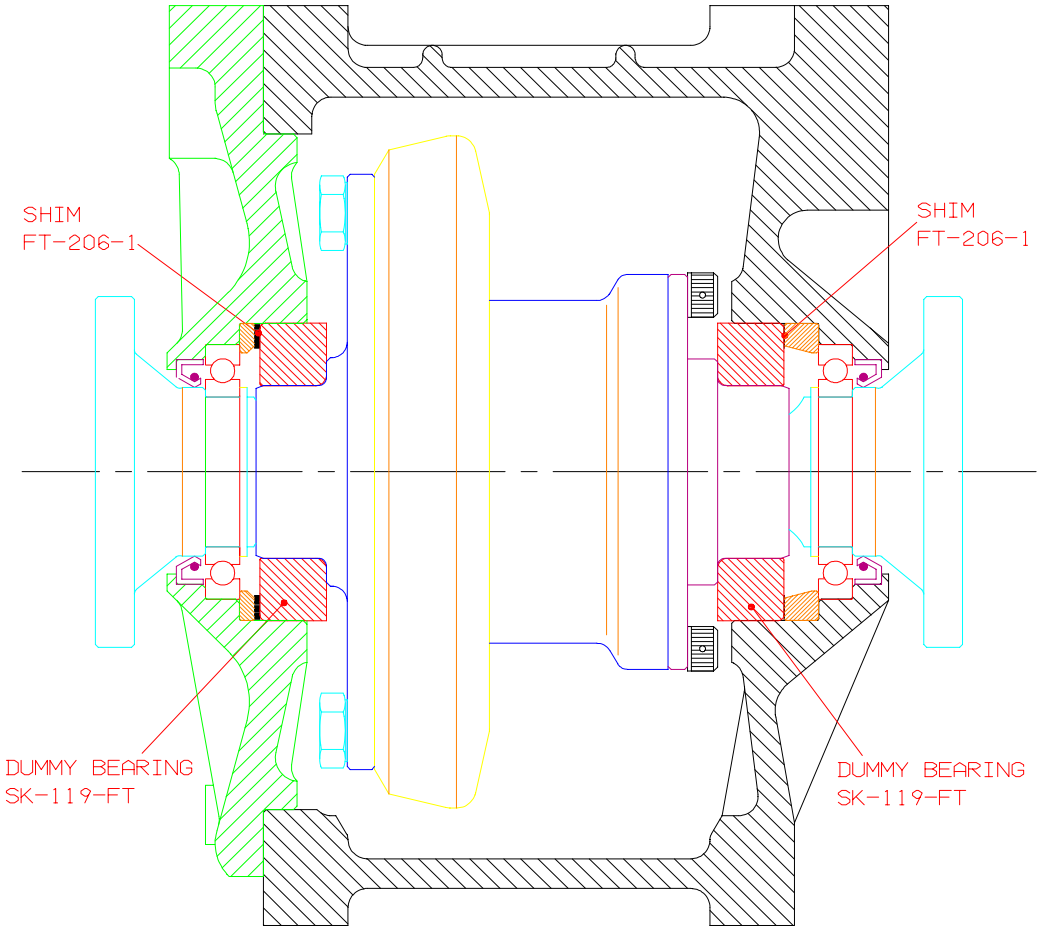


FIGURE 1

PINION SETTING
Requires special tool No.SK-906

Press the pinion head bearing assembly (4) onto the pinion shaft (81). Assemble the pinion shaft into the maincase (1) and slide on the hubs (7,12,13) and bearing inner track (14). Tighten the pinion shaft nut (18) onto the pinion shaft, to the specified torque.

Fit tool SK-906 into the maincase diff bearing bore, and use feeler gauges to measure the gap between the tool and the pinion front face. This clearance should comply with the dimension indicated on the pinion shaft label (also stamped on the front face of the pinion shaft), and can be adjusted by adding or removing shims (6) from behind the pinion head bearing housing (4).
It is imperative to check the selector barrel setting after changing / resetting a pinion shaft or bearing.

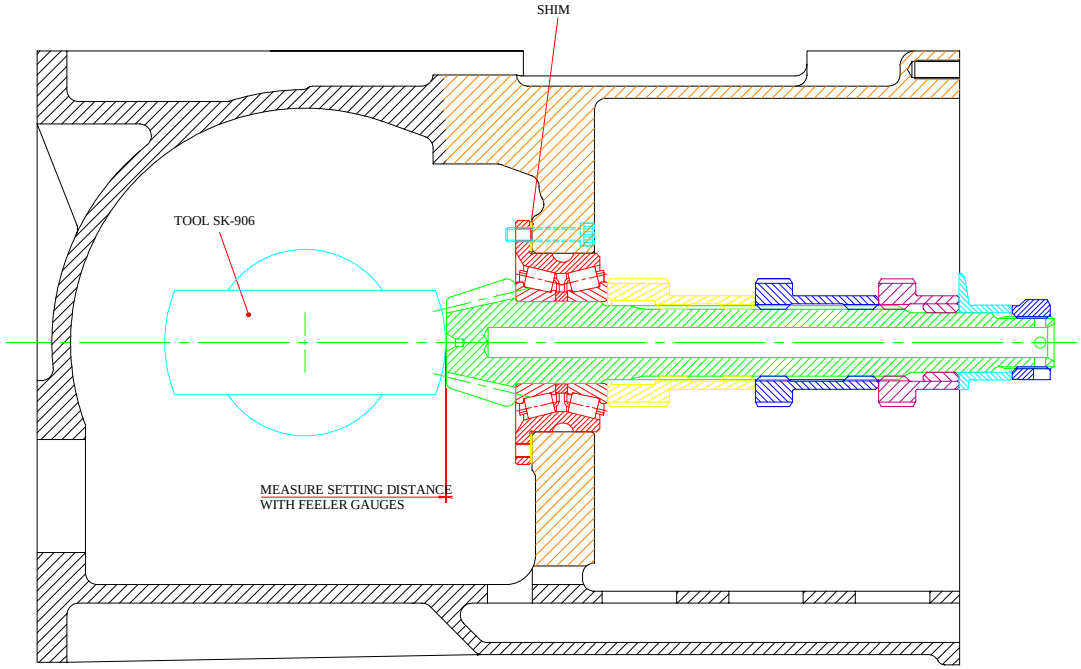


FIGURE 2

CROWNWHEEL & PINION BACKLASH SETTING

With the pinion shaft correctly fitted, and the correct crownwheel bearing shims assertained, the actual backlash can be measured by means of a dial test indicator against the pinion tail nut. Be sure to take at least 6 backlash readings, turning the crownwheel 30-45 degrees between each reading (this is to ensure that any variation due to manufacturing tolerances are taken account of.

Using this method,the minimum backlash figure should be .005” (.127mm). If the measured backlash is incorrect, rectify it by removing some shims (108) from behind one diff bearing, and inserting them behind the other, thus moving the diff across in the maincase. Do not add or discard any shims at this stage, as to do so would affect the diff bearing preload.

Once the correct backlash has been achieved, replace the dummy diff bearings with bearings (110) and confirm that the backlash is correct.

Note: Dummy are used so that it is easy to change the shims during the setting procedures. Before fitting the actual diff bearings, it is important compare their width with that of the dummy bearings and compensate the shims accordingly for any difference.

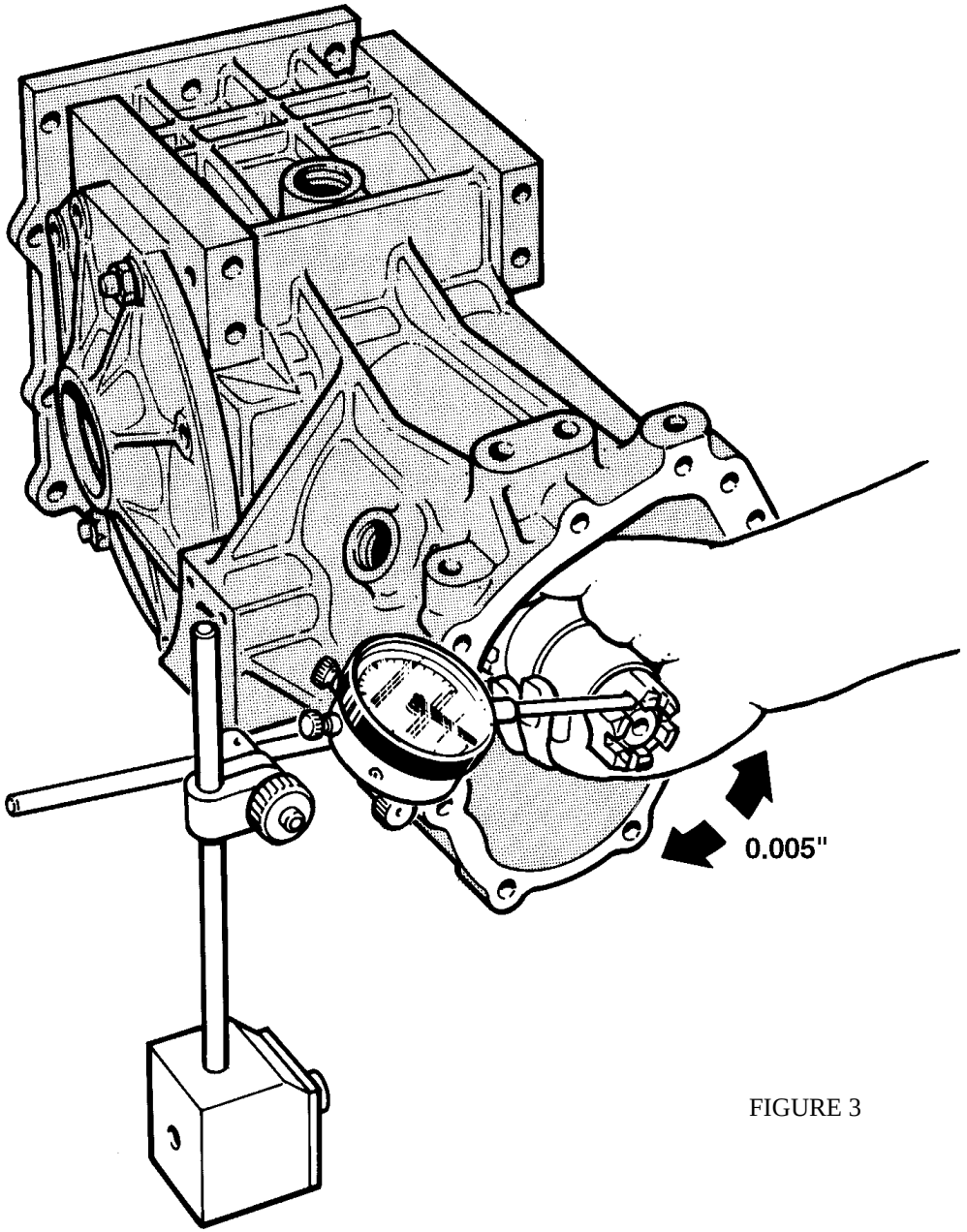


FIGURE 3

SEQUENTIAL BARREL SETTING

Requires special tool No.SK-1469

a/ It is most important that the rear face of the rear hub bears the same relationship with the front face of the bearing carrier, both when assembled in the fork setting fixture, and when installed in the gearbox maincase. To accomplish this, fit all three hubs onto the (fitted) pinion shaft. Place a straight edge across the back face of the maincase, and take a measurement between the straight edge and the rear face of the rear hub. Remove the hubs and slide them onto the dummy shaft of the fork setting fixture. Repeat the measurement, but this time place the straight edge across the ends of two of the fixture pillars. Adjust the fixture, by adding or removing shims from positions 'X' or 'Y', to reproduce the measurement taken from the maincase.

b/ Having set up the fixture to match your specific gearbox, add the bearing inner track (14) to the bearing carrier. Secure the selector rail (65) into the bearing carrier with screw (66). Slide the selector forks (61,64)over the rail, and rotate them to engage their pins (62) with the tracks in the barrel (116). Stack the hubs (7,12,13), clutch rings (11), pinion gears (10) and bearings (9) in position, and slide the whole bearing carrier assembly onto the fork setting fixture. Fit the pinion shaft nut (18) onto the end of the dummy shaft and tighten sufficiently to eliminate any play between the hubs.

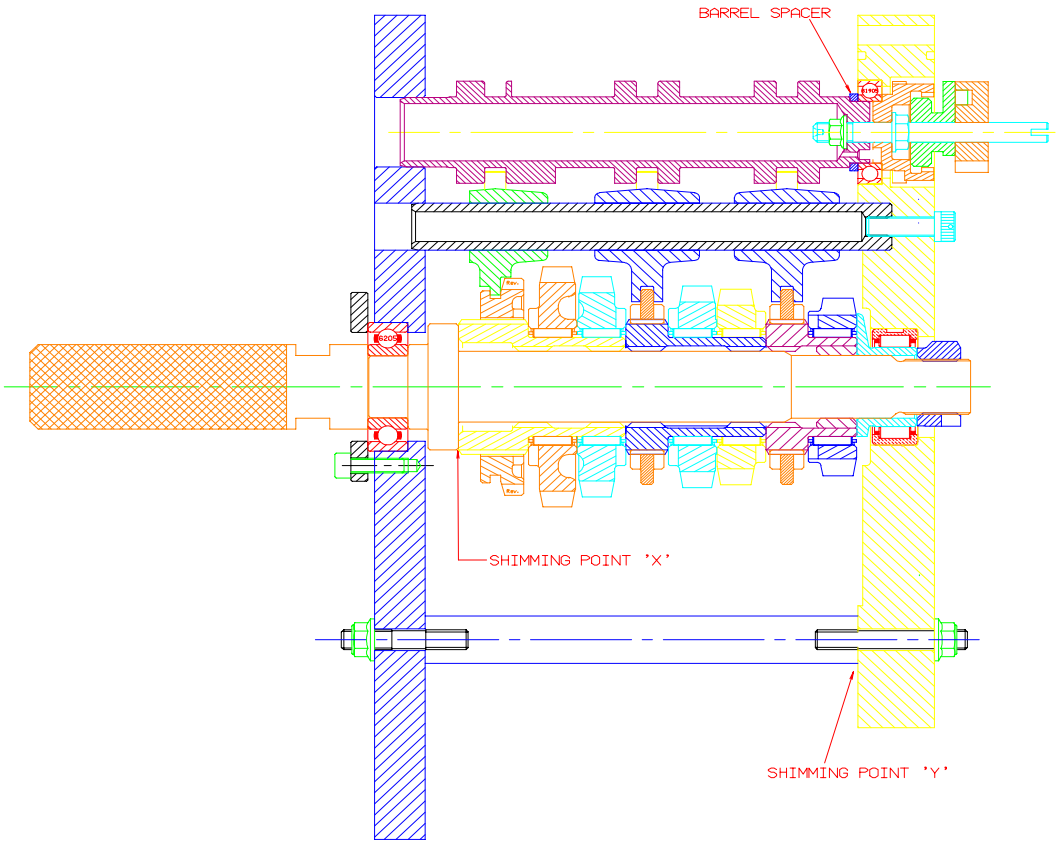


figure 4

c/ Rotate the barrel to engage first gear. Measure and record the gap between the dogfaces of third through fifth gears. Engage third gear and repeat the measurement for first and second dogfaces. It is important that these dimensions are not taken when the barrel is in the neutral position.
First, third and fifth gear dog gap measurements will be similar (as will second, and fourth). Any difference between the odd & even gear measurements must be corrected by replacing the barrel spacer (58) with one of the correct thickness.
Note: It is not possible (or necessary) to individually adjust each selector fork.

POWERFLOW DIFFERENTIAL

This Powerflow differential unit is designed with versatility as it's major asset. Many factors will contribute to the settings required. A car with good traction and low power, may require a completely different arrangement to that of a car with poor traction and high power.

There are 10 friction plates within the unit 4 splined to the diff casing, and 6 splined to the side bevel gears. Slip limiting is dependant on the friction resistance between these plates, and is affected by clamping the plates together.. Four factors contribute to the total friction torque between the plates :-

1/ The side bevel gears thrust apart to clamp the plates as they transmit the driving power. This is a feature of the gear geometry, and is not adjustable.

2/ The ramp angles cut on the side ring gears have an effect on how much of the transmitted torque is converted into sideways (clamping) force onto the plates. For example, on the drive side ramp, 45 degrees transmits less sideways force than 30 degrees. Likewise on the coast side ramp, an 80 degree angle will transmit little or no clamping force onto the plates, whereas a 45 degree angle will transmit a much greater force. Side ring gears are available with many different drive/coast ramp angle combinations.

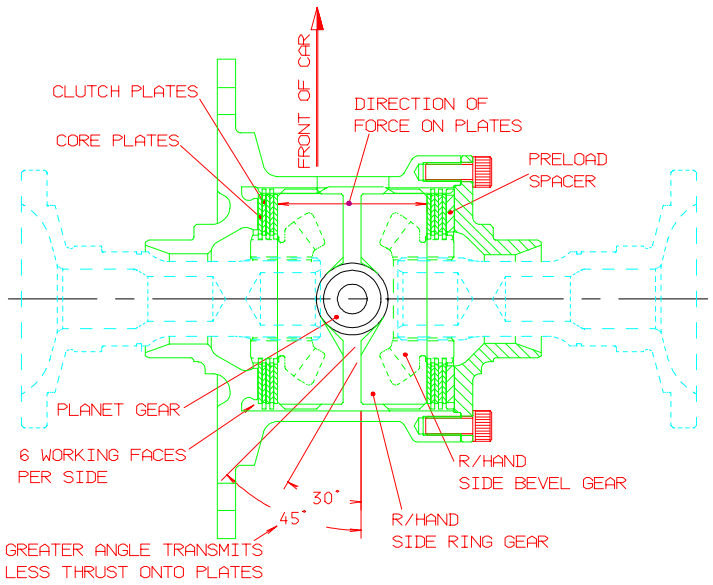


FIGURE 5

3/ The second adjustable factor is how tightly the plate stack is compressed on assembly (known as static preload). Included in the plate stack is a preload spacer. The preload torque is measured between the side bevel gears, by holding one side bevel gear stationary, and measuring the torque required to turn the other using tool SK-846. When the diff is assembled, the preload torque must be at least 10 lbs.ft, but can be much greater if required. New plates 'run in' so a higher preload is advised than with used plates.

4/ The final adjustment is simply to re-order the plate stack so as to change the number of relatively rotating faces. The diagram shows the stack setup with the maximum 12 working faces. Standard stack may be shuffled to give as few as 2 working faces.

GEARBOX ASSEMBLY

Note : It is assumed that the pinion shaft has been fitted to the maincase, and that the crownwheel bearing shims have been determined and fitted. It is also assumed that the correct barrel spacer has been ascertained and fitted to give correct fork setting.

1] Fit the selector input shaft inner bearing (84) into the rear cover (41). Hold the quadrant gear (46) in position inside the rear cover. Slide the selector input shaft (88) through the quadrant gear into engagement with the bearing (84) and add the circlip (85). Slide the spacer (86) into position. Heat the rear case gently (see general notes), drop the outer bearing (87) into place, and secure with circlip (90). When the casing has cooled, push the oil seal (89) into place.

2] Assemble the washers (74), spring (75) and circlip (76) onto the selector rack (73). Slide the selector rack into the rear cover (41), taking care to engage the quadrant gear (46) correctly at the centre of the rack teeth, and fit the rack stop (78) and sealing washer (77).

3] Fit the oil pump into the rear cover and secure with screws (45). Add the driven gear (92), drive key (131) and circlip (132).

4] Fit the oil pickup tube (27) into the rear cover.

5] Push the reverse idler spigot (101) into position in the maincase (1) and secure with countersunk screws (95), bolt (93) and washer (94). Press the bearing (99) into the reverse idler gear (97) and assemble with the thrust washers (96,99) onto the reverse idler spigot. Secure with nut (100).

6] Press the oil seal (39) and clutch spigot bearing (36) into their housing (40) and secure with circlip (35). slide the bearing & housing onto the clutch shaft (33) and secure with circlip (34). Add the o'ring (37) to the housing, and slide the whole thing into position through the front of the gearcase. Fix in place with screws (38).

7] If the bearing retaining screw (16) is fitted to the bearing carrier (23), remove it, slide the oil spray rail into place, and replace the screw.

8] Assemble the layshaft (28), gears (25), and spacer (26). Fit the layshaft into it's bearing (20) in the bearing carrier, and add the layshaft nut (21). tightening the nut by hand only, at this stage.

9] Push the bearing inner track (14) into the pinion tail bearing (15) in the bearing carrier. Build the pinion gears (10), clutch rings (11), reverse pinion gear (8), bearings (9), and their respective hubs (7,12,13) into position.

10] Engage the three selector forks (61,64) with their clutch rings, and slide the selector rail (65) through them to engage the bearing carrier. Secure the selector rail with screw (66).

11] Taking care to support the pinion shaft components, offer the complete bearing carrier and gear cluster assembly to the rear of the maincase, feeding the front hub onto the end of the pinion shaft. Gently ease the bearing carrier forwards, locating the bearing carrier onto the maincase studs. It will be necessary to rotate the centre (12) and rear (13) hubs to align their internal splines with those of the pinion shaft. As the assembly nears the fully home position, ensure that the layshaft engages it's front bearing (29) and the clutch shaft (33).

12] When the maincase dowels (91)enter the bearing carrier, it may be necessary to tap the bearing carrier gently, with a soft faced mallet, until it is fully home.

13] Screw the pinion shaft nut (18) onto the pinion shaft, and torque tighten it and the layshaft nut to115 lbs.ft (15.9 kg.m). To tighten the nuts it is necessary to engage a gear, and prevent the gear cluster from rotating. This can be done by applying the vehicle brakes, or by holding the layshaft with special tool SK-1472.

14] Lock the shaft nuts with split pins (19).

15] Locate the drum shifter gear (49) onto the drum shifter.

16] Fit the rear cover, taking care to correctly engage the selector rack (73) with the drum shifter gear (49), and the oil pump driven gear (92) with the driver gear (22) on the end of the layshaft. Secure the rear cover with nuts (83).

17] Fit the filler (117) and drain (119) plugs and sealing washers (120). Fit the pinion spray nozzle (3) and sealing washer (2).

18] Insert the reverse interlock cable (not a Hewland part) into the reverse locking plunger (122), add the spring (123) and plug (121) and screw the assembly into the side of the maincase.

CHANGING GEAR RATIOS

1] Disconnect the gear linkage from the selector input lever on the right side of the rear cover.

2] With a drip tray beneath the gearbox, remove the nuts (83) and remove the rear cover (41). If the cover is found to be tight or stuck, tap it gently with a soft faced mallet to break the joint. (Never attempt to force the cover off by levering between the joint faces, as this may damage the castings and result in an oil leak).

3] Remove the split pins (19) from the pinion shaft and layshaft nuts (18,21)

4] Engage a gear, and apply the vehicle brake. Untighten the layshaft nut but leave it finger tight. Untighten and remove the pinion shaft nut (N.B. The pinion shaft nut has a left hand thread).

5] Either operate the reverse interlock release, or unscrew the reverse locking bung (121) from the maincase.

6] Loosen the selector rail retaining bolt (66) but do not remove it.

7] Ease the bearing carrier and gear cluster assembly out of the maincase. The pinion shaft gears and hubs will need supporting as the cluster is withdrawn. This can be done by hand, or by inserting a rod thought the pinion shaft tail bearing (15) .

8] With the gear cluster now on the workbench, remove the selector rail bolt (66) and withdraw the selector rail (65). The selector forks (61,64) can now be removed.

9] Take the pinion shaft gears (10), bearings (9), hubs (7,12,13) and reverse pinion gear (8) out of the assembly.

10] Remove the layshaft nut (21) and withdraw the layshaft (28). The input gears (25) may now be removed.

11] Replace the gears with the correct ratios. Gears must be exchanged in matched pairs. For identification purposes, each gear is marked with two sets of numbers. The first of these indicates the number of teeth on the layshaft gear, while the second figure signifies the number of teeth on the mating pinion shaft gear. It is essential that gears are correctly paired to these numbers, and any prefix or suffix letters must also be identical, as mismatching of types will certainly result in damage or failure. For some first and second gears, the teeth are machined integral with the layshaft. Therefore in such cases, if change is required to either of these ratios, both pinion shaft gears, and the layshaft itself, will have to be changed.

12] Whilst changing ratios it is advisable to wash and inspect all components which are to be refitted. Check for wear and cracks, particularly to the engagement dogs. If the corners of the engagement dogs are badly damaged, gear selection will be poor, and damage may be caused to the selector components. If the driver has experienced any difficulty in selecting gears, check for bent selector forks. A good tip is to check the fork setting on the fixture, each time the gearbox is re-assembled, a bent fork will show up as a badly set fork (unequal dog gap on each side of the relevant clutch ring).

13] Re-assemble the gearbox. (see page 11).

ILLUSTRATED PARTS LIST

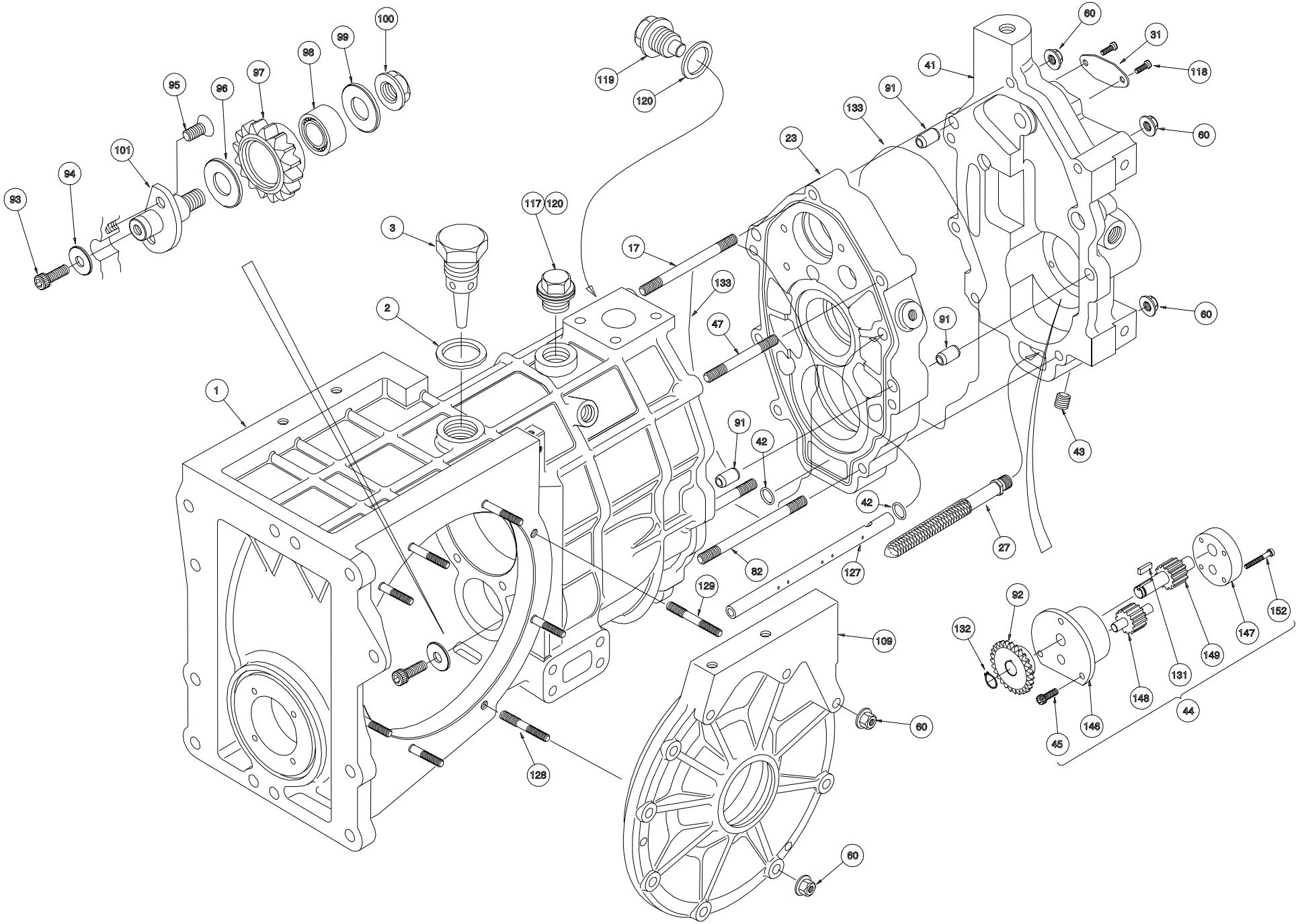


fig.6

CASINGS AND ASSOCIATED PARTS

ITEM	DESCRIPTION	PART NUMBER	QTY
1	MAINCASE	NST-201	1
2	BONDED SEAL	FGB-201- 8	1
3	OIL FEED PLUG	FGB-201- 7	1
17	STUD	STU-32	1
23	BEARING CARRIER	NST-202	1
27	OIL FILTER PICK UP TUBE	HP-O-2002	1
29	FRONT LAYSHAFT BEARING	F3A-234- 1	1
31	BLANKING PLATE	TE-201-4	1
41	END COVER	NST-204	1
42	O RING	TGT-205- 1	2
43	PLUG	FT-203-1	1
44	OIL PUMP ASSEMBLY	FGA-6-265	1
45	CAP SCREW	DG-265- 1	3
47	STUD	STU-33	3
60	KAYNUT 5/16” UNF	NUT-002	17
82	STUD	STU-34	3
91	DOWEL	HP-M-9015	4
92	OIL PUMP DRIVEN GEAR	NST-265-7	1
93	RETAINING SCREW	HC-237- 6	1
94	WASHER	ST-237- 9	1
95	SCREW	F3-237- 8	2
96	THRUST WASHER	HC9-6-237- 4	1

ITEM	DESCRIPTION	PART NUMBER	QTY
97	REVERSE IDLER GEAR	HC-237- 1	1
98	REVERSE IDLER BEARING	FT-237- 2	1
99	THRUST WASHER	FT-237- 4	1
100	NUT-REVERSE IDLER	VG-237- 5	1
101	REVERSE IDLER SPIGOT	F3-237- 3	1
109	SIDEPLATE	NST-205	1
117	FILLER PLUG	HP-M-9003	1
118	M5 X 10 BUTTON HEAD	HP-M-9029	2
119	MAGNETIC PLUG	HP-M-9004	1
120	BONDED WASHER	HP-M-9042	2
127	SPRAY RAIL	NST-202-10	1
128	STUD	FT-201-2A	7
129	STUD	FGC-201-2A	2
131	KEY	DG-265-6	1
132	CIRCLIP	DG-265-8	1
133	SEALING STRIP	VG-201-9	A/R
146	PUMP BODY	FGA-6-265-2	1
147	PUMP END COVER	FGA-6-265-2A	1
148	ROTOR	DG-265-4	1
149	ROTOR	DG-265-5	1
152	CAP SCREW	DGB-265-10	4

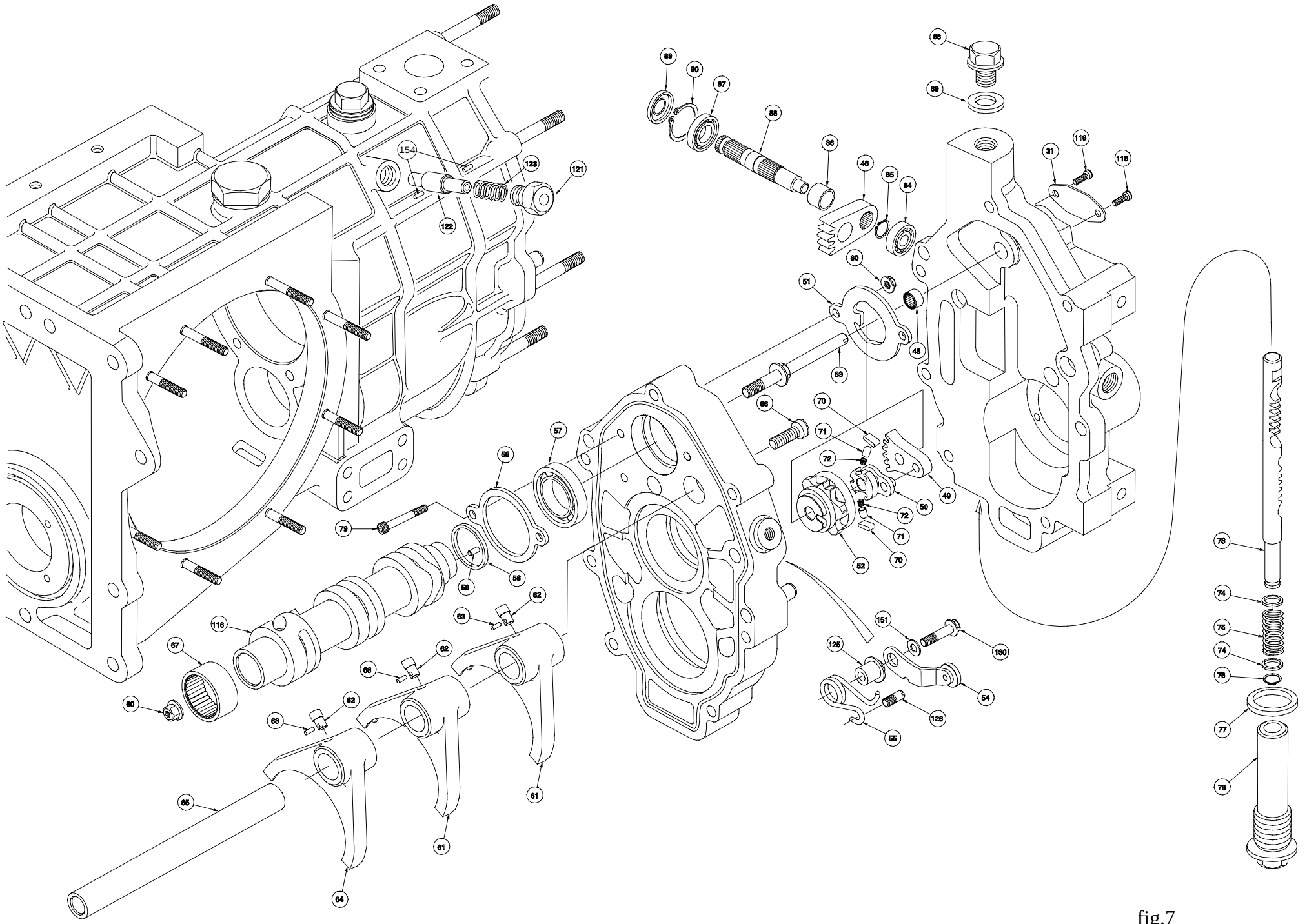


fig.7

SELECTION COMPONENTS

ITEM	DESCRIPTION	PART NUMBER	QTY
46	QUADRANT GEAR	NMT-252- 1	1
48	BEARING	BEA-050	1
49	DRUM SHIFTER GEAR	NST-260- 6	1
50	DRUM SHIFTER	HP-M-7015	1
51	GUIDE PLATE	NST-260-13	1
52	DETENT DRUM	HP-M-7013	1
53	SHIFTER SPINDLE	NST-260- 5	1
54	DRUM STOPPER	NST-260-1	1
55	SPRING	SPR-014	1
56	DOWEL	HP-M-7022	1
57	BALL BEARING	HP-M-8008	1
58	BARREL SPACER	HP-M-7056	1
59	KEEP PLATE	NMT-260- 2	1
60	KAYNUT	NUT-2	1
61	SELECTOR FORK	NST-250	2
62	SELECTOR FORK PIN	NST-250- 1	3
63	SPIROL PIN	VGC-6-252- 2	3
64	1st/REV FORK	NST-249	1
65	SELECTOR RAIL	NST-246	1
66	SOCKET HEAD CAP SCREW	SCR-52	1
67	NEEDLE ROLLER BEARING	105-260-6	1
68	SELECTOR RACK STOP	NST-204-1	1
69	BONDED SEAL	WSH-13	1
70	PAWL	HP-M-7017	2
71	PLUNGER	HP-M-7018	2

ITEM	DESCRIPTION	PART NUMBER	QTY
72	SPRING	HP-M-7018- A	2
73	SELECTOR RACK	NMT-260- 3	1
74	WASHER	102-260-11	2
75	SPRING	102-260- 9	1
76	CIRCLIP	102-260- 8	1
77	DOWTY SEAL	WSH-10	1
78	RACK STOP	NST-204- 2	1
79	SOCKET CAP SCREW	SCR-064	2
80	KAYNUT	NUT-5	2
84	BALL BEARING	BEA-52	1
85	CIRCLIP	CIR-33	1
86	SPACER	NMT-252- 3	1
87	BALL BEARING	BEA-51	1
88	SELECTOR INPUT SHAFT	NMT-252	1
89	OIL SEAL	LIP-20	1
90	CIRCLIP	CIR-40	1
116	SELECTOR BARREL	NST-260	1
118	BUTTON HEAD SCREW	HP-M-9062	2
121	REVERSE LOCKING PLUG	ST-210-36	1
122	REVERSE LOCKING PLUNGER	ST-210-35	1
123	SPRING	ST-210-44	1
125	SPRING TRUNNION	NST-202-1	1
126	SPRING POST	HP-M3-7108	1
130	BOLT	HP-M-9068	1
151	WASHER	HP-M-7039	1
154	GRUB SCREW	SCR-121	2

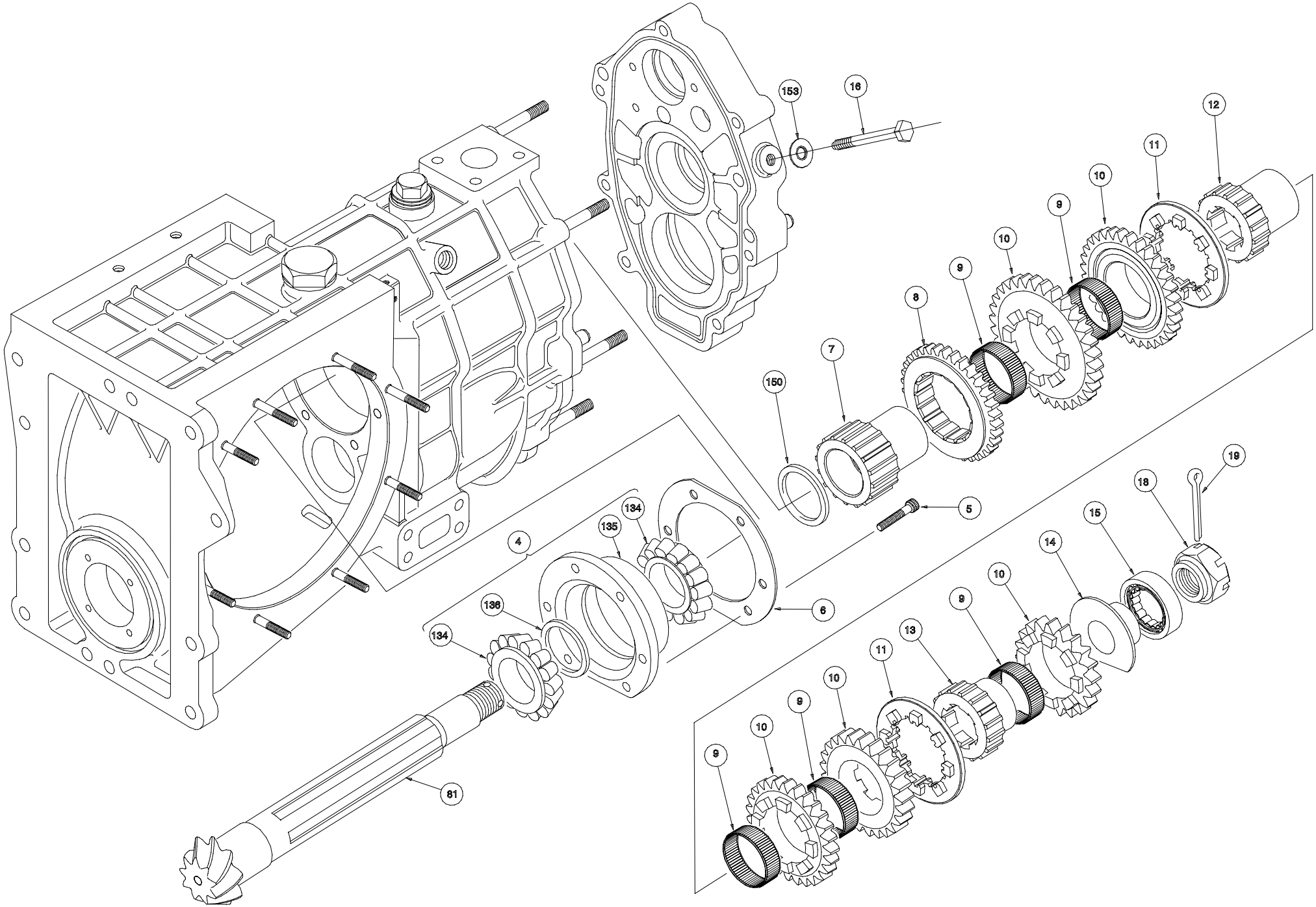


fig.8

PINION SHAFT ASSEMBLY

ITEM	DESCRIPTION	PART NUMBER	QTY
4	PINION BRG.HSG.ASSY	F3-222- 1	1
5	BOLT-PINION HEAD BRG.	F3-222- 3	6
6	SHIM	FGB-225- 3	1
7	FRONT HUB	HC8-5-226-HB	1
8	REVERSE SLIDING GEAR	HC8-5-231-HB	1
9	PINION GEAR NEEDLE BRG.	FT-226- 1	5
10	PINION GEARS	HC5R-233	5
11	CLUTCH RING	HC-232	2
12	CENTRE HUB	HC8-227	1
13	REAR HUB	F3A-228	1
14	INNER TRACK	F3A-229	1
15	PINION TAIL BEARING	HC-229- 1	1
16	RETAINING SCREW	VG-234-2	1
18	PINION NUT	FT-230- R	1
19	SPLIT PIN	FT-230- 1	2
81	9/37 PINION SHAFT	F3-221- P	1
134	BEARING	F3-222-1A	2
135	PINION BEARING HOUSING	F3-223-	1
136	SPACER	F3-223-1	1
150	SPACER	HC-226-2HB	1
153	DOWTY WASHER	WSH-003	1

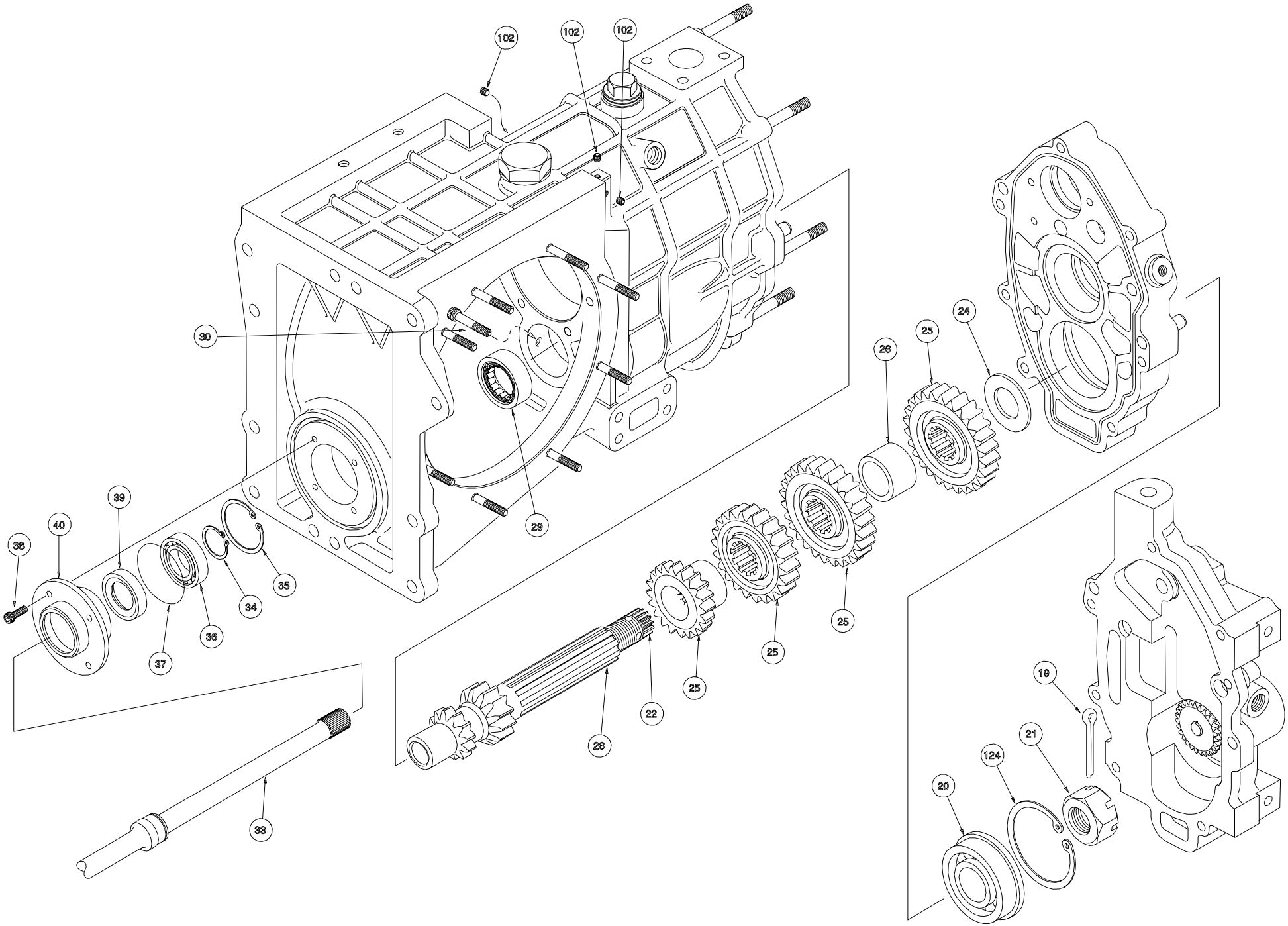


fig.9

LAYSHAFT ASSEMBLY

ITEM	DESCRIPTION	PART NUMBER	QTY
19	SPLIT PIN	FT-230- 1	2
20	REAR LAYSHAFT BEARING	BEA-082	1
21	LAYSHAFT NUT	FT-236	1
22	OIL PUMP DRIVE GEAR	NST-265- 9	1
24	THRUST WASHER	HC-234- 5	1
25	INPUT GEARS	HC5R-235	4
26	LAYSHAFT SPACER	HC5-234- 6	1
28	LAYSHAFT	F3-234	1
29	FRONT LAYSHAFT BEARING	F3A-234- 1	1
30	RETAINING SCREW	SCR-055	1
33	CLUTCH SHAFT	NST-239	1
34	CIRCLIP CLUTCH SHAFT	LD-2390	1
35	CIRCLIP SPIGOT HOUSING	LD-244-10	1
36	BEARING SPIGOT HOUSING	BEA-116	1
37	O-RING SPIGOT HOUSING	LD-244-13	1
38	SCREW SPIGOT HOUSING	F3A-244-13	4
39	OIL SEAL SPIGOT HOUSING	LD-244-11	1
40	SPIGOT HOUSING	LD-244	1
92	OIL PUMP DRIVEN GEAR	NST-2657	1
102	SOCKET SET SCREW	SCR-003	3
124	CIRCLIP	CIR-014	1

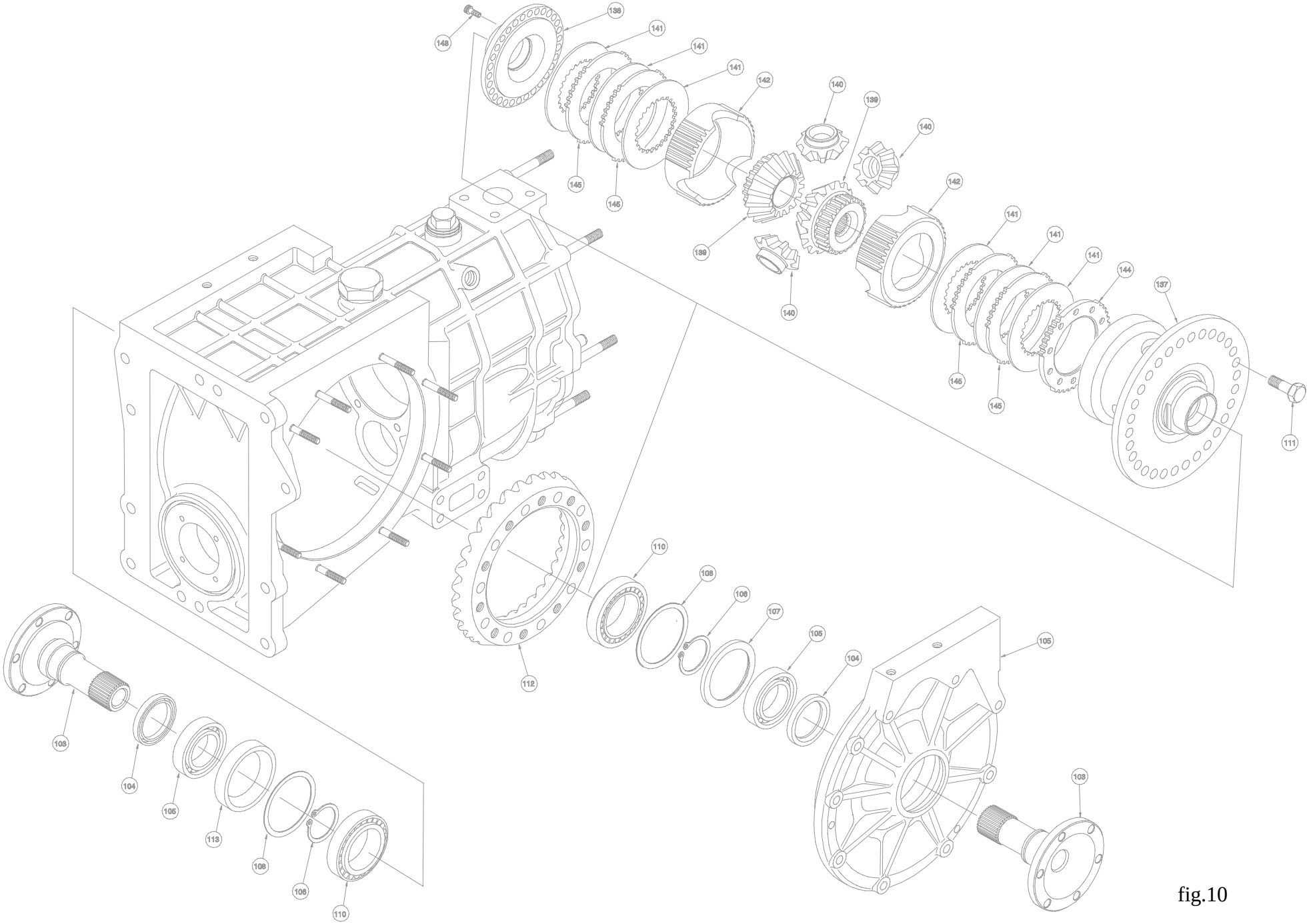


fig.10

POWERFLOW DIFFERENTIAL ASSEMBLY

ITEM	DESCRIPTION	PART NUMBER	QTY
103	DRIVESHAFT	F3-218- A	2
104	OIL SEAL	FGC-205- 4	2
105	BEARING	F3-205- 3	2
106	CIRCLIP	DG-219- 1A	2
107	SPACER-L.H.	F3-205-2	1
108	SIDEPLATE SHIM	FT-206- 1	1
109	SIDEPLATE	NST-205	1
110	BEARING	FT-205- 1	2
111	CROWNWHEEL BOLT	VG-221- 1	8
112	9/37 CROWNWHEEL	F3-221- W	1
113	SPACER-R.H.	F3-206- 2	1
114	POWERFLOW DIFF ASSY	F3A-212	1
137	DIFF CASE	F3-213	1
138	DIFF END PLATE	F3-214	1
139	SIDE BEVEL GEAR	HCC-213-6A	2
140	PLANET BEVEL GEAR	FTC-213-5A	3
141	CORE PLATE	FTC-213-8	6
142	SIDE RING GEAR	FTC-213-7	2
143	SKT CAP SCREW	F3-213-12	8
144	PRELOAD SPACER	FTC-213-3	1
145	CLUTCH PLATE	FTC-213-10	4

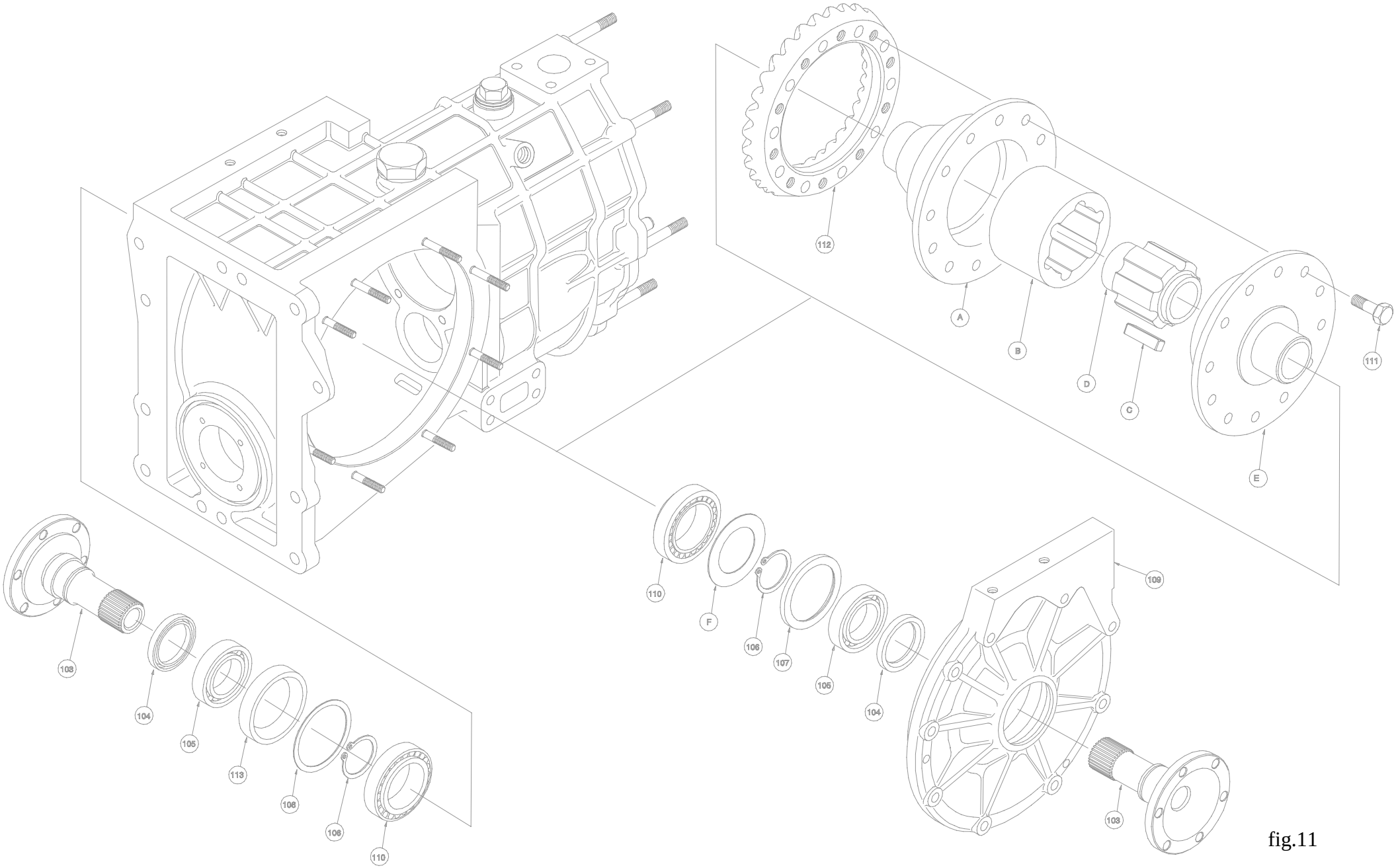


fig.11

CAM & PAWL DIFFERENTIAL ASSEMBLY

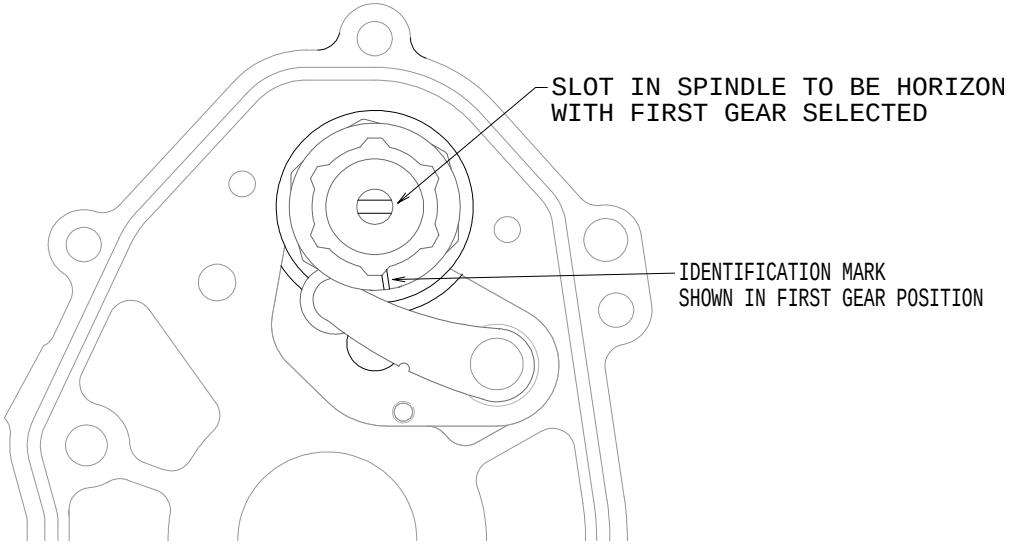
ITEM	DESCRIPTION	PART NUMBER	QTY
103	DRIVESHAFT	F3-218- A	2
104	OIL SEAL	FGC-205- 4	2
105	BEARING	F3-205- 3	2
106	CIRCLIP	DG-219- 1A	2
107	SPACER L/H	F3-205-2	1
108	SIDEPLATE SHIM	FT-206- 1	1
109	SIDEPLATE	NST-205	1
110	BEARING	FT-205- 1	2
111	CROWNWHEEL BOLT	VG-221- 1	8
112	9/37 CROWNWHEEL	F3-221- W	1
113	SPACER-R.H.	F3A-206- 2	1
A	OUTER CASING	FT-213	1
B	OUTER CAM TRACK	HC8-215-M	1
C	PLUNGER	FT-217	8
D	INNER CAM TRACK	F3-216	1
E	PLUNGER CARRIER	FT-214	1
F	SPACER L/H	FT-205-2A	1
G	SPACER (not illustrated)	F3-205-1S	

GEAR POSITION INDICATION

Some drivers, particularly those new to using a sequential shift system, require a visual indication of the currently selected gear.

Hewland Engineering can supply a stand alone unit for this purpose, but there is sometimes a requirement to integrate the position indication with an existing dash display or data acquisition system. If the Hewland unit is used, there are no special setup requirements for the gearbox, but this may not be so in the case of another manufacturer's equipment.

The 1998 Swift formula Atlantic car is one such special case. Please read the following instructions carefully, as failure to do so may lead to the driver's display giving incorrect gear position indication.



1 Care must be taken when assembling the shifter spindle (53) and tightening it's nut (60) to achieve the correct angular orientation between the spindle slot and the selector barrel. The barrel should be set at the first gear position, and the spindle nut tightened with the slot horizontal (see sketch).This parameter is not normally set when the gearbox leaves the factory.

2 The potentiometer has a small marker (dimple) on one end of it's tang drive. With first gear selected, the potentiometer should be mounted on the gearbox rear cover, with the tang marker to the right side of the car, and the wires exiting from the top of it's body. If it is more convenient to have the wires exiting from the bottom of the unit, assemble the unit with the tang marker to the left side of the car.

3 Switch on the vehicle power supply to the potentiometer. This should consist of +5 volts at the orange wire, and ground at the brown wire. Connect a voltmeter across the red wire and ground, and turn the potentiometer body until a reading of 750mV is obtained (again, with first gear selected). Tighten the fixing screws in this position.

4 The Toyota ECU must be programmed to the values shown in the table opposite.

Toyota ECU Gear Position Indicator Settings	
Gear Position	mVolt Threshold
Reverse	252
Neutral	540
1st	959
2nd	1780
3rd	2650
4th	3610
5th	4770

mVolt threshold figures modified 16th Feb 2000

HINTS & TIPS ON GEARBOX MAINTENANCE AND OPERATION

This page is dedicated to passing on solutions to some of the problems encountered by users of the NST gearbox.

Gearbox Linkage

One of the least appreciated differences between a sequential and a H pattern shift is the importance of a correctly functioning gear lever and linkage. Whilst the power to move the gear lever of an H pattern shift comes totally from the driver, the return stroke of a sequential gear lever is powered by a spring. A deliberately small spring is used so that it adds minimal force to that required from the driver to shift gear. Consequently, the return spring may not be able to provide the extra force required to overcome a stiff or sticky gear linkage. It is imperative then to maintain the gear linkage in good condition.

In the case of a rod linkage, ensure that the rod is free from obstructions (including the driver and his seat!), the spherical bearings are not necking out, and that any radial & linear bearings are free moving and lubricated. Never add any weight to a gear linkage, as the corresponding increase in inertia may slow down or stop the return stroke.

In the case of a push-pull cable, ensure that the cable inner moves freely within the outer, is well lubricated, and is not situated close to a high temperature source (e.g. exhaust).

Ensure that when the linkage is installed, all rod to crank junctions set as close as possible to square, otherwise the force returning the linkage will be less effective.

Check the gear linkage return spring length regularly (item 75, page 16). This spring has a finite life and will weaken with use. A new spring has a free height of 1.450".

Internal Selector Parts

Since the first NST's were made, the selector barrel, forks, and fork pins have been strengthened. the main problem was that on making a poor shift, a large force is generated by the engaging dogs and transmitted through the forks and pins to the barrel and it's retaining plate, potentially damaging all four. Be sure to frequently inspect these parts for damage, as any damage on any selector parts gives a reduction in shift performance which in turn leads to more damage. It is a false economy to skimp on replacing damaged components.

When subjected to abnormally high loads, the fork pins may tend to work loose in their forks. Don't allow any free play here as it will rapidly escalate into component failure.

Barrels tend to sustain brining or denting on the pin tracks. Light damage may be polished out with a dremmel, but the barrel should be replaced if the damage is repeated.

The bearing retaining plate will bend if subjected to heavy loading. The plate should be replaced if bent.

The guide plate can suffer from burrs being created on the front face of the internal tang. These burrs must be dressed off or they will rub on the gearshaft drum. Also check that the internal tang is not bent (the internal profile should appear symmetrical).

HINTS & TIPS ON GEARBOX MAINTENANCE AND OPERATION

This page is dedicated to passing on solutions to some of the problems encountered by users of the NST gearbox.

Gear Engaging Dogs

The gears and clutch rings used in the NST gearbox are Hewland HC5 type. These parts have been proven over many years, in many different classes of race car (most notably Formula 3), to give long and reliable service. The gears and clutch rings drive though a set of 8 dogs. Most drivers are quite capable of upshifting these gears, but sometimes have a little difficulty in synchronizing the gears on a downshift. A poorly synchronized shift may cause damage to the engaging dogs and to the selection mechanism.

Some users remove every other dog from the gears and clutch rings. This modification gives a bigger gap for the dogs to engage, enabling them to put up with more asynchronous speed. The down side of only having four dogs is that they have to take the load previously taken by eight dogs. In summary, removing half of the gear dogs roughly doubles the chance of engaging a badly synchronized shift without dog corner contact, but means that the remaining dogs will sustain twice the damage on the occasions when they collide. Hewland's do not manufacture 4 dog gears or clutch rings for the NST gearbox.

Fork Setting

It is extremely important to check the fork setting whenever the pinion shaft, pinion head bearing, spacer, or either hub is changed. If the fork setting is not correct, the barrel overtravel may take the driving dogs out of engagement enough to drive on their tip radii. This will almost certainly result in finding a false neutral, guide plate failure (bent tang), and possible retaining plate damage, followed by increased chances of repeating the same.

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