THE TR 6 HUB HANDBOOK

BY LEN RENKENBERGER

THE ARTICLES IN THIS BOOKLET ARE SOMEWHAT AUTONOMOUS BUT WILL GIVE THE GREATEST BENEFIT WHEN YOU HAVE READ ALL AND HAVE THE SIX-TECH MANUAL AND SUPPLEMENT. I MUST APOLIGIZE FOR MY LACK OF COMPUTER SKILLS AND MY OLD MAC COMPUTER AND PRINTER. SOMETIMES THE PRINT KIND OF RUNS TOGETHER ON THE REDUCED DRAWINGS. I ALSO OCCASIONALLY WILL USE DIFFERENT COMMON NAMES FOR PARTS. I HOPE THIS DOESN'T CONFUSE YOU. I'D ALSO LIKE TO PASS ON ONE LAST TIP - LOOK FOR TR 4 IRS PARTS CARS. THE TRANSMISSION, DIFFERENTIAL, AND AXLES ARE INTERCHANGEABLE AND A WHOLE TR 4 CAN BE HAD FOR THE PRICE OF A TR 6 REAR END.

REAR HUBS - COPING WITH ONE OF THE BIGGEST PROBLEMS YOU WILL EVER FACE WITH YOUR TR-6

(Note: Even if some of these jobs may be beyond the level of your skills and equipment, make sure you give this information to the person doing the work).

I don't wish to start off on a negative note, but I will tell you that as sure as Dolly Parton stands out in a crowd, the rear wheel bearings on your TR 6 will go dry and need replacing. I'll also tell you right off that the longer you ignore this problem the less chance you will have of successfully rebuilding your hubs. The importance of doing this job at an early date can not be overstated. The inner bearing has a relatively small contact area with the stub shaft. Unfortunately, it goes dry and the inner bearing race begins spinning on the stub shaft. If this happens the odds of saving the stub shaft become 50/50 at best. Also, the spacer behind the bearing begins spinning sooner or later and this lets it wear against the harder bearing race thus producing excess end play (lateral movement) of the bearings, and this accelerates hub failure.

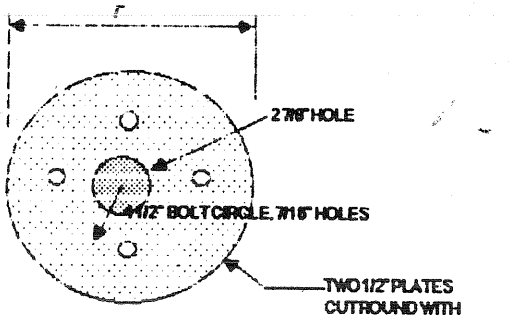
It is an absolute certainty that you can not get the rear hub apart without special tools. It is equally certain that some auto repair shops will assure you they can press the hub off. Guaranteed, they'll destroy it. It simply is too thin and will bend or break long before the hub comes apart. I can't tell you why TR hubs are so difficult to separate. Rolls Royce uses a nearly identical design that is about 4 times as big and 4 times easier to separate. Many older American cars used tapered axles and these can be readily removed with a wheel puller.

If you look at a better cross sectional view of the hub assembly than the ones in this article you will see that the hub has a tapered inner bore which is held in place on the stub shaft by a woodruff key and a nyloc nut. It looks like you could just loosen the nut and disassemble the whole mess. Ain't so Charley. I have put 30 tons of pressure on some of these things in a press and not been able to separate them. With the tools described in these articles and shown in the illustrations you have a chance (my average to date for rebuilds is about 60% success with the first tool and 100% with the second). Without one of them you've got a better chance of hitting the numbers.

The Tools:

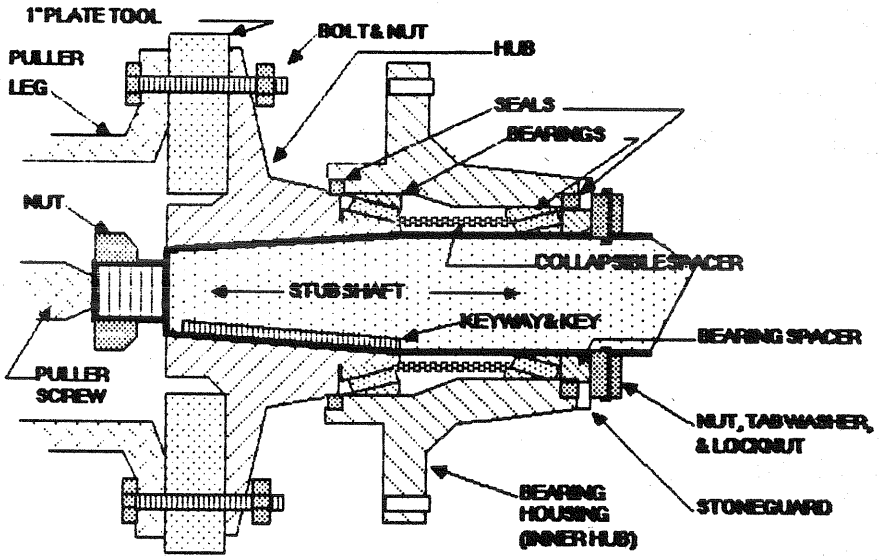
1. The first "tool" is for those who don't have a press or a shop that has one. It is made from 3/4 inch or thicker plate steel (mine is two 1/2 inch plates liberally welded together). Its purpose is to stiffen the hub flange. Without it, the force required to separate the hub from the stub shaft will bend and destroy the hub - GUARANTEED. It is not the perfect answer since it only stiffens the hub by being tight against the top of the hub and depends on the bolts to keep the hub from flexing.

TR6 REAR HUB REMOVAL TOOL



ADDITIONAL TOOLS REQUIRED ARE A 4 LEG HUB PULLER AND GRADE 8 BOLTS AND NUTS LONG ENOUGH TO GO THRU THE HUB FLANGE, THIS TOOL, AND THE HUB PULLER LEGS.

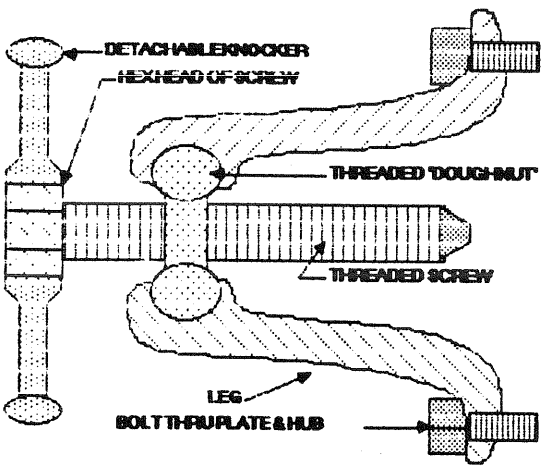
HUB ASSEMBLY WITH REMOVAL TOOLS



You will also need a puller with 4 legs (most have 3, make sure you can get extra legs before you buy). Mine is a New Britain P99 purchased from a NAPA dealer. Again a negative note - the puller may not be able to exert the force required, and you may need a press. The problem with a press is getting sufficient support under the hub due to its proximity to the bearing housing and the extreme pressure required. The tool in the next section overcomes this, but at a price.

The plate can be made from 1/2" base plates for steel building columns at a much lower cost than having it fabricated from sheet steel (look under structural steel in the yellow pages.

TYPICAL PULLER USED WITH PLATE

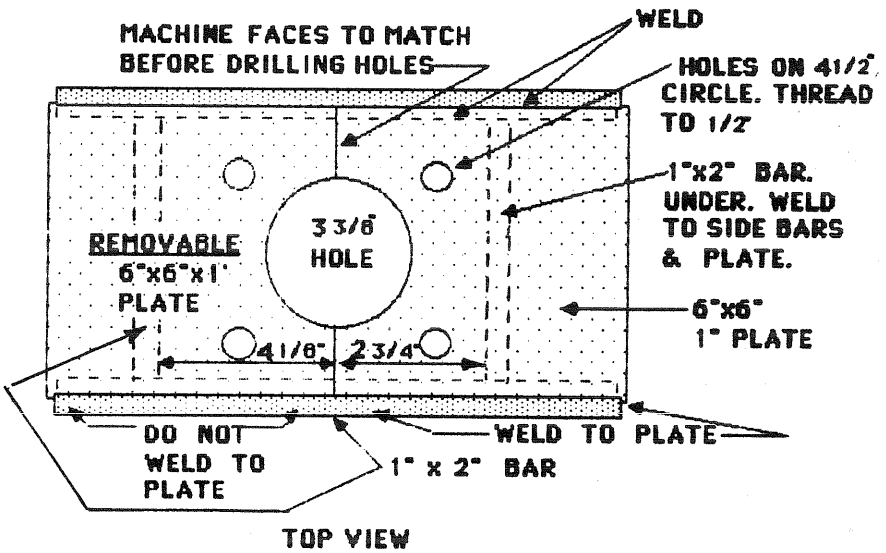


Their scrap barrels should provide the things you need at low prices so you don't have to buy full 20' bars, etc). The holes for the hub bolts must be drilled with a drill press. The center hole is most easily made by drilling 1/4 inch holes nearly edge to edge on a circle slightly smaller than the finish diameter. The hole is then finished by carefully cutting the metal between holes away with a torch and then finishing and smoothing the edge by cutting with the torch or grinding with a heavy grinder. Not pretty, but cheap !

2. The alternate tool requires a hydraulic press. The tool shown here works better than anything I've ever used. That is not to say it is easy. My 30 ton press has two handles, a 12" and a 24". This is the only job I've ever done on it that requires the 24" handle to pump up enough pressure. When the hub lets go it sounds like a rifle shot and the floor shakes. Frankly, it scares the hell out of me. It can be put on the hub and the whole assembly taken to a shop, a big advantage. This is not a cheap tool either. Machining the joining faces of the plates, boring the 3 3/8" hole, and taping the holes in the plate cost me $135. The materials were another $30. Nor is it light. The tool and a full axle assembly weigh 66 pounds.

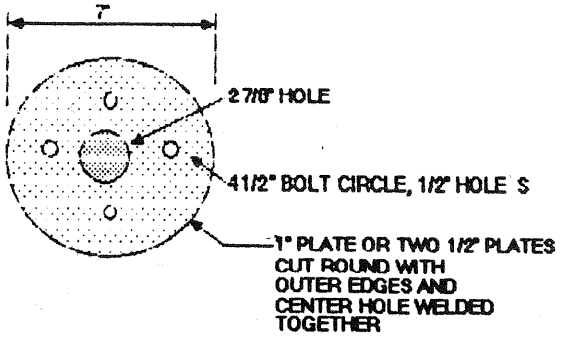
Start by having the plates machined. The two mating faces of the 6" x 6" x1" plates must be cut first. With the plates held tightly together, the center hole is cut and the holes for the 1/2" bolts are taped. These must be very accurate or the hub can't be bolted on. I recommend you furnish a hub to be used as a guide. The reason the plates have to

BOTTOM HUB REMOVAL TOOL

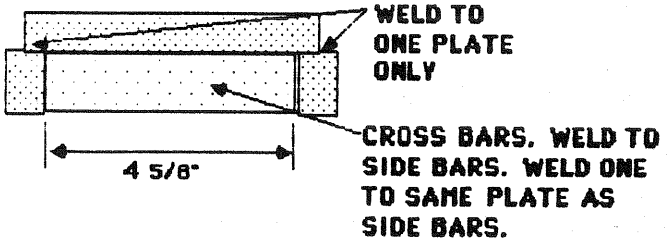


TOP VIEW

TOP PLATE OF HUB REMOVAL TOOL

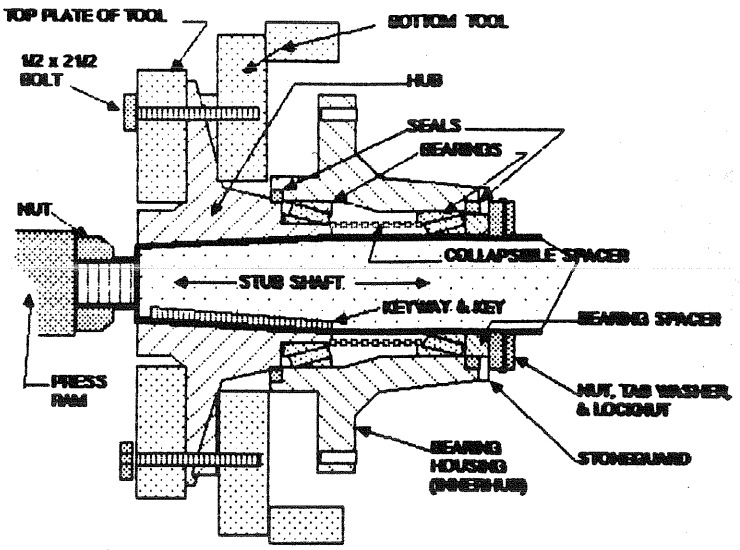


END VIEW



mate tightly is to add rigidity to the tool. Deflection, or bending inward, of the flange actually causes the outer end of the taper to press inward and tighten on the stub axle, so great is the force required to remove it.

HUB ASSEMBLY WITH REMOVAL TOOL S



Seperating The Hub

Remove the axle assembly from the car. Remove the wire from one end of the rubber boot on the axle assembly and carefully separate the halves of the axle. Keep the splines covered and clean. Knock out the wheel studs. Remove the nyloc nut from the stub shaft and reverse the nut, turning the outer end down until flush with the end of the stub shaft. This will keep the tremendous pressure on the end of the spindle from mushrooming it (yes, there IS that much pressure).

With the Hub Puller: Using four 1/2 inch x 2 1/2 inch (or 3 inch) bolts with washers, attach the tool and hub puller to the hub assembly as shown. These bolts and nuts must be grade 8. Hardware store bolts are usually grade 2. Grade 5 can be found at most auto supplies and grade 8 at bolt and fastener suppliers or aircraft suppliers (again to the yellow pages). Lightly grease the washers. Snug down the bolts evenly so that the puller screw is centered on the stub shaft and then torque them to about 65 - 70 foot pounds (ft. lbs.). Tighten the wheel puller until you think it is ready to break (unless you are lucky enough to have the hub separate first). Keep watching the bolts. Should they elongate appreciably or the washers get deformed due to the high pressure, release some of the pressure on the puller and torque the bolts down again. It is very hard to hold the hub assembly while you are hammering with all your might to tighten the puller. It helps to place a tire iron transversely between two legs of the puller and to have a friend help by standing on it, etc. Heat the back side of the hub with the torch (adjacent to the bearing housing) as much
and rapidly as possible. Quickly tighten the hub puller even more if possible. If still not free, hit the hub with a few hard hammer blows in

the area behind the flange (about where the arrow of the 'hub' note is pointing in the illustration). Again a negative note - some assemblies won't come and must be pressed, some hubs will actually shear at the outer face of the outer bearing from the force, and some won't come regardless. Let me say in advance that this part is going to be a very traumatic experience.
But look at it this way - you've nothing to lose since a bad hub is of no value.

With The Press: Assemble the top and bottom tools to the hub and axle assembly using Grade 8 bolts with a good (not hardware store quality) washer under the head. Insure that your bolts reach all the way (or very near) the bottom of the bottom tool or they will strip the threads in the tool. The tension of these bolts is the most critical thing in the whole operation. Torque the bolts to 75 foot pounds (ft. lb.). When the tool and hub are positioned in the press, pressure should be applied slowly. With a hand operated press this is not a problem. With a press using an electric pump like shops have the pressure builds rapidly and a careless operator will apply quickly and may exert unneeded pressure that will bend the tool before the hub lets go and he can release the pressure.

Rebuilding The Hub:

After removing the hub and bearing housing from the stub shaft, remove the seals and bearing inner races (or cups) from the bearing housing. Clean everything thoroughly. Look for a worn stub shaft at the inner bearing and for a worn bearing spacer, especially the face which is against the bearing.

Clean all grease from the outer races of your new bearings. Put them back in the box and seal the box. Put the boxed races in the freezer for at least an hour and preferably a day. This shrinks them and makes them easier to install. Install quickly and make sure they are both all the way in and pointed in the right direction. Install the seals making sure the open side faces toward the center of the housing. Clean the inner races of the bearings. Heating them slightly (too much heat will ruin them) in an oven or the sun will help in installation. Pack the bearings with grease, but not the races. Install the outer bearing on the hub. Back off the lock nut and adjusting nut on the stub shaft all the way. Place some grease in the bearing housing. Install the inner bearing cone in the bearing housing. Install the bearing spacer on the stub shaft with a liberal

amount of fast setting Permatex or Loctite behind it and on the shaft to keep it from spinning later and scoring the stub shaft. Check that grease will not be able to get on the stub shaft or inner race of the inner bearing during assembly. A little Loctite Bolt Lock (not Bearing Lock) should be used to insure the inner race can't spin on the stub shaft. Lightly coat the tapered portion of the stub shaft with anti-seize compound (you may want to take it apart someday). Install the bearing housing, a new collapsible spacer, and the hub on the stub shaft and tighten the new nyloc nut to 100 - 110 ft. lbs. (it must be very tight). Incidentally, you do not need the collapsible spacer if you use elementary care in adjustment and have the bearing spacer on which the inner seal rides on secured from turning with Permatex or Loctite. However, in my opinion, the best thing to do is place a set screw in the spacer as described in the article later in this booklet.

Not having the collapsible spacer there does have an advantage. It enables you to feel adjustment just like you would with a front wheel bearing. The following is only applicable if you do not use the collapsible spacer. Tighten the adjusting nut to an estimated 10-12 ft. lbs. of torque. Rotate the bearing housing several times to insure the bearings are seated. Loosen the adjusting nut to relieve all preload on the bearings. Tighten the adjusting nut until just snug - no load. Tighten 1/12 (Note: 1/12, not 1/2) turn more (there are six flats on the nut, index the nut and turn 1/2 a flat). Tap the back face of the bearing housing toward the hub with a hammer, then try prying them apart with a screwdriver in the space between them. If the housing moves, the adjusting nut exercise must be repeated. A dial indicator or use of feeler gauges will greatly enhance your ability to accurately determine end play.

With the collapsible spacer, just keep tightening and checking until there is .002" or less end play. This small amount of movement is very difficult to feel. A jig to hold the axle and a dial indicator to check play are described in one of the following articles. A no tools method that is more time consuming is to mount the hub assembly (not the complete axle assembly) on the car. This is described in the following article.

Set the locknut and tab. When you have the locknut tight, place a dull chisel near the end of one of the flats and hit sharply with a hammer to insure the locknut is tight enough. and reassemble the axle halves making sure you really have the adjusting nut locked in place. Reassemble the axle halves making sure you have not cut the rubber boot by overtightening the wire. It is desireable to clean and grease the splines while you have the axle apart.

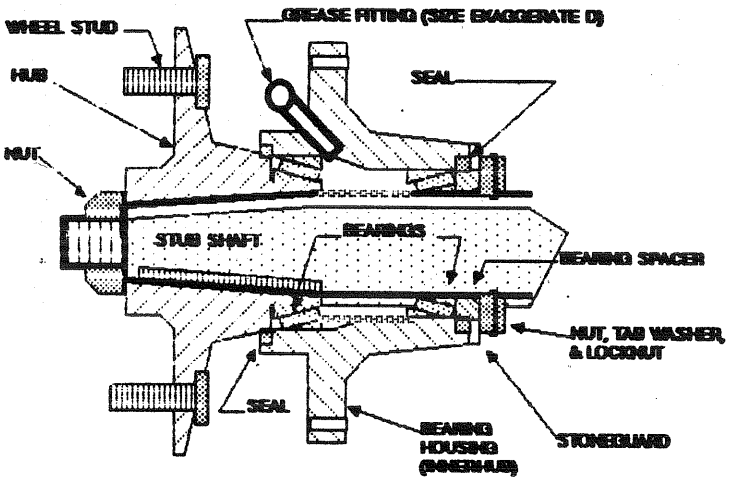
A wrench for the adjusting nut can be rather easily cut from sheet steel as described in a following article.

Bearings - SKF or Timken
Inner Cup- L44610
Inner Cone- L44649
Outer Cup- LM29710
Outer Cone- LM29749

Seals - BAP-GEON # NA261 and #NA530

I've been told that recently there has been some kind of trade ruling against US companies importing bearings and putting them in their packages (or something like that). Anyhow, the end result is a significant increase in bearing prices. Presently the Roadster Factory hub kit is a better deal than local purchase.

EXTENDING THE LIFE OF REAR HUBS



Skill Level D (Part 1)

Skill Level B/C (Part 2)

What we have here is a very easy method to greatly extend the life of your hubs - and with a little more work maybe make them last the life of the car.

If you look at the drawing of the hub at left (or better, a good one in a manual) you'll see a resemblance between the rear hub and the front one. Both have tapered bearings and a means of adjusting the distance between them until they are just snug against the bearing cones (commonly called races). But since the front has a much simpler job to do it turns on the stub axle wheras the axle turns the rear hub. What I'm leading up to is this - since you regularly grease (pack is the common term) and adjust the front bearings why shouldn't you pack and adjust the rear? The truth is you should. However, on the TR 6 rear axle that would be a job requiring special disassembly tools which are no longer available and professional mechanic level skills.

The first part of this project, modifying the hub so it can be greased is easy and can be done on the car with the brake drum removed. It helps to remove the axle assembly from the car or the brake shoes. If you have uncertainties about that, work around them. We are simply going to drill a hole in the bearing housing where shown in the sketch on an angle (about 45 degrees) that will take the hole into the cavity between the bearings and then install a grease fitting. It is best to drill this hole from the side or bottom to prevent cuttings from getting inside. Drill slowly, stop often, and put grease on the end of the drill each time to carry away the cuttings. The latter is especially true when breaking through into the cavity. If you hit the bearing race, drill another hole. I know this sounds Mickey Mouse, but if you take your time it will work just fine. The initial hole should be with a 1/8" drill. Follow with a 15/64" or 7/32" to a depth of 1/4" to no more than 3/8". Then tap that hole with a 1/4" x 28 fine thread tap. You may only get a turn or two on the tap before it hits bottom. That's OK. Follow with a 1/4" x 28 bottoming tap. Bottoming taps have full threads all the way to the end as opposed to the starting threads of a regular tap. This will give you sufficient threads in the hole to hold the new fitting. A few shots of spray carb cleaner will clean any fine cuttings out the hole.

Because it is necessary to drill at the intersection of the housing and the flange, we need a long grease fitting. All those available at most auto parts stores are too short for the threads to reach the hole. The original fittings for early TR 6 universal joints were about 1" long and are just perfect. However, they are no longer available. I have found fittings like this at a local truck parts supply which are made by Imperial-Eastman. Try that approach first. The next alternative is to use a short piece of tubing threaded inside for the grease fitting on one end and outside on the other end to go in the threaded hole in the hub - a sort of extension. With this you should remove the extension and plug the hole with a 1/4" bolt after greasing. The last alternative is a grease injector needle. This is literally a grease fitting adapted to a large hypodermic needle. Just put the needle in the hole in the hub and pump away on your grease gun. The grease injection needle is made by Plews Division of Parker Automotive, Eden Prarie, MN 55344, part 05-037 and cost $3.50 at my local auto parts store. As above, plug the hole with a 1/4" bolt after. Lastly, the grease. Don't completely fill the hub. Grease is an insulator of sorts and too much causes drag on bearings. About 20 to 25 pumps should do and about thereafter when servicing at about 25,000 miles.

Now for the adjustment. First, test for play in the bearings by installing the axle assembly on the rear suspension if you have removed it for the above job but do not bolt up the inner end. Grasp the wheel at the top and the bottom and firmly try to wiggle it by pushing with one hand and pulling with the other. If there is any play you'll feel it. Remove the assembly from the car. If you try to turn the stoneguard it may or may not turn but turning is one sign of loseness. If it does not turn make sure it is not bent against the hub or otherwise hung up because turning this guard is one of the ways to tell if your adjustment is right. Bend back the tabs on the nut and locknut and loosen the locknut. Let me digress here long enough to suggest two ways of turning these thin nuts. One is to cut a set of wrench from steel plate as shown in a following article. The other, the Fred Flintstone method, is to pound on the corners at an angle with a dull chisel and hammer - driving the nut. You can now either just tighten down on the nut while turning the hub until you have about 10 foot pounds of torque on the nut, back off until it is free of torque, then tighten until just snug - or; you can tighten a little while turning the hub, check for spin on the stoneguard, and repeat until the stoneguard doesn't turn anymore. Tighten the locknut but don't bend the tabs over. Install the axle assembly with only the hub end bolted up. Install the wheel and again check for wobble. If you have any, remove the assembly and tighten the nut and locknut one flat (1/6) turn at a time and again check for wobble until the wobble is gone. You should check that the hub turns with just a little effort each time. If the hub begins to get tight and you still have wobble in the wheel it means the bearing spacer has been badly grooved by the bearing and is tight against the bearing race. This, in turn, means rebuild time.

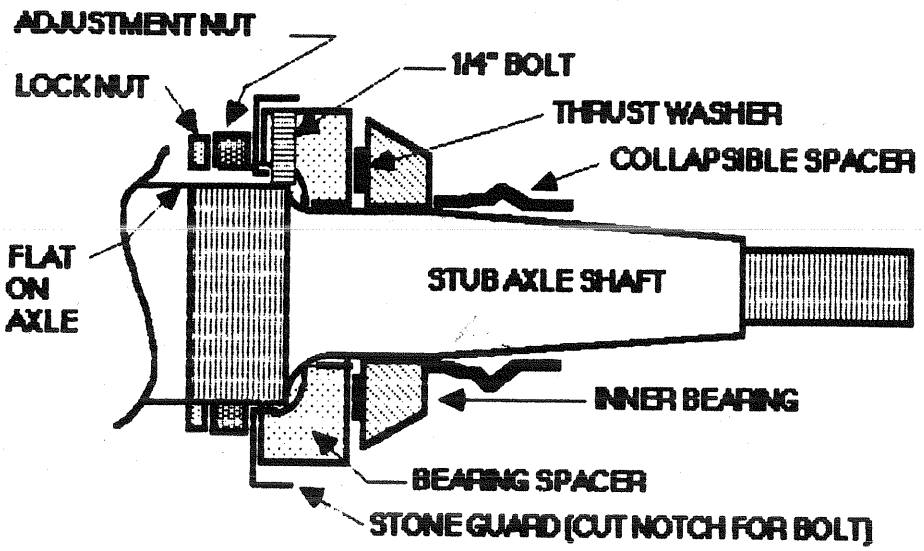
MODIFYING THE REAR HUB WHEN REBUILDING

Skill Level B

I recently had to go back into a couple of hubs I had rebuilt between 5 and 8 years ago (an acceptable service for a rebuild). They showed signs of a problem nearly every hub I've ever disassembled had. Almost all had a deep groove in the bearing spacer, indicating that the spacer was being held by the seal and turning with the hub. This makes it turn against the inner cone of the bearing. Since it is soft and the bearing race is hard it wears away leaving the bearing free to move. It is supposed to stay on the axles, being held tight by the bearing which is, in turn, held tight by the collapsed spacer between the bearings. As to whether it moves because the bearings wear or because there is .002 " of end play to begin with doesn't really matter. The challenge, then, is to make the spacer stay put. Two methods are given below. Frankly they are untried but I feel they have to make an improvement.

They can be used together or alone. I used both and, hopefully, in about 10 years I can tell you they help.

The first and simplest thing is to put a Torrington TRA 1628 race for a



radial thrust bearing between the spacer and the bearing cone. This is a hardened chrome steel washer that is machined to exactly .030" thickness. Do not use a plain washer or an .060" race. Plain washers will wear away as fast as the spacer and the .060" race may move the hub out so far that the spacer is not inside the seal. The theory here is that the hard bearing race and the hard thrust washer can't wear each other out if there is even the tightest amount of grease present. There is also a much larger surface against the spacer and this spreads the pressure over a much larger area than if the narrow face of the wheel bearing cone were against the spacer.

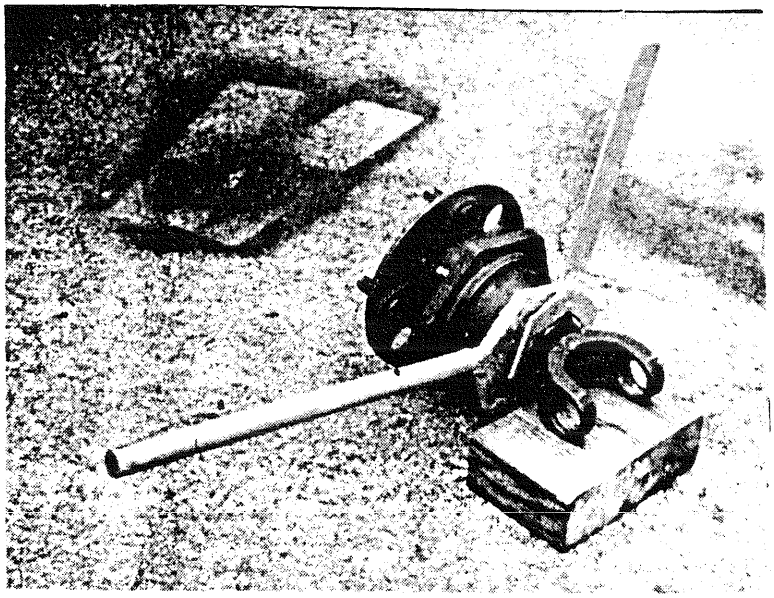
The second method is to physically prevent the spacer from turning by placing a bolt through it that sets firmly on the flat on the stub axle. Because the spacer is relatively narrow, has only a narrow portion of it over the axle flat, and also has a narrow area near the edge to contact the seal, this bolt must be carefully placed. It should be 1/16" or less from the outer edge of the spacer. The bolt should be a grade 5 1/4" x28 N.F.. Place the adjusting nut on the axle, place the spacer on the axle, then turn the adjuster until the spacer is roughly in its normal position. You should be able to see a shiny band on the axle where the spacer has been turning and this is where it should be when you position the bolt. Put Lock-tite on the threads of the bolt and the hole. Hold the spacer firmly against the nut. Tighten the bolt snugly with your fingers then about 1/2 a flat or less with a wrench to ensure it doesn't spin. Let set overnight. Try turning the spacer. If it moves

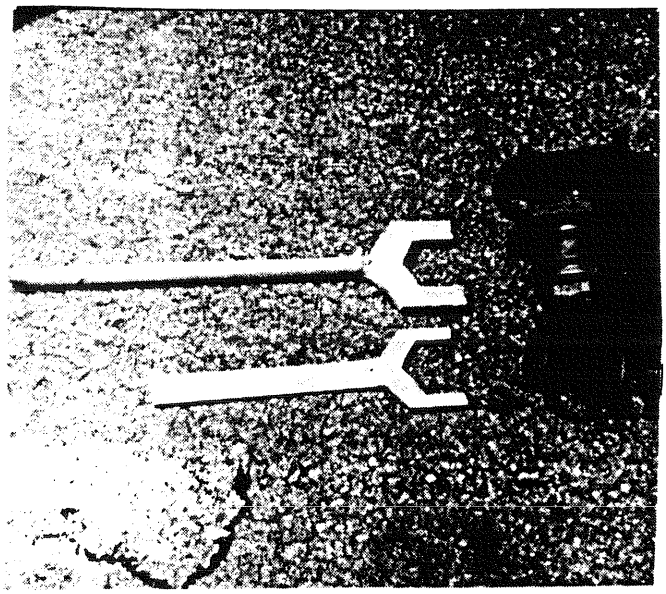
either way, redo the bolt. If the bolt is properly positioned carefully cut it off and file to the curve of the spacer. Actually this is not as critical as it sounds because the bolt should be clear of the seal. Be careful you don't file the surface the seal rides on.

Reassemble and adjust the hub. A little Loctite between the spacer and axle and between the wheel bearing cones and axle is also good insurance against spinning.

REAR HUB BEARING ADJUSTMENT WRENCHES

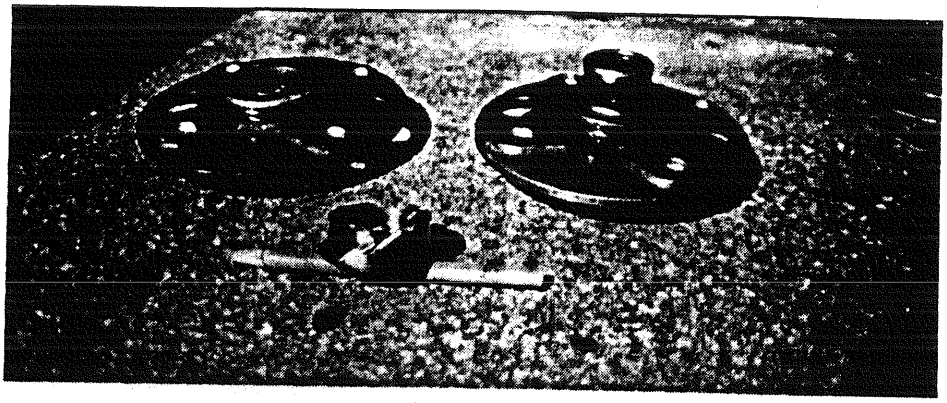
The wrenches shown will aid considerably in adjusting hub bearings, especially when setting end play on a rebuilt hub. Incidentally, it is a lot easier to set the required .002" if the hub is free of the axle assembly as shown here. The thickness of the adjustment nut wrench and the lock nut wrench are dictated by the thickness of the respective nuts. The adjusment wrench should be 3/8" thick and about 3/4" wide on each side. The handle is 5/8" rod 12" long. Weld securely. The lock nut wrench is 1/8" stock 5/8" wide on the sides with an 8" handle.





REAR HUB FLANGE REMOVAL FORCE

Any time someone tells you they can remove a hub flange without a special tool show them the photo on the next page. The force required to remove the flange at left pulled it apart at the base of the bearing. Think about that! The race in front was removed by cutting diagonally very carefully with an air drive cut-off tool and then spread with a chisel.



A JIG TO HOLD THE HUB ASSEMBLY FOR END FLOAT ADJUSTMENT

The tool shown here is relatively easy and cheap to build. You will find it makes the adjustment of the .002" end float much easier. The dial indicator is magnetic but one could be clamped on. The indicator and magnetic holder are about $15 each from places like Harbor Freight. Drill the holes in the uprights first, then cut out the radii to clear the bearing housing, then cut the inner faces of the angle to allow the bearing housing to slide between the uprights. Don't just place the angles further apart. That puts all of the holes too close to the edge instead of just the top two. Bolt the uprights to a hub assembly to hold them while welding.

To adjust, simply bolt the bearing housing to the back side of the uprights. To move the hub forward use a lever between it and the upright. The bolt on the front of the base is used to pry against the hub with a tire iron or other tool to move it back. The dial indicator should be mounted to the upright so that the "plunger" is parallel to the axle to get a true reading. You can also use feeler gauges between the back face of the hub and the bearing housing by first prying back on the hub and checking the clearance with the feelers, then pry forward and see how much greater the distance. When finished, be sure you get the adjustment locknut very tight against the tab washer before you bend the tabs over.