From: Floating, Power November 1986 (Traction Owners Club, UK).

More glide in your Stride!

In the first of two articles, Roger Williams describes his conversion to a four-speed box – just the task to start on during the long winter evenings.

WHILST renovating the bodywork of my Light 15 I decided that a four speed gearbox would be better than the fragile (or so I was told) original three speed box. I saw Tom Evans's car at the Dent rally in 1980, and although at the time it did not mean much to me, as I had never seen an ID19 engine/gearbox before, various statements coming over the shoulders of the front row of onlookers did stick in my mind . . . "across the gate movement . . . joined to cables . . . behind the dash . . . difficult to get into reverse sometimes . . . bags of space" . . . etc.

In due course I acquired an ID19 engine/gearbox and set about fitting it into my Lt15 with the brief that the modifications to the car itself should be minimal, so that the original power unit could be put back in without further work. I soldiered-on on my own and eventually got my prototype conversion working but not road tested, when Jonathan Howard asked me to do a similar conversion for his Commerciale. This became Mk2, which performed very satisfactorily under hard everyday driving conditions, and this was followed by Mk3 for his Lt15, and Mk4 as a spare. Mk5, Mk6 and finally Mk7 followed with small but successive refinements, and the current version described here, Mk8, represents, dare I say it, the final version!

The ID/DS power unit was not designed for fitting into a Traction, and the solution to one problem seems to generate another, and whilst none of the modifications necessary are major, there are quite a few of them.

The final result, however, is a robust, reliable and economic power unit which, not being a purist, I think is a great improvement over the original.

The basis of the conversion is:

(i) The ID/DS engine block is similar to the Traction allowing direct transfer of engine side suspension brackets and timing chain cover with the rear rubber mounting block.

(ii) The Traction differential unit, and hence the output shafts, can with suitable bushing and shimming, replace the original ID/DS one.

The ID/DS bellhousing, however, is 35mm shorter than the Traction bellhousing, thus when the output shafts from the gearbox are aligned with the drive shafts, the engine block side and rear mountings do not align with the original hull mountings.

The hull side mounting brackets are replaced by new ones as shown in Fig. 1, and the housing for the rear rubber mounting modified as shown in Fig. 2.

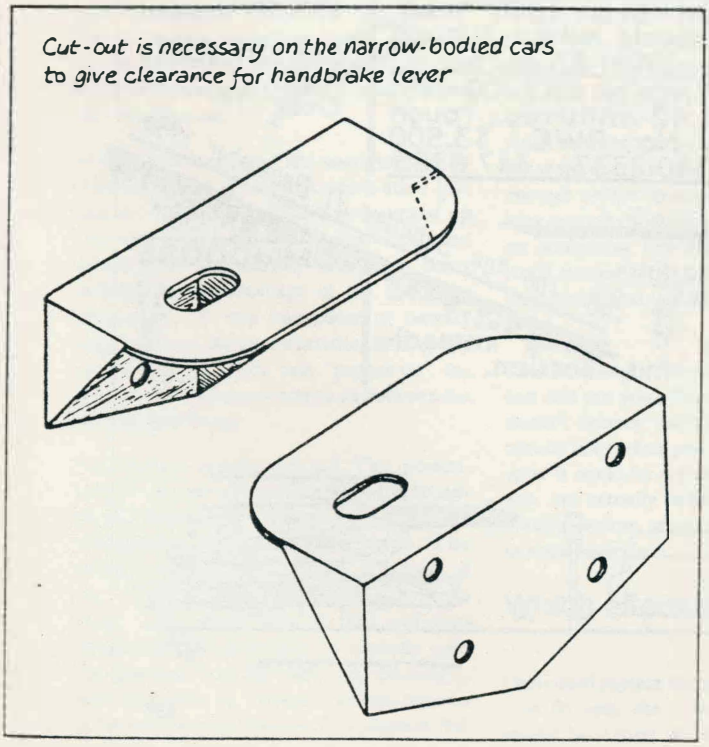

Fig. 1. New brackets for engine side mountings.

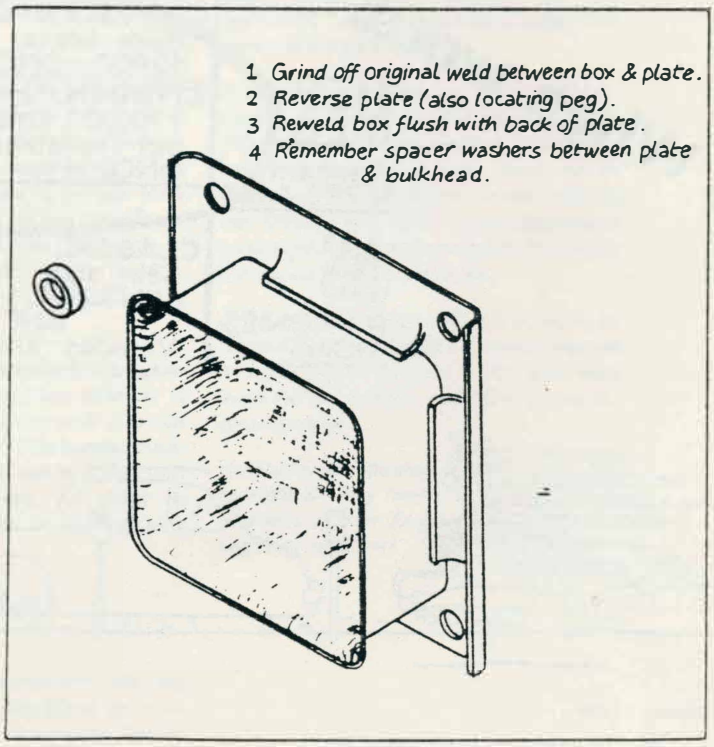

Fig. 2. Modified housing for rear engine mounting.

There certainly is not "bags of space" in the narrow bodied cars, and the mechanism shown in Fig. 3 is necessary to operate the carburettor on RHD cars. The LHD cars are easier because the throttle pedal is on the 'correct' side of the car, and a direct connection to the carburettor drive rod is, therefore, fairly straightforward.

A steel mounting boss, to the same dimensions as the one cast into the top of the Traction gearbox, is machined and welded to a steel plate as shown in Fig. 4, and bolted to the top of the ID/DS gearbox, such that its position relative to the output shafts is the same as the Traction.

Unfortunately, however, the gearbox side lower flanges foul the suspension cradle on the narrow bodied cars, and the cradle has to be modified as shown in Fig. 5 to allow the power unit to float on/about its mounting.

The next problem to be overcome is to provide a clearance between the camshaft pulley and the cross member which, in the original state, can be seen from Fig. 6 as being about minus 5mm. The radiator, however, is mounted on the cross member and anything other than minor modification will affect the position of the radiator, which in turn affects the alignment and fit of the grill/bonnet/side valance panels/wings etc.

Various solutions were tried on the earlier prototypes, all of which were variations of machining back the camshaft and water pump pulleys as far as possible, combined with cutting and strengthening of the cross member to give sufficient clearance to run the pulley, and to also allow a fan belt to be changed without dismantling half the car!

If all the original parts are to be re-used, the limiting factor is the water pump pulley which can only be set back about 5mm before it fouls the nose of the water pump body. When the camshaft pulley is then lined up with it there is just enough running clearance, and the extra 10mm required to change a fan belt can only be obtained by cutting into the cross member. The solution is to machine a completely new water pump pulley, as shown in Fig. 7, which changes the limiting factor to the clearance between the rim of the camshaft pulley and the pivot bar of the clutch fork lever.

The camshaft pulley is a steel pressing, dished towards the front and rivetted to a central boss. The most satisfactory way of re-positioning it is to separate it, reverse the dish and then re-rivet the dish to the central boss. The result of these modifications is to move the line of the pulley train back by about 15mm, as shown in Fig. 8, which also gives details of the new mounting position of the dynamo.

Some modification is still necessary to the cross member, but it is extremely minor and is shown in Fig. 9.

Now we get to the heart of the problem – the output shafts from the gearbox. The original ID/DS gearbox is shown in Fig. 10.

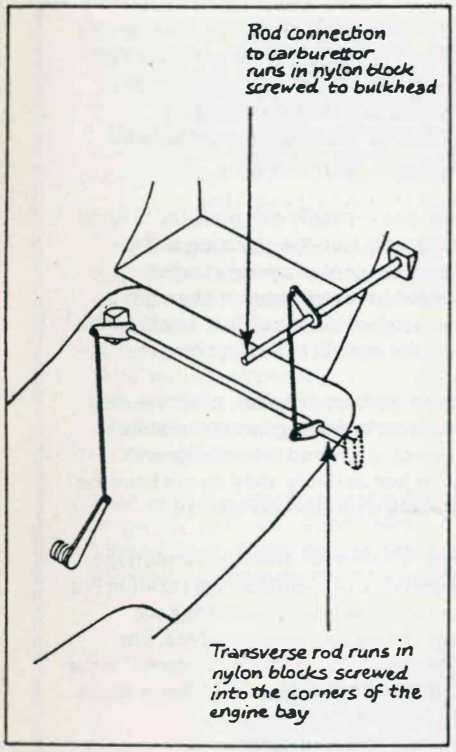

Fig. 3. Carburettor control mechanism for RHD cars.

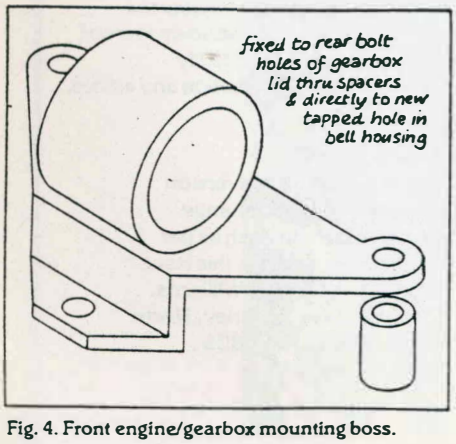

Fig. 4. Front engine/gearbox mounting boss.

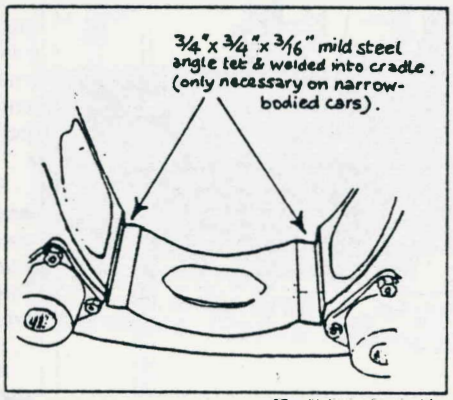

Fig. 5. Modification to cradle. (On narrow bodied cars only.)

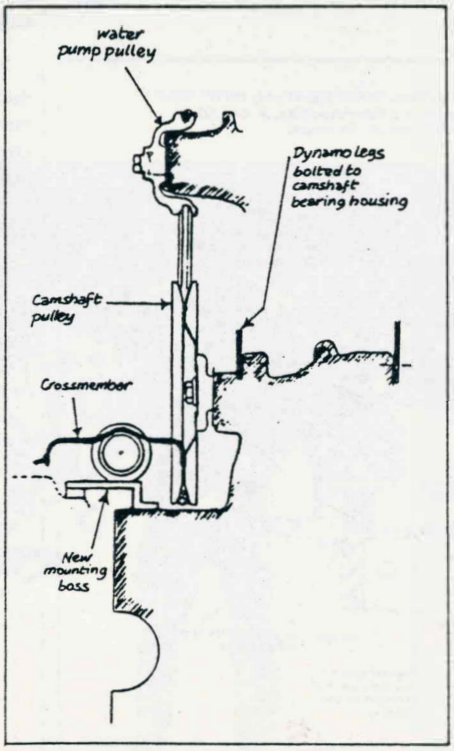

Fig. 6. Camshaft pulley fouling cross member.

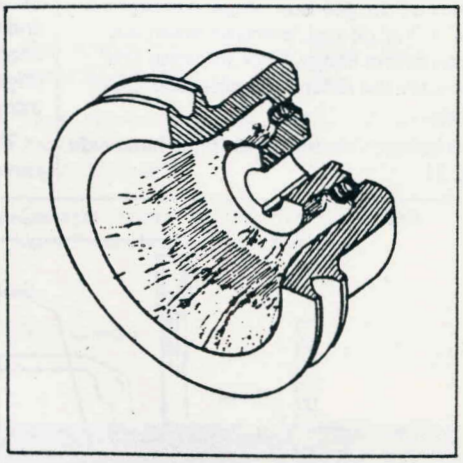

Fig. 7. New water pump pulley.

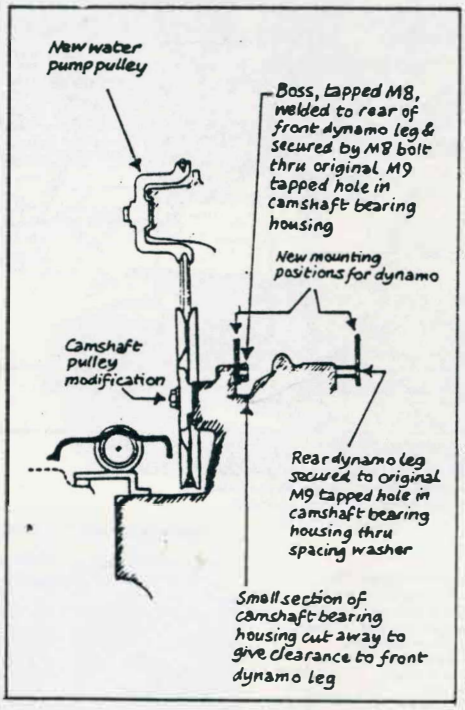

Fig. 8. New water pump pulley and modified camshaft pulley in position.

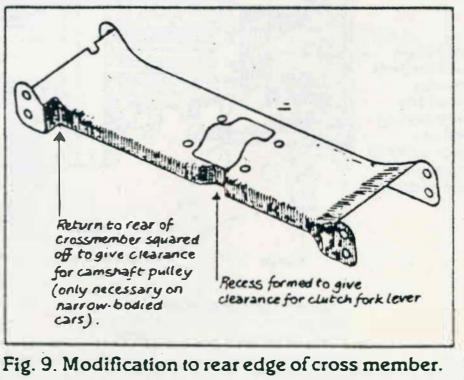

Fig. 9. Modification to rear edge of cross member.

The easy way is to swap the ID/DS differential for a Traction one, and machine a bush into the ID/DS crown wheel in which the Traction planetary wheel shaft can run. Whilst this is an easy, and in many ways, a practical solution it uses a Traction differential, which is not particularly well engineered. It is inherently weak because the planetary wheel shaft, onto which the output flange is splined, runs in a bush bearing from which the face of the output flange overhangs by about 50mm.

The only other work necessary is to machine off the gearbox flange to accept a 3" × 1⅜" × 9/16" oil seal, machine down the Traction output flange from 36mm to 1⅜", and re-shim the differential-side taper roller bearings.

This layout is shown on the right-hand side of Fig. 11.

By the time I'd got to Mk4, I was convinced it would be far superior to retain the ID/DS differential and make up a new pair of output shafts. These are machined from a solid 3" × 3" bar of EN24 steel, and it grieves me to see over 90% of the original bar disappear in swarf! The shafts are then hardened and tempered after basic machining, and finally ground to the correct dimensions and finish for the bearing seating/oil seal face.

The principle is the same as the original; the outer end of the output shaft runs in a ball bearing. I considered various arrangements for retaining the bearing to the output shaft and the flange of the bearbox using standard bearing and oil seals, but could not better the original layout, with the possible exception of using circlips instead of threaded sections.

The existing bearing/oil seal housing, however, is begging to be re-used, which I did by machining down the outside of the housing and shrinking it into the flange, as shown in the left-hand side of Fig. 11.

In order to provide proper support for the bearing, it must be located mostly within the flange and this pushes the oil seal outside the line of the flange. This in turn pushes the face of the output flange out so far that it would be impossible to install if the normal stud fixings to the drive shafts were used. The output flange is, therefore, made a little thicker and the stud holes tapped for connection to the drive shafts via caphead allen screws.

The flanges are held to the gearbox via four No. M7 bolts and six No. M9 bolts. The M9 bolts pass through the original gearbox support brackets and are too long for re-use. Replace these with ⅜" BSF bolts 1¼" or 1½" lg. (M9 is 0.354" dia. with 20.32 TPI – ⅜" BSF is 0.375" dia. with 20 TPI – just run a plug tap through original holes but be careful not to leave swarf inside gearbox). It is necessary to recess countersunk head allen screws for the bottom two holes on each side, and file away the bottom of the flange for the narrow-bodied cars, to give clearance in the cradle.

The engine/gearbox unit is now ready for installation in the car, so we are about half way there! I will describe the gear change mechanism and the other ancillary modifications necessary to complete the conversion in the next issue.

Roger has certainly given a lot of thought and hard work into the planning and development of his 4 speed gearbox conversion in recent years, and we are fortunate to be able to publish details of his work for the benefit of all members.

Many members may feel, however, that the actual task of doing the conversion themselves is beyond their ability and scope, or just as likely, they do not have the engineering equipment required!

Roger is, however, willing to undertake the conversion of members' cars at what is a very reasonable cost, considering the amount of time and work involved. For further details, Roger can be contacted at the address given in the Classified Ads. section of the magazine.

Whilst every effort is made to ensure the accuracy of the information and advice published in this magazine, neither the T.O.C. or the officers and members thereof, or the authors, accept any liability whatsoever for such information and advice.

Service
4 speed gearbox conversion complete with gearchange mounted behind dash as per original. See article in this issue of FP, contact Roger Williams, 37 Wood Lane, Beverley, North Humberside, HU17 8BS. Tel. 0482 881220.

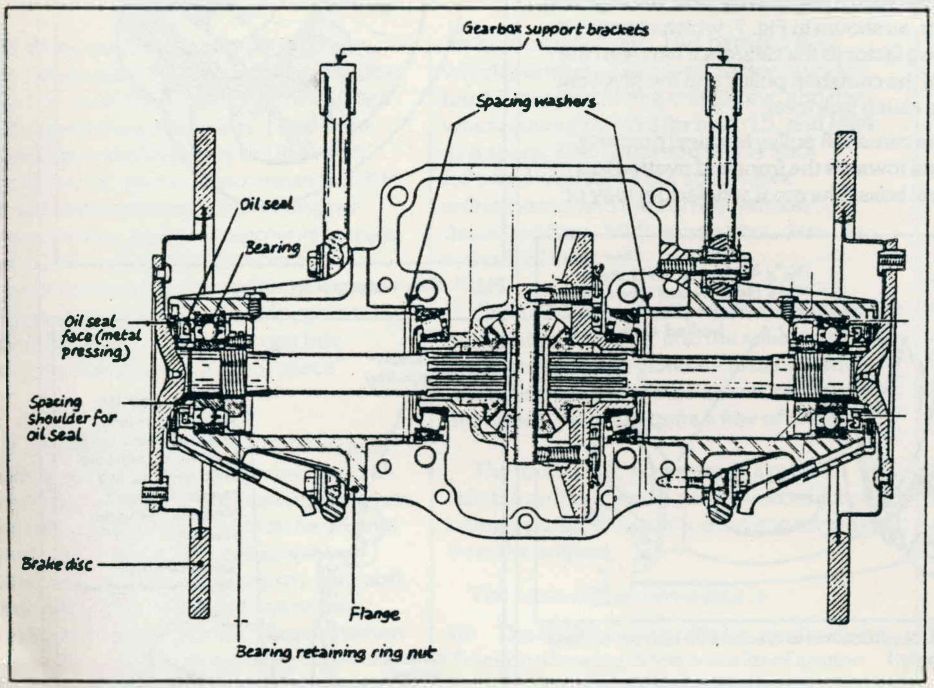

Fig. 10. Original ID/DS gearbox before modifications.

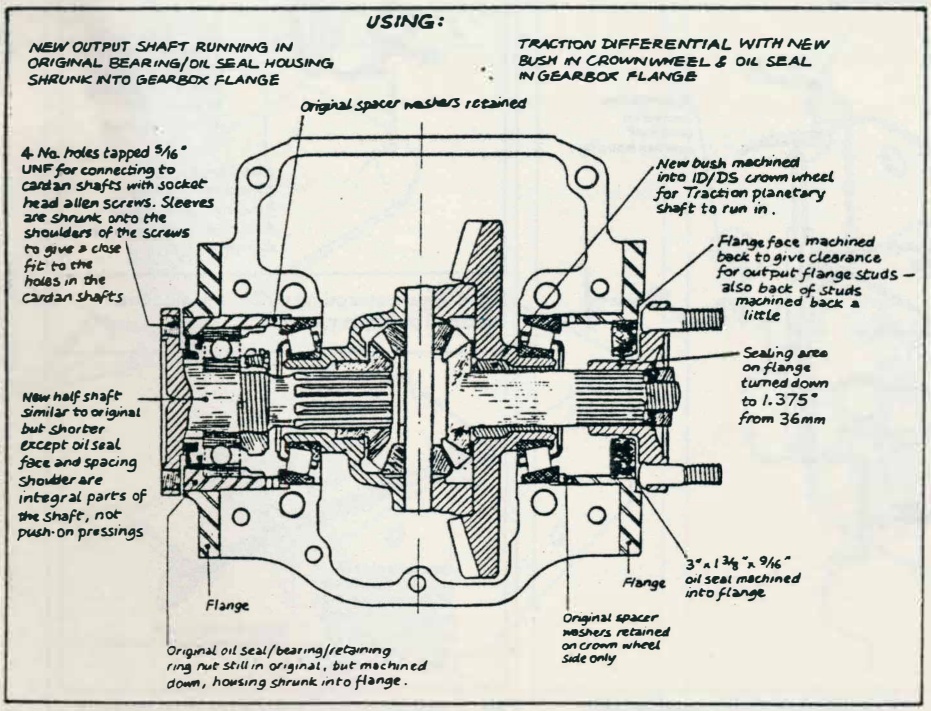

Fig. 11. Section through ID/DS gearbox showing conversion using

TRACTION TRANSPLANTS

More glide in your Stride!

From: Floating Power, January 1987 (Traction Owners Club, UK).

Roger Williams concludes his workshop special on his conversion to a four-speed box.

AFTER INSTALLING the engine/gearbox unit in the car as described in the last issue there is the small problem of getting the ancillaries like the gear change and clutch to walk properly AND look as if they were original fittings.

Starting with the exhaust – there are at least two types of exhaust manifold fitted to ID/DS engines depending on the age. The most common type appears to be the one which points toward the front of the car which gives very little space in which to turn the line of the exhaust through 90° to get it through the hole in the side valance panel. It is particularly tight on the narrow bodied cars. I've not found an exhaust factor that can satisfactorily bend a 50 mm dia. pipe through 90° with a centre line radius of 75 mm adjacent to a flared end. The solution was to make one up based on a malleable iron water pipe elbow which is perfectly smooth and of constant section around the bend. A flared flange is brazed into the top end and new pipe, which an exhaust factor can bend, connects to the existing pipe under the hull.

The other types of manifold points relatively directly at the hole in the valance panel and a special pipe can be made up by the local exhaust factor. These non-standard front sections are made of the thickest gauge steel available so that replacement is only necessary every 5–10 years.

The bottom hose connection from the radiator to the water pump has to follow a tortuous path around the camshaft pulley and under the dynamo as shown in Fig. 1. This can be made from odd bits of heater hose but is more satisfactorily made by brazing together a series of large diameter copper central heating elbows. The water pump on the ID/DS cylinder head is offset to the left and the original Traction fan which is mounted on the new water pump pulley has to have the tips of the blades shortened by about 20 mm on the narrow bodied cars to give clearance to the bottom hose. Cooling efficiency is unaffected. The bottom hose, on the narrow bodied cars, covers the rear wishbone grease nipple and this is replaced by one with a 45° elbow.

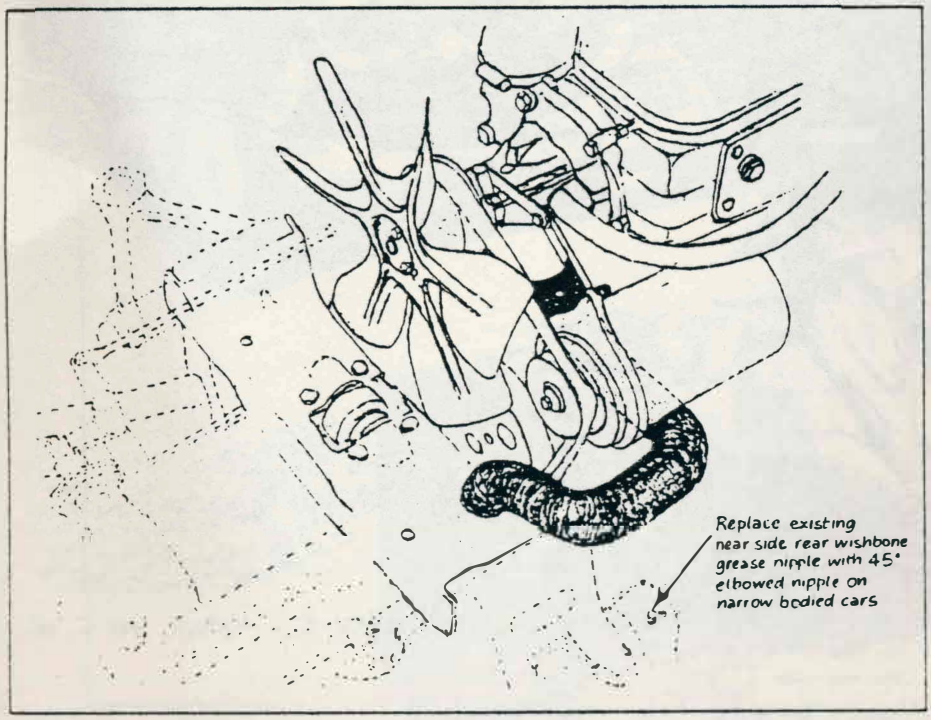

Fig 1. Special bottom hose for the narrow-bodied cars (wide-bodied cars similar).

The top hose is made by joining the radiator end of the Traction one to a shortened ID/DS one. Push an old bit of exhaust pipe into the Traction hose and then feed the ID/DS hose over it and clamp with a jubilee clip. When connecting the water pipes make sure you can get to all the jubilee clips to tighten them with all the body panels on. I made the mistake first time of clamping the piping before installing the engine/gearbox in the car and connecting to the radiator before fitting the body panels. Needless to say there was the odd weeping joint and half the car had to be taken to bits to get at the offending joints.

And so to the gearbox linkage. The gear change mechanism is a combination of back/forward and lateral movements. In the ID19 the gear change is via a column mounted mechanism which provides the back/forward motion via a series of articulated ball cranks/rods and the lateral one with a cable. To keep the Traction looking original, the guts of the original column change mechanism is mounted horizontally behind the dash with the original gear lever cut off just behind the dash and a Traction leader welded to the stump. The layout is as shown in Fig. 2. However, this repositioning of the column change mechanism moves it further away from the gearbox and the original cable and rod are too short. Also the operating mechanism of the gearbox is forward of the radiator and on the narrow bodied cars there is no direct line between the bulk head and the gearbox without going through the radiator. It is possible to get a direct connection on the wide bodied cars but I wanted a mechanism that would fit all cars with only minor modifications necessary when changing to/from a wide to a narrow bodied car. With the column change mounted horizontally behind the dash, the cable and rod (with a small extension piece) can reach the bell housing and the solution was to provide a new linkage system from here to the gearbox operating mechanism. Fig. 3 shows a general view of an ID19 gearbox fitted with a gear linkage for a narrow bodied car with a rod operated clutch. Fig 4 shows this mechanism in more detail. Note that the connecting rod between the cable and the bell crank operating the 'across the gate'

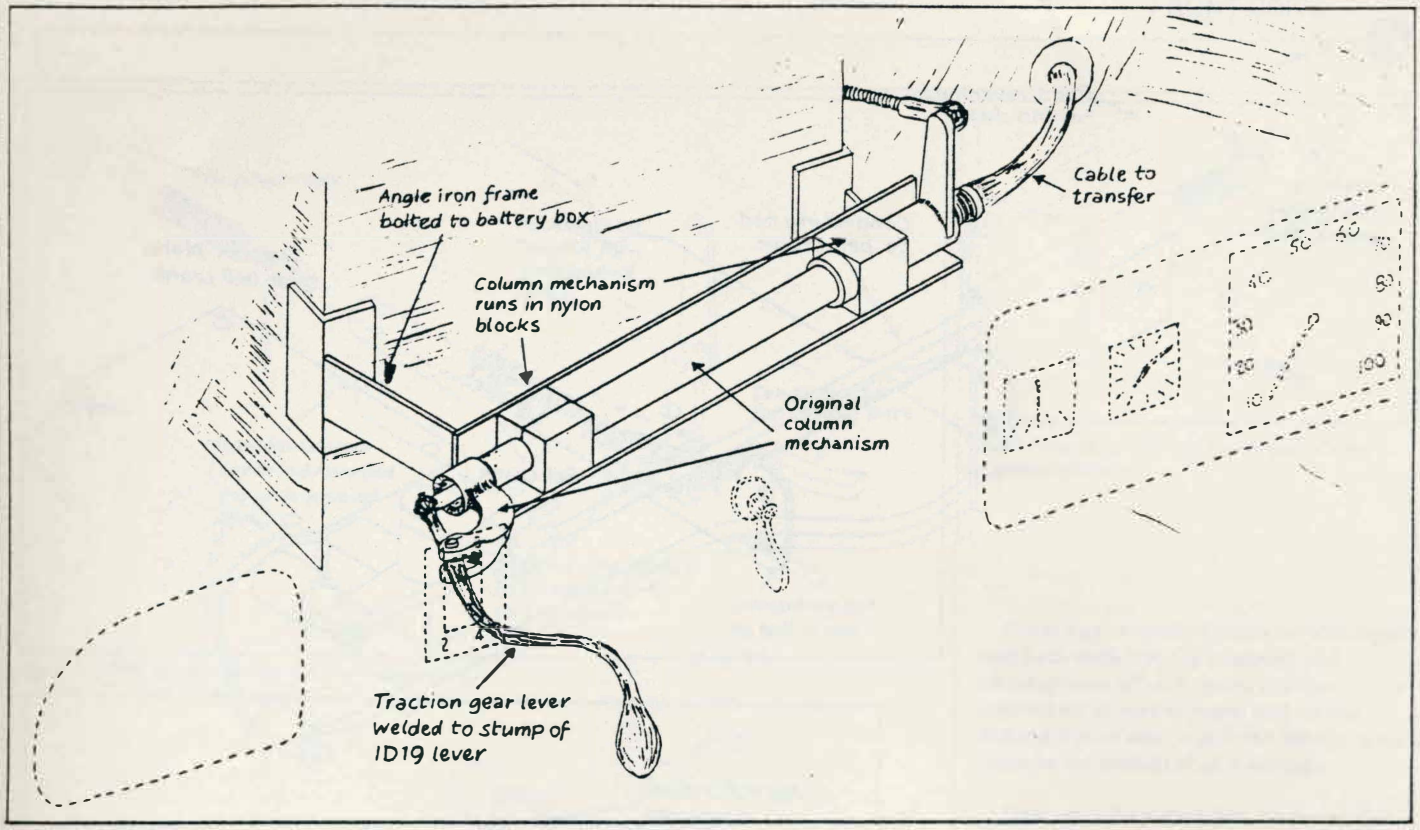

Fig. 2.

movement passes over the crossmember but under the radiator. There is enough room but only just! Unfortunately this rod passes exactly through the offside radiator mounting on the wide bodied cars. Early systems had a kink in the rod to get around this mounting but this did not prove entirely satisfactory and a modification was necessary. Tom Evans and I arrived at the same solution independently which was to take the connecting rod under the crossmember. This involved inverting the transfer mechanism, which is mounted on the bell housing, and the bell crank operating the 'across the gate' movement. Fig. 5 shows this in more detail. The individual components of the transfer mechanism and the extension of the 'across the gate' plunger are shown in exploded form in Figs. 6 & 7 respectively.

One of the problems is getting reverse gear which is engaged by pushing against a strong spring within the gearbox presumably to stop anyone slipping into reverse instead of top. In the ID19 the original gear lever gives more than a 10:1 lever arm and the push forward with the full support of the seat is easy. However, when the column mechanism is mounted horizontally behind the Traction dash with the Traction gear lever, not only is over half the lever arm advantage lost but the action is across the car. This is not so bad on the LHD cars where you can push away from yourself with the support of the seat/door. On the RHD cars you have to pull with your left hand and you tend to slide over the slippery leather seat. A couple of coils are ground off the spring to give some resistance to warn you that you are going into reverse, but not enough to develop a Charles Atlas left arm.

Finally to the clutch – the operation in the original ID19 cars was by cable which was anchored in a boss cast into the top of the bell housing. Bosses are cast for both left and right hand drive cars but only one will have been slotted and tapped. The clutch fork lever is operated by an articulated rod actuated by a bell crank and this system can be used directly with an original compatible cable on the left hand drive cars with minor modification at the pedal end. Right hand drive cars have rod operated clutches and to retain this robust and reliable operation a new clutch lever and pivot boss, as shown in Fig 8, is made up.

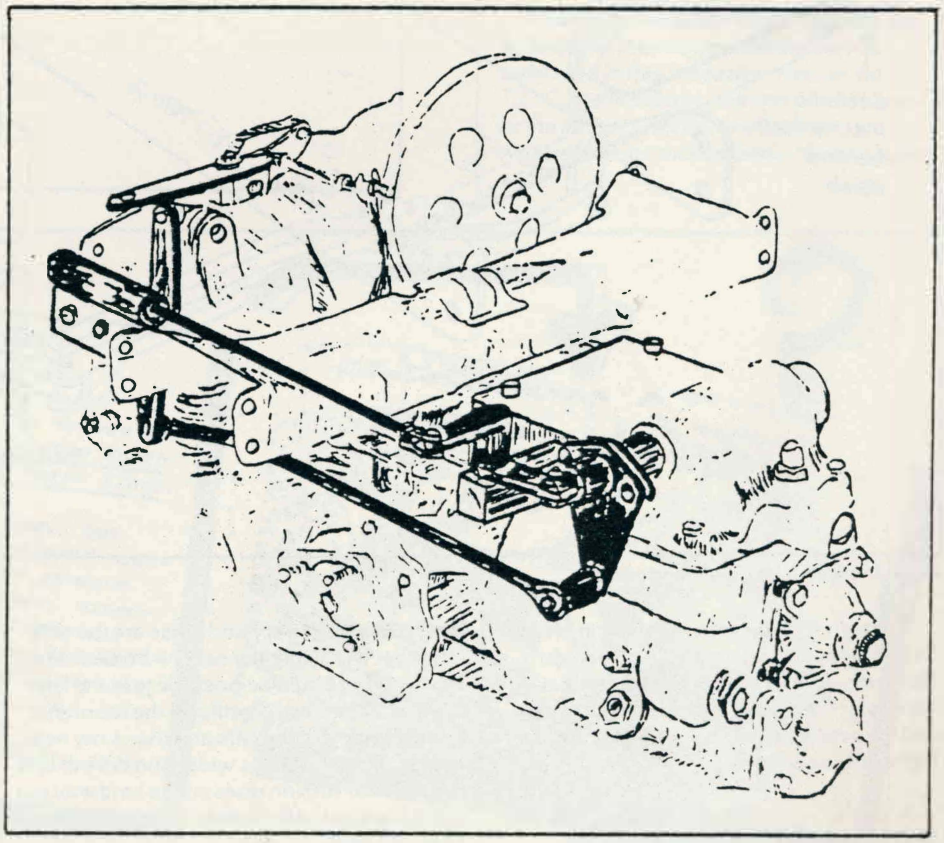

Fig. 3.

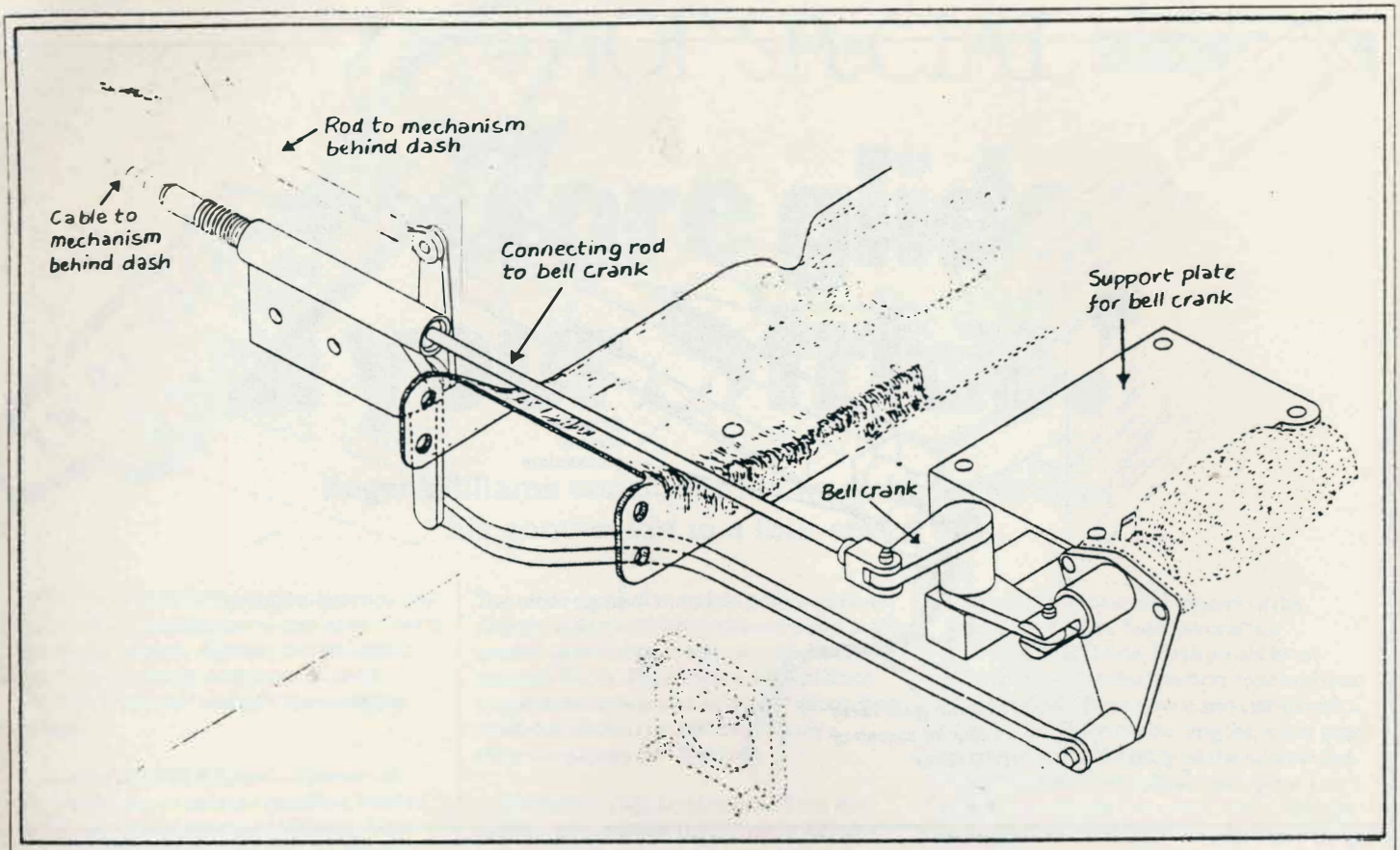

Fig. 4. Arrangement for narrow-bodied cars.

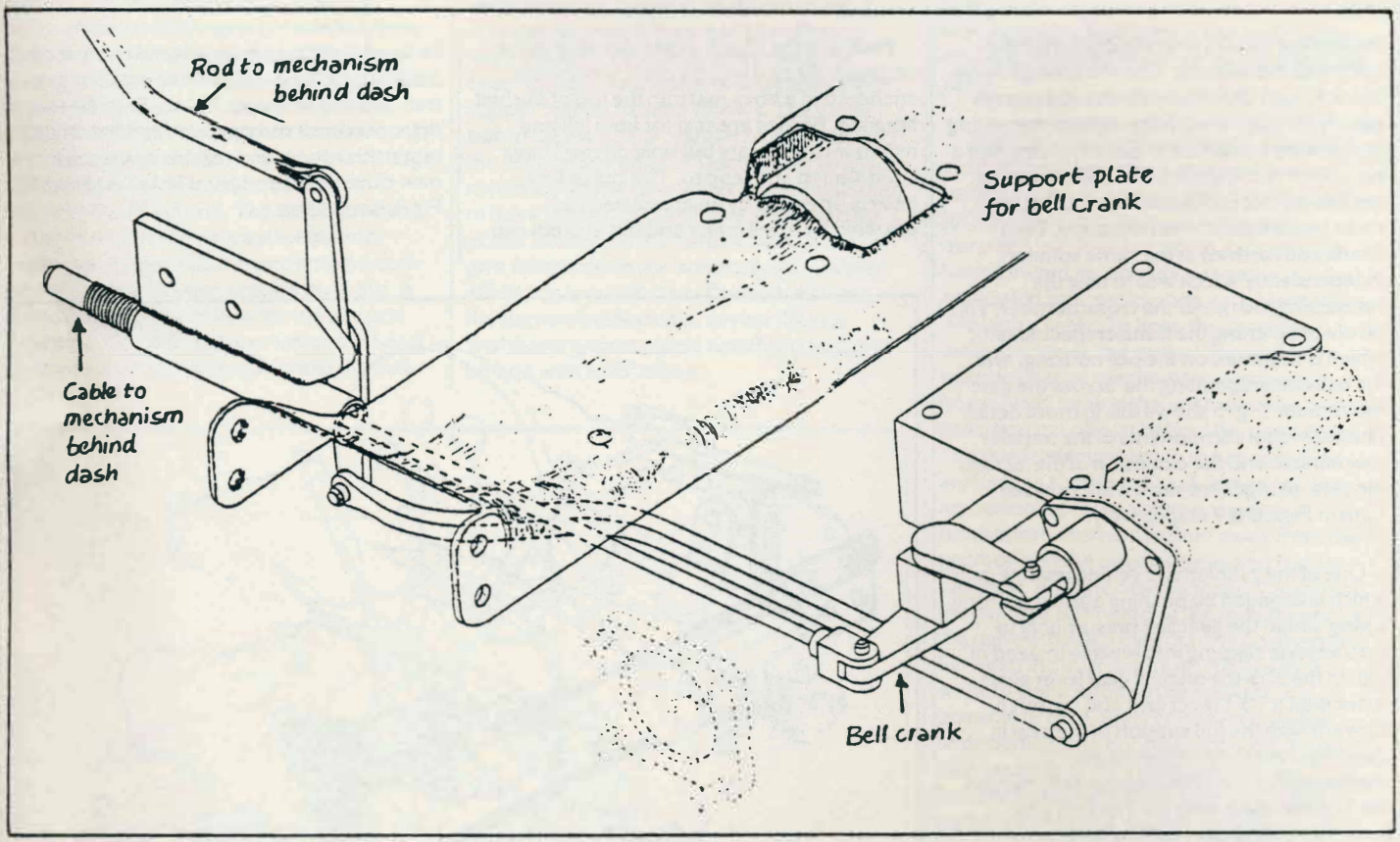

Fig. 5. Arrangement for wide-bodied cars.

Although you can get everything in, it is a bit of a squeeze on the narrow bodied cars. However, once installed and operational there is less maintenance than on a Traction and the performance and economy are in a higher league altogether.

And what of the future. The supply of early ID/DS engines/gearboxes is becoming limited in this country and these are the only ones that will fit into the narrow bodied cars. However, it should be possible to fit the later engines, which are plentiful at the moment, into the wide bodied cars and that is my next project. The gearbox is wider and deeper and the 5-speed version does stick a long way out at the front but I am hopeful that it can be made to work.

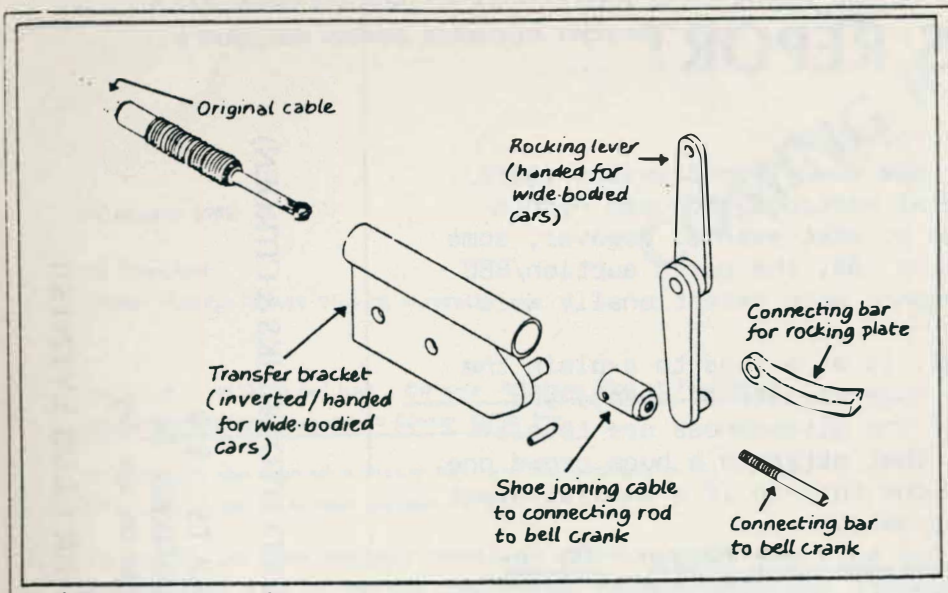

Fig. 6. Transfer mechanism for narrow-bodied cars.

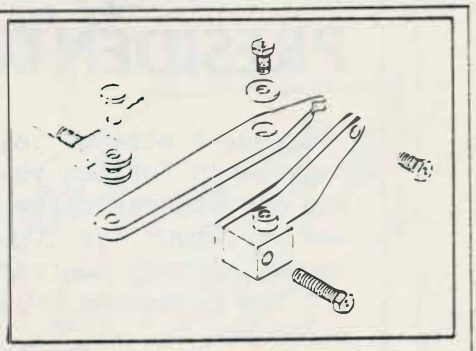

Fig. 8. New clutch lever and pivot boss for rod operated clutches.

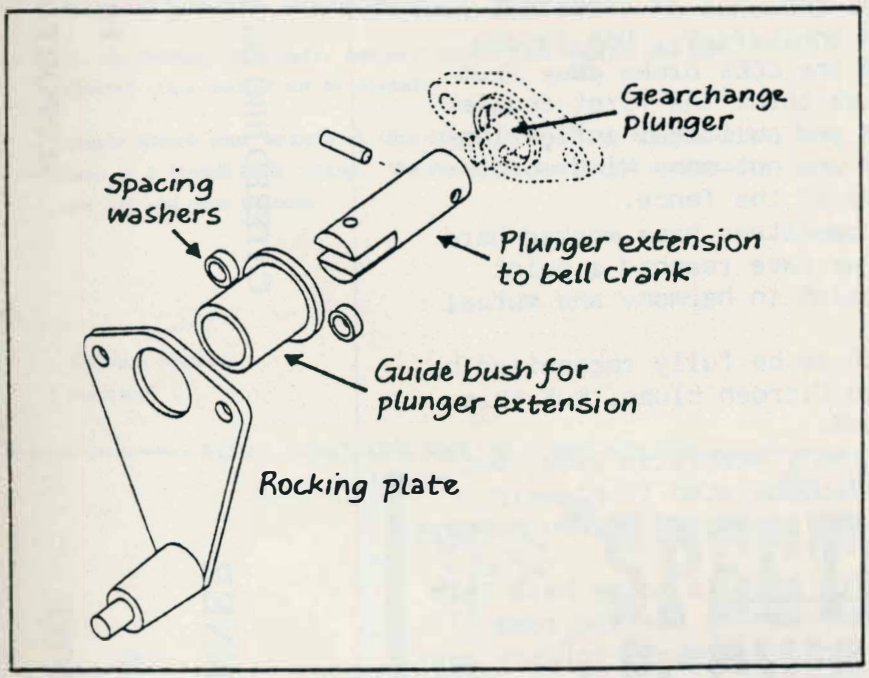

Fig. 7.

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WHAT'S THE STORY BEHIND THIS PICTURE?

The car, we can tell you, is a rear-drive Traction-based Grand Prix racer. The driver is none other than our GUEST SPEAKER at the March CCOCA meeting at Nunawading (8 pm, March 22nd).

We're not going to give much more away, but let's put it this way. If you want a good evening out, and would like to hear from someone who has devoted a lifetime to Citroens, especially Tractions and 2CVs, from the technical side and in fierce competition, then this has to be the opportunity for you. Format informal, question-and-answers after a short intro.

Coffee and chat to follow. You'll be sorry if you don't come!