Since 1981 I have won the Florida State Championship's FTD trophy four times. I have also won a Solo 1.5 run in the Florida Keys called the Bay Bottom Crawl (which it ain't -- the winner's average speed over a 2.25 mile course is in excess of 60MPH) four times. I have also won 8 SCCA Divisionals and been SEDIV Solo II Champion in A-Mod for 1986 and 1988.

A couple of notes on parts. I think the outer U-joints on the rear half shafts are the same as TR-6 parts. Also, the rubber do-nuts are the same as used on old Lotus Elans. To pick just a bit on your information, I think the brake calipers are made of iron rather than steel. I think iron has a higher modulus of elasticity than steel.

On the Lotus 69, as far as I could tell the frame was identical to the 59B space frame, except the body support brackets were for the more angular 69 body. The 59 and 69 bodies are not at all similar; however, I thought the 69 was much more attractive. Somewhere I have a picture of Fred Stevenson driving one of the four 69s you mentioned.

I would like to know what the chassis modifications were that were applied to the 61X series. The 61 (and presumably the 51) could both have used some stiffening, particularly in the rear, and I was wondering what was done.

With regards to parts needed, I have a space Hewland transmission. I may also have some rear uprights buried somewhere in the garage. The major part I could use is a new or repairable chassis. Do you mind if I contact other individuals on the roster to ask about parts?

Jay Stannard

EDITOR'S NOTE: Since Jay wrote that letter he has also acquired a Lotus 61 that is set up and licensed for street driving!

The reason I want questionnaires to "register" a car is because I keep the the actual questionnaires on file as the record of the cars. Picking the information, randomly placed, out of letters of varying sizes is unhandy. Anyone who is too busy to fill out a questionnaire, and expects that I'll dummy one up for them, is presuming too much.

And, yes, the brake calipers are iron rather than steel. When I said steel, I was really just thinking "ferrous metal," which is required under F/F rules, rather than being definitive. They're stock, production units, which are probably made of iron rather than steel primarily because iron is a lot easier and less expensive to cast than steel. One of the major differences between 51s and 61s is in the rear upright, hub, and brake areas.

As far as I know, there is NO difference in the frame between a 61 and a 61X. Insofar as I've been able to learn, a 61M was merely a 61 with a "chopped" (lower) upper body, and a 61MX was a 61M with a more "sales sizzle" (Bill Dolson's words) chassis plate. Certainly at least all MXs were modifications of previously constructed 61s. The "last" 61 is 61MX/F3/254, which is a rebuild of the quite early 61/FF/54! It's possible that some late 61s were built from scratch to 61M spec, but the "61M" designation doesn't appear on the inventory list at all.

As for the use of the Roster: YES, you may contact others on the list. That's what it's primarily FOR! It's **not** for commercial use outside LFFR, but is to facilitate interchange of parts, know how, etc. among members. Anyone who doesn't want to be on the published roster can ask off.

Huntsville, AL

Dear Vern,

Thanks for the BULLETINS.

I own Lotus 61/FF/84, with "61-FF-84, LH-323?, H6 925, and G/130Y (or 9/80Y) scratched on the chassis plate. I don't know what the G/130Y means. The transaxle is also marked H6 925 on the end cover plate, so I assume it is original. I don't know of any other numbers on the chassis, but the paint is awful thick!

I know quite a lot about this car as I have had it since March, 1979 and have the Log Book which goes back to 1974. I also have the original Certificate of Title issued by the state of Oregon on 4/7/70.

My son and I used the car for Solo I and II competition until 1985 when I got my Regional Competition license. I have raced the car extensively since then, and was SE Division Club Ford Champion in 1987 with three wins in a row at Road Atlanta. I have raced the car six times this year at Talladega, Savannah, and Road Atlanta.

Keep up the good work and keep me on the list.

Joe L. Bryd

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Huntsville, AL

Dear Vern,

Thanks for the letter. I didn't expect a personal reply and I do appreciate learning more about my car.

You have probably greatly affected my racing! My theory is that if you can't afford to write off the car, you shouldn't be on the track, and I cannot afford to write off "Ole 84" if it is going to appreciate as you say. I'm 52.5 years old, work for a living as an engineer at the Army Missile Command, and I don't need anything else to think about while trying to stay with these young lead foots.

My chassis plate looked new when I got the car, but now it is in bad shape. The "scratching" on the plate is very crude and for a long time I didn't think it was original. The G/130Y could just as easily be 9/80Y. The first four digits of the chassis plate engine number are definetely LH 32, and it looks like it could be LH 323 H or LH 323 I.

I received a Lotus-Holbay cast valve cover with the car, and have it loaned to another Club Ford driver. Over the phone he said the original plate has been removed and QSR 03 stamped into the aluminum. We think that is for Quick Silver Racing. I did not get the original engine front cover.

I have an original upper body shell with the cockpit opening a little wider than the one in the present body, which is illegal in SCCA due to the narrow opening, but I have never been protested about it. I would not cut the body just to please some tech inspector, as I would rather withdraw from the event. I have an original engine cover to fit the wider body, but it dosn't fit the narrow body. I fabricated the present engine cover of aluminum to fit the narrow body, and tried to maintain the original slope of the wedge body.

I have the original down pipe and battery box. I just about threw out the original water expansion tank, but I think I have it around here. I formed the present windscreen from lexan.

I have tried to keep the chassis original. I did cut off the little "U" clips that attach the front inboard pickup points since they did not support the narrow body. I brazed a short tube to the tube just below the steering rack to hold up the nose. I had a new radiator made about two years ago.

Joe L. Bryd

(CONTINUED ON P-13)

CORRESPONDANCE (Cont.)

Los Angeles, CA

Dear Vern,

I was very excited to see in the "Dolson Report" page 6 of the summer 1989 LFFR BULLETIN that Lotus 61/FF/2 is shown as being built on chassis AM-202. As you know, I have 61/FF/2 and it does have frame number AM-202. I was very confused by this, as it didn't make sense that a low chassis number would have a high frame number. Since this is a frame number from the 51 series, though, I now understand this. Of course, I'm very excited that I have what may be the earliest Lotus 61, but as I am as curious as everyone else to know if there is a #1.

This is the history I've been able to develop on my cars:

61/FF/2: The SCCA Log Book was issued by San Francisco Region on April 15, 1972 at a Vaca Valley Regional race. No entrant name shown. The car was raced by various owners through Sept. 5, 1983. I purchased it on April 4, 1987 from John Mattingly of Studio City, CA, who bought it from Wayne Chuman. When I bought the car, it was not running but complete. Lotus 61/FF/61 was with it, for parts.

Interestingly, the car shows no indication it ever had the high-mounted rear oil cooler which we usually see on Lotus 61s. A period photo from the Log Book shows no oil cooler in this position. Also, the rear anti-roll bar brace is straight, and would not leave room for this oil cooler.

This leaves me with more questions than answers. For instance, who owned it before the first Log Book entry? The "Dolson Report" says it was owned by the Russell School. Which Russell School?

Finding that this might be the first Lotus 61 was truly a pleasent surprise. When I purchased it, the vintage Ford "craze" had not really started, and I really bought it because it came with a lot of spare parts. Of course, the price was right then, as well, as Lotus 61s were viewed simply as worn out race cars.

Lotus 61/FF/61: The SCCA Log Book on this car was issued on Oct. 5, 1974, when it was first shown as having been raced at Willow Springs by Joseph Angelo, who subsequently sold it to Wayne Chuman. I have the original of this bill of sale, describing the car as a 61M, indicating it sold without engine for $1600. The Log Book photos of this car show no rear bodywork, but the high mounted rear oil cooler.

The car was painted black with gold lettering (no doubt a copy of the JPS paint), and still shows the legend "Lotus prepared by Claudius" on the nose of the now fading bodywork.

As mentioned, 61/FF/61 was really a box of parts when I bought it, and someone had apparently stripped it for a rebuild. The frame is in primer, and I think the owner had disassembled virtually every part that could be disassembled. I expect it will take some time to put all these bits and pieces back together, and I am taking my time to get all the parts right as I go.

This is all the information I have on either of these cars. By a separate letter to Bill Dolson, I am providing the history that I have on my Lotus 69.

On an entirely separate point, I highly recommend to all readers of the VFCA Newsletter and the LFFR Bulletin a visit to the Donington Museum in England. It is a truly incredible collection of single-seat race cars, and includes several Lotuses. I had the luck to visit on the same day as the RAC Union Classic, a rally open to cars over 20 years old, but too young for the Brighton (i.e., for cars built between 1905 and 1969). The cars start from various points throughout England, and end up at Donington Raceway Park, where they take several hot laps before parking in the paddock. Although the program listed 900 entries, I counted over a thousand classic cars parked in the parking lot, the most amazing array of cars I have ever seen gathered in one place.

Douglas B. Schrierer

EDITOR'S NOTE: See the (second) "Dolson Report" in this issue as it refers to Arch Motors frame numbers. We've been over-presuming on these -- they are **not** absolute identification numbers, though (particularly in combination with other numbers) they can be used to identify individual cars. Rather, they are basically just Arch Motors billing numbers. There are duplicate frame numbers in the lists, and also missing numbers. Toss in replacement chassis for crashed cars, and incorrect recording of numbers, and they are far from 100%. And the "51 series" frame number on 61/FF/2 may simply mean that Arch Motors hadn't gotten around to changing the 51 number sequences for the first 61s.
Considering where the car ended up, it probably went to the Russell School at Willow Springs. This is long gone, and see (again) the latest "Dolson Report" on the possibility of obtaining info from the Russell Schools.

We really need to get an early and a late 51, and an early and a late 61, sit them down side by side, and compare them point by point. Of course, then there is the problem of what is original, and what are subsequent updates and modifications _ _ _ !

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Peekskill, NY

Dear Vern,

I have some good news to report about the Lotus FF build/sales records. Until now it has been reported that there were no factory records on the 51C cars, and that they were possibly included with the 61 chassis records. Well, I recently wrote Lotus inquiring about my two ex-Russell Canada cars and discovered that Lotus does have some records on the 51Cs after all. Based on my AM number, they were able to tell me that my 51C (AM 210) was sold to the Russell School in 1969, and that the Lotus chassis number is 51C/200/FF.

Any other 51C owner who is missing the chassis number and interested in learning more about their car should write to Andrew Ferguson at Club Team Lotus. The address is as follows:

Club Team Lotus
Lotus Marketing Services Ltd.
Ketteringham Hall
Wymondham, Norfolk
England, NR189RS
Attn: Andrew Ferguson

Another interesting note for those members with broken or missing rear uprights. Don Schafer in Framington, CT is now reproducing Lotus 22/23/31/51 uprights in magnesium. Unlike some of the others I have seen, these are an exact copy of the original, and truly a quality product. Some other parts that Don can supply are aluminum rack mounts and rear brake rotors. His first batch of uprights is almost sold out, so if you are interested, act quickly. Don can be reached at (203) 677-8453.

Thanks again for the Register and VFCA. Your contribution to the sport is greatly appreciated.

Joseph Griffin

Peter Denty Type 51/61 Components Price List

Peter has also finally produced a type 51/61 price list which forms as complete a parts list as anything. I've enclosed a copy for you and will be glad to provide anyone who calls with a copy or they can be had from Peter direct. As I've said before he can provide about anything. The surprises are his bodywork prices which are very reasonable. Shipping is another story. I have to ship a chassis over here year end so if enough people want stuff it may be cost effective to get a container. Note also that he can provide exchange calipers. When I was there we compared weights of the original mag rear uprights (3-3/4 lbs) with the reproduction aluminum ones (5-1/2 lbs), not a lot for a car which usually must run steel wheels and often street tires. The aluminum ones could be further lightened also and are stronger and easier to repair. The few things without a price are not currently available and include the original dampers. Nobody seems to be able to provide the original Armstrong adjustables anymore so if you have these hang on to them. If you're interested in making a small fortune find a barn full somewhere. If your's are broken call Jack White at 5 Points Classic Auto Shocks (714) 842-0707 who says he can rebuild them and would also like a set for his Junior if you have extras. Not on the price list since they've come in since my return are reproduction side-plate/hangers for the Renault gearbox, having been long unavailable.

The "Original Formula Fords" Type 31/51 Mystery

Also enclosed are Peter's register entry form for his sons's 61 and a very early 51 he is restoring for himself. This may be the earliest one yet as it is 51-FF-20A AM 10/24. He doesn't know what the 20A means but the funny Arch Motors chassis number with the 10 is consistent with the earlist 51 in the Lotus chassis records which also has this type of number instead of the simple sequential numbers. I took a long look at the chassis and it appears to be identical to my 51A chassis and does not appear to have been originally a 31. In Peter's opinion the answer to my last letter about type 31 chassis differences is not very conclusive. The only real difference between a late 31 and a 51 is the battery location. In the 31 the battery is located on the right side of the chassis, outboard of the lower longeron and most 31's had a steel mounting bracket brazed on there. The other difference which may exist is provision in the roll bar bulkhead upper tube for the right side "Y" piece as used with the upright engines although later 31's with the lay over motor used a left side "Y' piece and may not have ever had provision for the right side location. The Arch Motors numbers are not a real help here since we know only one of the 12 31 numbers and none of the first 20 or so 51 numbers.

Nigel Halliday and I have both gotten very interested in trying to locate and identify these early cars. According to the chassis records which he has ten of the 31's were shipped to the Jim Russell school in 1966 in a "school car" configuration which included type 22 style noses, a 1500cc Cosworth prepared non-crossflow early Cortina motor with two Webers (which would require the right side "Y" piece), and steel wheels. While in England I called Jim Russell and talked to him about these early days and the 1966 cars. After the original Russell 20's and 22's were sold to the film "Grand Prix" he placed an order with Lotus for 10 new cars. He remembered the cars as being Type 22's but I believe he's mistaken, possibly because of the similar bodywork. Mr. Russell told me numerous anecdotes about dealing with Chapman and selling the Russell Alexis which corraborated most of the published histories. It was also Mr. Russell's opinion that many of the original cars could well have ended up with the Russell school in Canada. I've recently called Ralph Firman of VanDiemen who was Jim Russell's mechanic at the school in '66 and he remembered the cars as being type 31's which agrees with the chassis records and his remembrance of the specification agrees as well. Ralph is looking further into the matter as is Nigel so we may get a breakthrough yet.

(CONTINUED ON P-15)

While we are on the topic of the Russell schools I also spoke to John Kirkpatrick at the Donnington school who has been besieged with inquiries from 51 owners looking for parts, pictures, history, etc. Please don't bother the U.K. school anymore, they don't have anything. John said the school has changed hands several times in the last 5 years and no old records survive. All parts supplies are long gone as are the last of the cars. He would love to be able to help but has nothing. He did put me in contact with a gentleman who is doing a biography of Jim Russell who I will contact. The Russell School in Canada refers all Lotus calls to me since they are cleaned out also.

Type 51 Formula Ford Brochure Reproduction

An Australian company has begun printing reproductions of early Lotus sales literature and has included a Type 51 6 page 8" by 5" sales brochure in thier offerings. It is identified as brochure number 2807 available for U.S. $5 with an additional $5 for shipping on orders under $45. They also produce early Elite, Elan, and full Lotus Range brochures. I haven't got mine yet but they are supposed to be good repros. The company is:

DB Motorbilia
P.O. Box 418
Abbotsford, Melbourne
Victoria, Australia 3067

Type 61 Factory Photos

Nigel Halliday has found four photos which were originally Lotus publicity stills from the 61 sales era. I've enclosed my only copies. One shows a model sitting in one of two 61's at the Racing Car Show introduction. The other three are from a Lotus Components open house day and show the showroom, the 61 assembly line, and the Works team preparation area. In the last shot are a 61, 3 59's, a 69, and a 70.

Duplicate/Missing Arch Numbers

Your comments on the duplicate chassis number issue got me thinking so one night I plotted the occurence of all the chassis numbers and it turns out that quite a few are duplicated! The 51 records show 4 duplicate Arch numbers, and the 61 records show no less than 17! Enclosed is the list of duplicates. Also, a lot of numbers are missing. So... having the Arch number is no guarantee of uniquely identifying a car. While in England I spoke to Don Gadd at Arch a couple times and he gave me a better feel for just how casually these numbers were applied. Chassis were made up and shipped to Lotus every two or three days in batches of 10 to 12. Immediately prior to being loaded on the truck they were stamped with a number which was recorded on the bill of lading. The primary purpose of the number was simply to uniquely identify the chassis to the Lotus recieving department for billing purposes. It was never intended to be anything like a road car Vehicle Identification Number and Arch never kept of log of these numbers as such. The numbers only appeared on shipping and billing paperwork and Arch have only retained the last ten years of accounting records as required by Inland Revenue. So, no Arch records. The source of many of the duplicate Arch numbers are probably uncertainty about the last number used, with it sometimes being repeated. Mr. Gadd in fact joked that the week that I was there they had somehow lost the "AM" punches and had shipped a batch of Van Diemen chassis with no "AM", just a number. He wondered if in twenty years somebody is going to get concerned about the deep significance of this! This might well explain why the early 61's are numbered "61-##" not "AM-##". This may not be the first time those punches have gone missing.

(CONTINUED ON P-16)

Renault Gearboxes

The only reliable source for Renault parts I have found in the States is P.F. Engineering, Box 39472, Los Angeles, CA 90039. (818) 244-2498. I spoke to Jean there about gearboxes and he has good stocks of spares for the Renault gearbox types 330, 336, and 352. The last two are as used in the Europa and many Renault parts work for the Lotus application. The type 330 is apparently the most common (only?) Renault box supplied with the Lotus type 51. Jean is not sure what if any internals were modified by Lotus for the racing application. I just bought a type 318 box, supposedly out of a Lotus 51 although several people said this box was used only in the Lotus types 18 and 20 and maybe 22. At any rate P.F. has virtually nothing for this box, just gaskets. Jean also said that in his recollection about the only parts in the Lotus application 318 which were original Renault are the case. Lotus had new gears and shafts made by Hewland and others. Hopefully this is not the situation with the 330 but beware!

Type 61 Works Development

Last month when I ran the C.A.R.E. vintage event supporting the CART Meadowlands event I had a surprise visitor. A compact, energetic, Brazilian gentleman came over to my 61 in the paddock and excitedly explained that he had been one of three works development drivers for the Lotus 61!. Carlos Avalone had come up from Sao Paolo, where he sells limousines, to investigate buying a car for next years CART season and had spotted my 61, the first he had seen in 20 years. The Brazilian F1 magazine "GRID" took pictures of him in the car. Carlos was the first Brazilian driver to go to England in the 60's and is still active in motosports. Emerson Fittipaldi affectionately included Carlos in an on-camera interview, calling him his godfather! Anyway, Carlos, Dave Walker, and Mo Harness were all retained by Lotus to do development on the then ultra-secret type 61, including clandestine test sessions together with the F1 team. I'm corresponding with Carlos, who has a pretty good scrapbook from the time, and will report more in the future. Just to offer a little preview, when he first walked up and introduced himself he walked around the car, shook his head and muttered something in Portugese. Carl De Almeida was there crewing for me and he speaks the language fluently. When asked to translate Carlos' remarks the closest he could get was "Son of a Whore"!

LOTUS FORMULA FORD PARTS SOURCES

GENERAL LOTUS RACE CAR PARTS

Curtis Unlimited
5990 Greenwood Hts.
Kneeland, CA 95549
(707) 443-8523

Peter J. Denty Racing
Mill House
East Wretham near Thetford
Norfolk IP24 1QS, England
011 44 95 382 529 (from US)

CERTAIN SPECIALIZED PARTS

William Hallandal
Vintage Motorsports
25860 McAlister
Southfield, MI 48034
(313) 357-3644

Don Schaefer
Farmington, Conn.
(203) 677-8453

WINDSCREENS

Aircraft Windshield Co. (Judy)
Los Alamitos, CA
(213) 430-8108

FUEL CELLS

Fuel Safe
10925 "K" Kalama River Rd.
Fountain Valley, CA 92708
(714) 962-0027
(800) 433-6524 (outside Calif.)

BODYWORK AND/OR MOLDS

Al Cantrell (51)
5703 First Avenue
Halethorpe, MD 21277
(301) 247-5874

John McKnight
3516 Merrimac Ave.
San Diego, CA 92117
(619) 274-4265

Dave Mericle (61)
1023 Passiflora Ave.
Leucadia, CA 92024
(619) 436-6477

Michael McBade
Graflight
P.O. Box 4262
Santa Barbara, CA 93140
(805) 564-8908

REAR-MOUNT HEWLAND SIDEPLATES, etc.

Wayne Mitchell
Halibrand Engineering
9349 Wheatlands Road
Santa, CA 92071
(619) 562-7930

THE GEARBOX

The following info is copied from the gearbox section of a Renault Workshop Manual, unearthed by Jack Arntzen, and has been edited to cover only the Type 330 gearbox as fitted to the Lotus 51. This was standard equipment on the Renault R-8 sedan and some related models. Insofar as we know, there is NO North American source of new replacement parts. (Junkyard prowls indicated!) In addition to the information here, Bill Dolson has unearthed an "exploded view" parts list for the gearbox, which would take up too much space to publish here. If you need it, copies can be obtained from me or Bill.

THE EDITOR

6 : 1 Description

A gearbox is fitted to increase the engine torque as the engine torque is insufficient to move the vehicle from rest or enable the vehicle to ascent steep hills. It also has a permanent neutral allowing the engine to be disconnected from the rear wheels in order that the clutch pedal does not have to be held down all the time the vehicle is stationary in traffic and a reverse gear to allow the driver to drive the vehicle backwards.

The gearboxes fitted to the Renault R.1130 and R.1190 models all have an aluminium housing which is pressure diecast. The layout of the gear assemblies of the type 318 gearbox is shown in **FIG 6:1**, those of the type 325 gearbox are shown in **FIGS 6:2** and **6:3** illustrates the gear assemblies of the 330 type gearbox.

The clutch plate is splined to the primary shaft and when the plate is trapped between the flywheel and clutch pressure plate, that is when the clutch is engaged, the rotary motion of the engine is transmitted to the primary shaft and as the secondary shaft assembly is in constant mesh with the primary shaft, to the secondary shaft as well.

The 330 type of gearbox has four synchronized forward gears and one reverse gear. The first and second synchronizer is one manufactured by Renault whereas the third and fourth synchronizer is of the Borg–Warner type. The primary shaft has four gears integral with the shaft whilst the secondary shaft contains four gearwheels running free on the shaft and two synchronizers. The reverse gear is a single gearwheel running free on a shaft and the crownwheel and pinion are the same as those fitted to the other two types of gearboxes. The speedometer drive consists of a, 6 start worm with a pinion of 14 teeth.

The layout of the gear assembly when first gear is selected gives a ratio of 3.61:1 whereas the second gear ratio is 2.25:1. Selection of third gear gives a ratio of 1.48:1 and top gear ratio is again 1.03:1. Reverse gear ratio is 3.07:1.

6:2 Maintenance

The only regular maintenance that can be applied to the gearbox is to periodically check the level of the oil in the box and every 24,000 miles to change the oil.

To check the gearbox oil level undo the hexagon screw placed on the side of the box, 'A' in **FIG 6:9** for the 318 type and 'A' in **FIG 6:10** for the 330 type and ensure the oil is level with the lower edge on the tapped hole the plug was removed from. If the oil level is low fill the box to the required level. Refit and **tighten** the plug.

6:6 Dismantling the gearbox (330 type)

1 Remove the clutch withdrawal fork and unscrew the clutch housing securing bolts. Undo the nuts securing the speedometer drive housing, pull out the housing until it makes contact with the control lug and using a small drift push out the control lever rollpin. Take out the control shaft, the control lever and the housing. Remove the primary shaft bearing shims and spacer.
2 Remove the bolts which connect the two half-housings and separate them. Take out the secondary shaft assembly. Remove the differential and the differential carriers from each half housing.
3 With regard to **FIG 6:32** push out the third shift fork rollpin using a small drift and remove the shaft, its end fitting and the fork putting aside the locking ball and spring. Remove the locking disc from between the shafts.

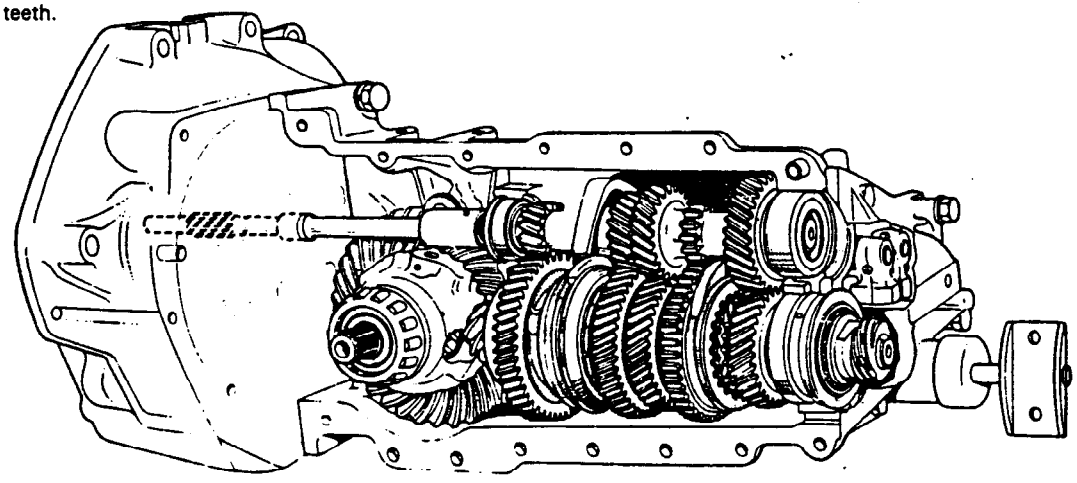


FIG 6:3 Gearbox (type 330)

4 Pull the reverse shaft as far as it will go towards the control end and push out the first/second shift fork rollpin in the manner shown in **FIG 6:33**. Remove the fork.
5 Push out the reverse shaft end fitting rollpin using a small drift as shown in **FIG 6:34** and remove the end fitting. Remove the first/second shaft putting aside the locking ball and spring. Unscrew the reverse shaft idle lever pin, arrowed in **FIG 6:35** and remove the lever.
6 Again using a small drift push out the reverse shaft positioning fork rollpin, in the manner illustrated in **FIG 6:36** until it comes against the housing then rotate the shaft and pull the pin out using a pair of pliers. Remove the reverse shaft and the shift fork.
7 Remove the gearwheel retaining circlip and take out the shaft, gearwheel, friction washer and guide, placing the locking ball and spring to one side.
8 Take off the bearing track rings and adjusting washers from the primary shaft and separate the clutch shaft

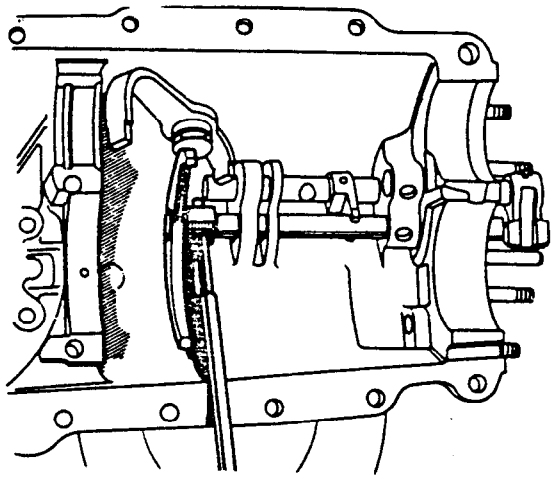


FIG 6:33 First/second shift fork rollpin

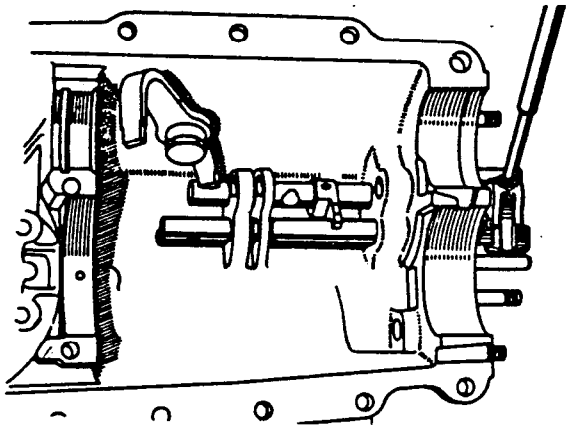


FIG 6:34 Reverse shaft end fitting rollpin

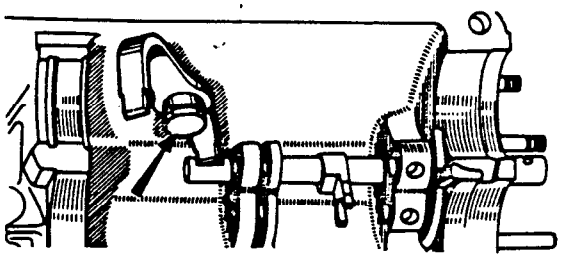


FIG 6:35 Reverse shaft idle lever bolt

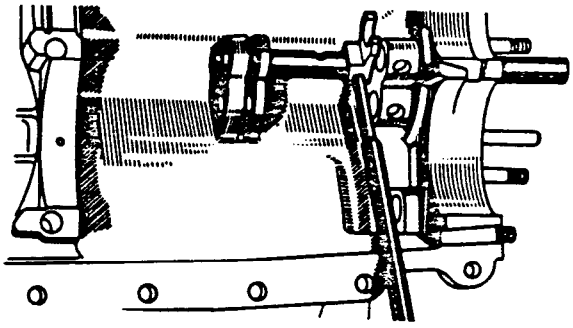


FIG 6:36 Reverse shaft positioning fork rollpin

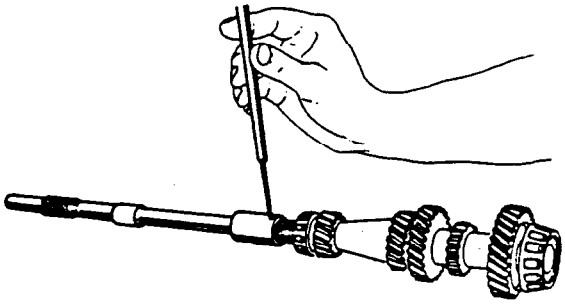


FIG 6:37 Primary shaft rollpin

from the primary shaft by knocking out the rollpin with a drift in the manner shown in **FIG 6:37**.
9 Extract the bearing at the differential end using extractor B.V1.22 fitted with shell B.V1.41 and the other bearing on the primary shaft using the same extractor fitted with shell B.V1.47.
10 Grip the secondary shaft in a vice, engage two gears and unlock and unscrew the speedometer drive worm. Remove the double taper roller bearing, the pinion depth adjusting washer and the fourth-speed gearwheel together with its ring.

As the synchronizer hubs on the secondary shaft are hot force fitted any other fault on the shaft must be rectified by replacing the complete shaft assembly. Carry out 11 in **Section 6:4**.

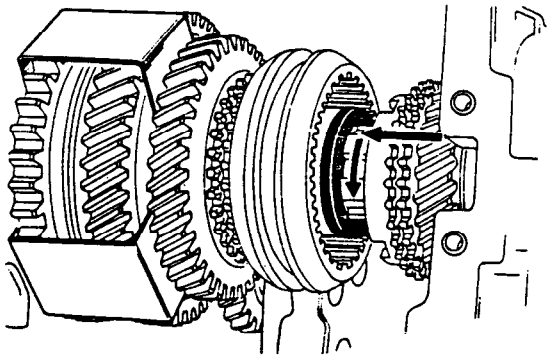


FIG 6:59 Second splined washer (type 325)

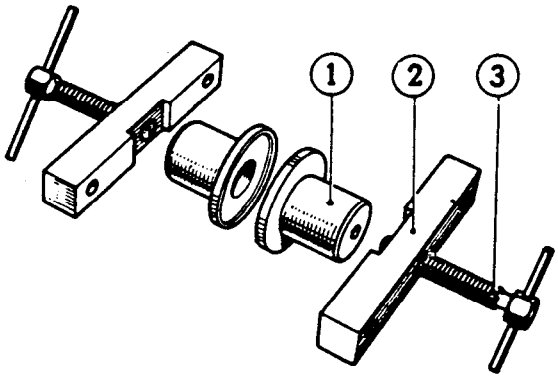


FIG 6:60 Tool T.Ar.63

shift fork into its bore. Fit the shift fork onto the shaft and pin it in place. Fit the first/reverse shift fork, select reverse and engage the fork in the housing and turn it through a quarter of a turn. Place it in the sliding gearwheel groove and return it to the neutral position.

10 Fit the interlocking plunger and slide the first/reverse shift fork shaft into position. Pin the fork to the shaft. Place the locking ball and spring in position and screw in and tighten down the lockstop after smearing its threads with locking compound.

11 Carry out sequences 22 and 23 in **Section 6:7.**

6:9 Reassembling the gearbox (330 type)

1 Place one of the sun wheels, the planet wheels and their bearing washer in the differential housing after immersing them in EP.80 oil. Insert the planet wheel shaft ensuring that the hole in the shaft is aligned with that in the housing and replace the rollpin. Dip the other sun wheel in EP.80 oil and place it in the crownwheel.

2 Fit new self-locking bolts to secure the crownwheel to the housing and tighten the bolts to 45 lb ft (6 kg m) torque for bolts of 10 mm diameter. 60 to 80 lb ft (9 to 11 kg m) for bolts of 11 mm diameter. Fit the differential bearings using a press and again using the press fit the two bearings to the primary shaft.

3 Fit the fourth speed gearwheel, its ring, the pinion depth adjusting washer, the double taper roller bearing and the speedometer drive worm to the secondary shaft then grip the shaft in a vice, fitted with soft metal jaws and engage a gear. Tighten the worm to a torque of 85 lb ft (12 kg m), but do not lock it.

4 Fit the secondary shaft to the lefthand half-housing then fit the righthand half-housing and secure it in place by a few bolts. Do not tighten the bolts. Temporarily fit the speedometer drive housing to hold the double taper roller bearing track right in place and tighten the half-housing securing bolts.

5 Fit tool T.Ar.64 with the graduated rule against the front face of the pinion and the plate with the 'O' reference pressed against the righthand half-housing. The dimension read opposite the 'O' mark should be 1.988 inch (50.50 mm) which is the correct pinion depth if bolts of 10 mm diameter are fitted. If the crownwheel is secured by 11 mm diameter bolts this dimension should be 2.008 inch (51 mm). If the dimension is greater, fit a thicker pinion depth adjusting washer, if less, fit a thinner one. Washers can be obtained in thicknesses ranging from .138 to .162 inch (3.5 to 4.1 mm) varying in .002 inch (.05 mm) increments. When the final adjustment has been obtained remove tool T.Ar.64, the speedometer drive housing, the righthand half-housing and the secondary shaft assembly, then finally lock the speedometer drive worm.

6 The crownwheel and pinion backlash will next have to be adjusted, this adjustment being carried out by tool T.Ar.63, shown in **FIG 6:60**. Place a plug in each differential carrier and press home the bearing

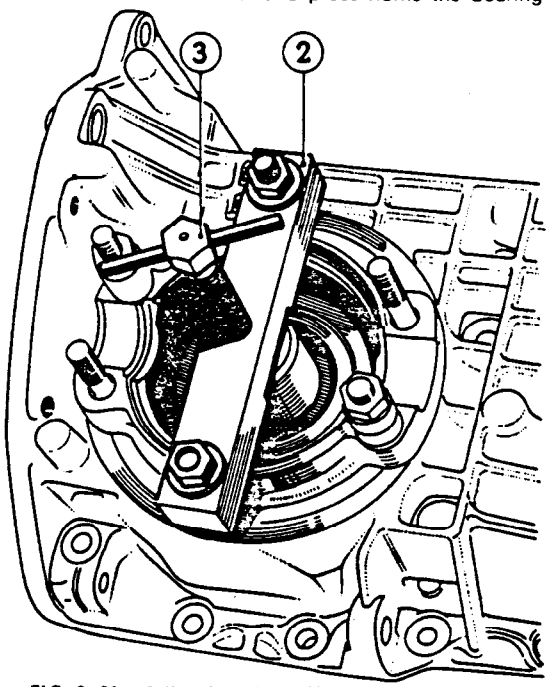


FIG 6:61 Adjusting the differential bearings

Key to Fig 6:61 2 Crossbar 3 Screw

track ring into both carriers. Fit the correct differential carrier, together with their paper gaskets, to each half-housing aligning the reference marks made during dismantling. Fully unscrew the screw on each crossbar of Tool T.Ar.63 and fit the crossbar in place on the differential carrier then secure the carrier by a minimum of four nuts (see **FIG 6:61**), but do not fully tighten them.

7 Fit the differential together with its bearings, the secondary shaft assembly, the righthand half-housing and secure it by a few bolts; do not fully tighten them. Temporarily fit the speedometer drive housing and then tighten the half-housing bolts. Tighten the differential carrier securing nuts to a torque of 35 lb ft (5 kg m).

8 Using the screws of tool T.Ar.63 bring the plugs against their respective track rings. When the plugs are in contact with the track rings measure the clearance between each of the crossbars and their plugs. Fit a dial indicator on the housing placing the indicator plunger in contact with one of the crownwheel teeth in the manner shown in **FIG 6:62**. Continue to turn the screws of tool T.Ar.63 until the correct backlash of between .005 and .010 inch (.12 and .25 mm) is obtained. **Lightly** tap the end of each of the screws to eliminate any possible strain and repeat the backlash measurement on several of the crownwheel teeth to obtain an average. Remove the dial indicator.

9 Measure the new clearance between each crossbar and its plug and deduct these new measurements from the previous ones, the difference being the necessary thickness of shims to be fitted to each side. Remove the speedometer drive housing, righthand half-housing, secondary shaft assembly, the differential, the crossbars of tool T.Ar.63 and the differential carriers then remove the bearing track rings by pressing on the plugs.

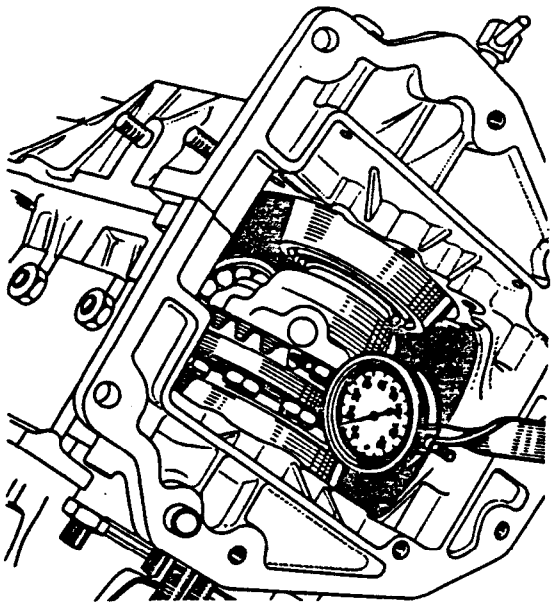


FIG 6:62 Measuring pinion backlash (type 330)

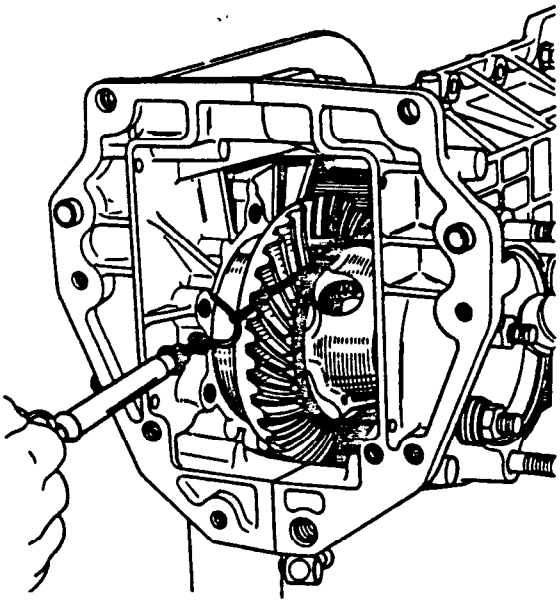


FIG 6:63 Checking the preload (type 330)

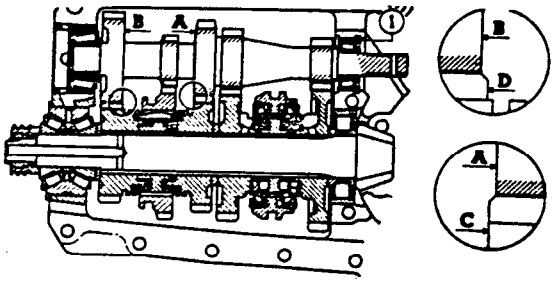


FIG 6:64 Positioning the primary shaft

10 If the original bearings are to be fitted make up two shim packs to the determined clearances but add a .006 inch (.15 mm) shim to each pack of shims if new bearings are fitted to give the new bearings the necessary preload. Place an oil seal and the correct shim packs to the determined clearances, but add a track rings into both carriers.

11 Place the corresponding differential carrier in the lefthand half-housing securing it by several bolts. Fit the righthand differential carrier and tighten the differential carrier nuts to a torque of 35 lb ft (5 kg m). Turn the differential a few turns to centralize the bearings then check the load required to turn the differential, as illustrated in **FIG 6:63** which should be between 3 lb 12 oz and 8 lb 2 oz (1.7 and 3.7 kg). If the preload is not correct increase or reduce the shim pack thickness by the **same amount** in each

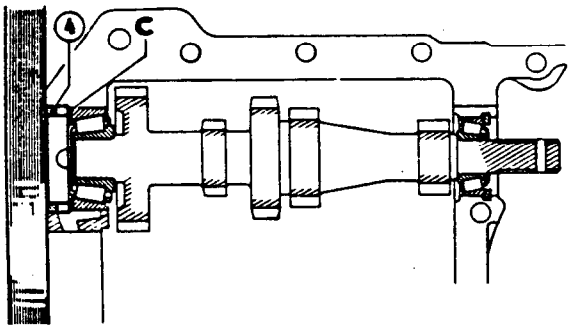


FIG 6:65 Adjusting the bearings

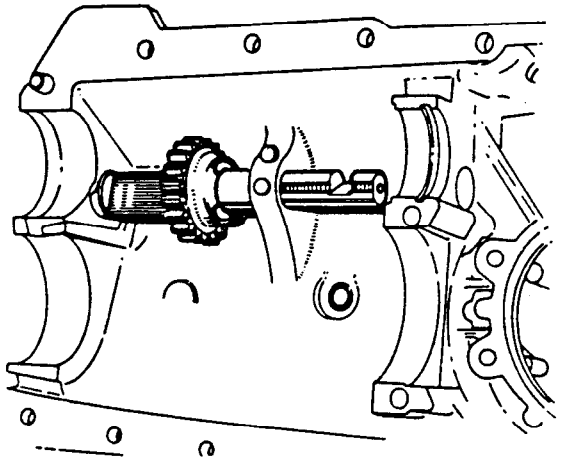


FIG 6:66 Reverse gearwheel (type 330)

carrier. When the adjustment is correct separate the half-housings and remove the differential and the carriers

12 Place the bearing track rings and adjusting washer on the primary shaft and fit the primary and secondary shaft into the lefthand half-housing. With regard to **FIG 6:64** adjust the position of the primary shaft in relation to the secondary shaft by means of adjusting washers until face 'A' of the third-speed gearwheel on the primary is offset with reference to face 'C' on the third-speed gearwheel on the secondary shaft assembly by the same amount as face 'B' of the fourth-speed gearwheel of the primary shaft is with reference to face 'D' on the fourth-speed gearwheel on the secondary shaft assembly.

13 With the primary shaft in position, place the righthand half-housing against the lefthand without securing it. With reference to **FIG 6:65** fit shim pack 'C' and spacer 4 which should allow the shaft to turn freely without play. If it does not do so increase or decrease the thickness of the shim pack until the adjustment is correct then remove the righthand half-housing and primary shaft. Fit the clutch shaft to the primary shaft by inserting the rollpin.

14 Insert the reverse shaft and fit the positioning fork with its boss towards the differential then pin the positioning fork using a small drift. Fit the reverse idle lever ensuring its ends are engaged in the slot of the reverse fork shaft and then tighten the shaft to a torque of 20 lb ft (2.8 kg m). Fit the first/second shaft locking ball and spring then engage the first/second shaft. Fit the reverse shaft end fitting and pin it in place. Locate the first/second shift fork with its boss towards the control side and pin it in place. Fit the locking disc between the two shafts then fit the third/fourth shaft locking ball and spring. Insert the shaft and fit the fork, with its boss towards the differential and pin it in place.

15 Fit the reverse locking ball and spring, the reverse shaft, the reverse gearwheel with its hub towards the differential and the friction washer with its bronze face towards the gearwheel to the righthand half-housing. Fit the guide from inside the bore and push the shaft fully home and then fit the gearwheel retaining circlip.

16 Fit the differential, primary shaft and secondary shaft assembly to the lefthand half-housing. Smear the

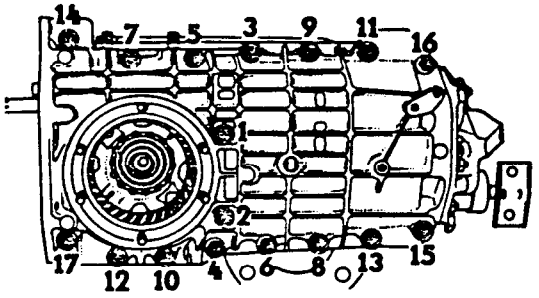


FIG 6:67 Sequence of tightening the half-housing nuts

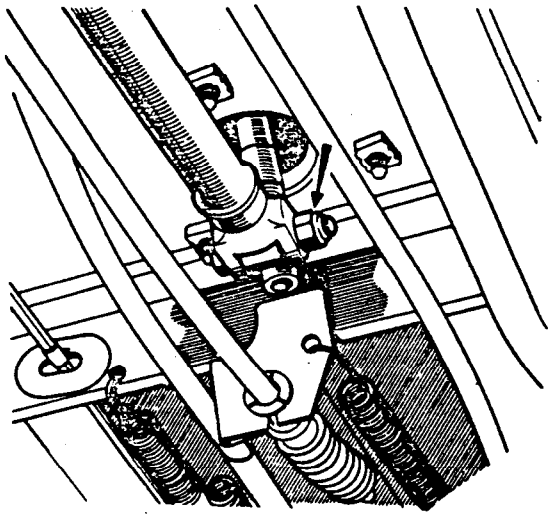


FIG 6:68 Gearshift link bolt

joint faces of the half-housing with a jointing compound then fit the righthand half-housing taking care to ensure that the end of the reverse idle lever enters the slot in the reverse gearwheel shaft. Fit the half-housing securing bolts, the nuts being placed on the righthand half-housing side except for the three marked in **FIG 6:66** which are fitted in the opposite direction to permit the clutch control to clear. **Do not fully tighten the nuts.**

17 Fit the primary shaft bearing adjusting shims, the spacer, the shift fork shaft control lever and the speedometer drive housing whilst engaging the shaft in the control lever. Pin the lever to its shaft and secure the speedometer drive housing again without fully tightening the nuts. Fully tighten the nuts which connect the two half-housings in the order shown in **FIG 6:67**, the .276 inch (7 mm) bolts to a torque of 15 lb ft (2 kg m) and the .315 inch (8 mm) bolts to a torque of 20 lb ft (2.8 kg m). Finally tighten the speedometer drive housing nuts. Fit the differential carriers holding them in place with two nuts then fit the clutch housing and clutch withdrawal fork.

6:11 Fault diagnosis

(a) Jumping out of gear

1 Broken locking spring behind selector rod locating ball
2 Excessively worn groove in selector rod
3 Worn synchromesh coupling dogs
4 Fork to selector rod securing pin loose

(b) Noisy transmission

1 Insufficient oil
2 Excessive end float of secondary shaft
3 Incorrect end float of primary shaft
4 Incorrect preload on differential bearings
5 Worn or damaged bearings
6 Worn or damaged gear teeth

(c) Difficulty in engaging gear

1 Incorrect clutch cable adjustment
2 Worn synchromesh cones
3 First/second gear hub incorrectly assembled on hub

(d) Oil leaks

1 Damaged joint washers or half-housings on type 330
2 Worn or damaged oil seals
3 Faulty joint faces on covers

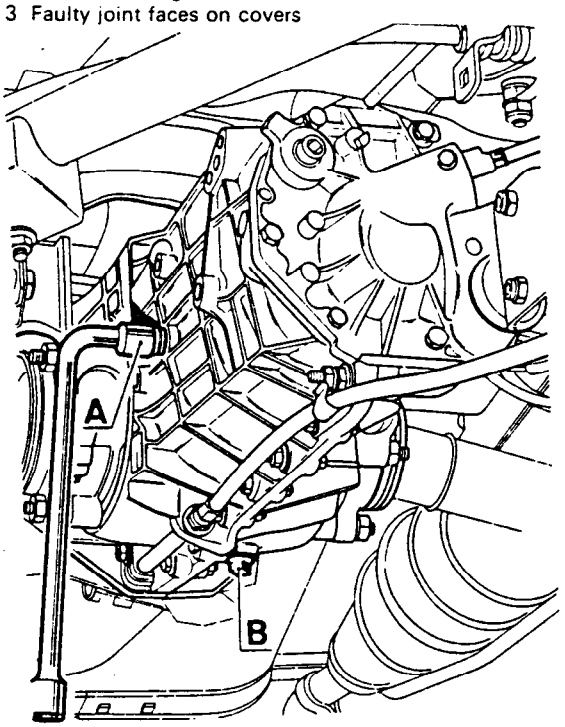
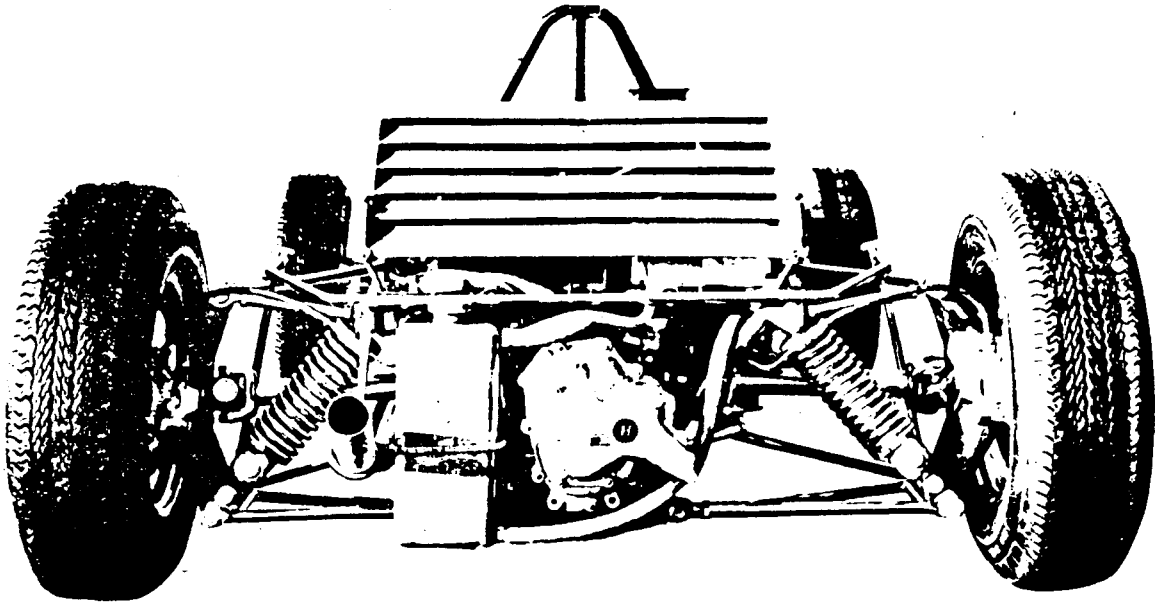


FIG 6:10 Gearbox drain and refill plugs (type 330)

Key to Fig 6:10 A Fill B Drain plug



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