ROCKER GEOMETRY

When the cylinder head is milled, the rocker geometry is changed unless the rocker assembly is shimmed, or the push rods shortened. When the valve is half open, the rocker arm and the valve stem center lines should be at 90 degrees, and the rocker radius should be directly in the center of the valve.

If the geometry is off you will have excess valve guide wear, and also a rounding off of the valve stem ends. It is possible you may even experience very fast wear on the end of the valve stems. A stopgap method of adjusting the geometry is to pack up the rocker pedestals — but this is not the best method.

In milling the cylinder head we have affected only one part of the cylinder head assembly, this being the push rod length. It is therefore necessary to shorten the push rods to the correct length, thus regaining the proper geometry as described above. As we have indicated, the competition push rods have sweated end pieces, and therefore shortening of these rods can easily be accomplished in a lathe.

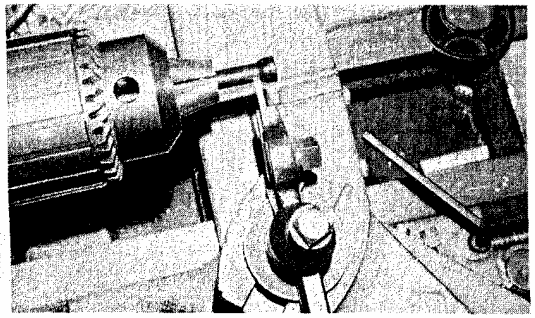


Figure 13

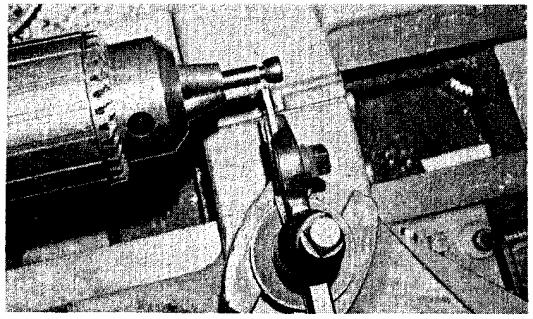


Figure 14

Note Figures 13 and 14 which show the lathe set up for this process. The parting tool involved is ground to the width that you wish to remove. The material is turned from the end of the rod right up next to the cup end. The cup end can now be driven back down into the push rod for a good tight fit. Occasionally, it is necessary to apply a LITTLE heat on the end of the tube, to drive the cup end back into position. DO NOT USE EXCESSIVE HEAT or you might well remove the temper from the cup end piece.

As a general rule it is best to shorten the push rods approximately three-quarters of the amount that was milled from the cylinder head face, then adjust each push rod for the correct length for the particular valve.

It is done in this manner of 'a bit at a time' because you cannot put metal back onto the push rod.

Rocker geometry that is 'way off' can usually be determined by a clicking of the tappets even though the adjustment checks out okay. If this occurs in YOUR engine, fix it. Don't let this condition exist. You will lose power and wear out things needlessly.

CAM FOLLOWERS

The standard cam followers can be fitted as furnished with a slight amount of work. Smooth off the sharp edge of the cam follower at its base with 240 wet or dry sandpaper. Polish the cam followers all over. It is possible to lighten the cam followers approximately 15 per cent, but this work must be done in a lathe. To lighten, remove .375″ from the top end of each follower in a lathe with a parting tool. Radius the edges. Further lightening can be accomplished by boring the internal diameter an additional .050″. Further boring can be done, but this will make the shell rather fragile, without giving much benefit.

Your author has been using cam followers as described for a number of years, and has never experienced any trouble with the units due to lightening.

When building up your engine or replacing the camshaft, remember to replace the old followers with new ones. DO NOT drill holes in the sides of the followers.

Drain holes were attempted in the bottom of the follower . . . but a rash of broken followers — the foot breaking off, etc. — and the idea was speedily dropped.

Replace any follower that shows even a slight pit.

CAMSHAFTS

A tremendous amount of effort has gone into providing Triumph owners with the very best in performance camshafts. Testing has gone on constantly for three years with other grinds, grinds from speed shops . . . and the special 'hot' ones from the big advertisers of this type of equipment.

Nothing tested had the outright power and reliability of the units furnished by Triumph.

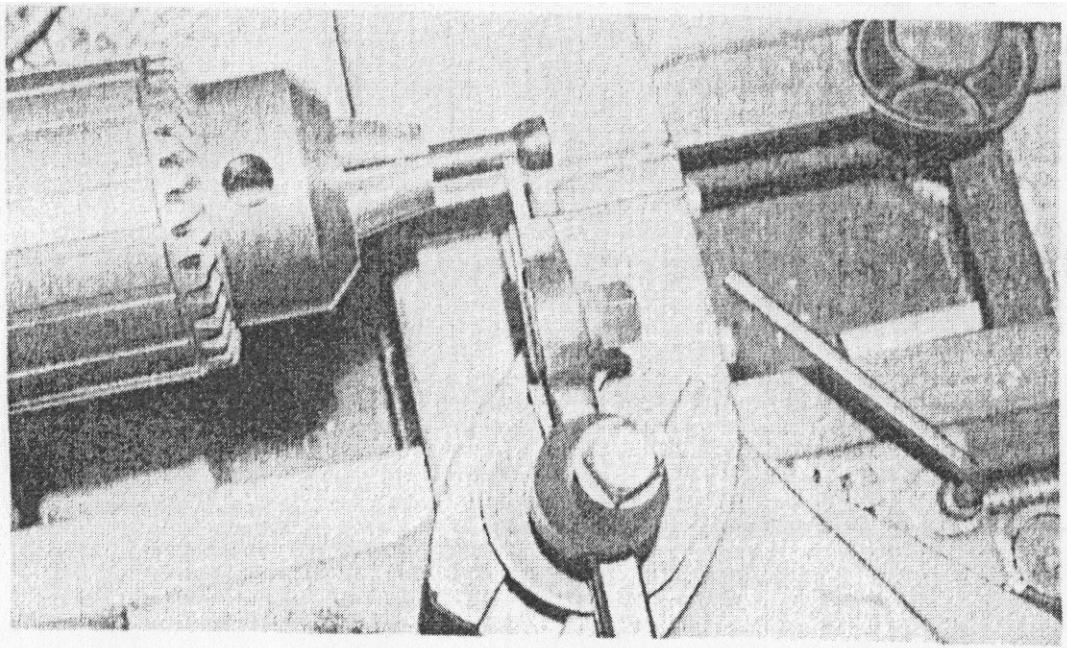
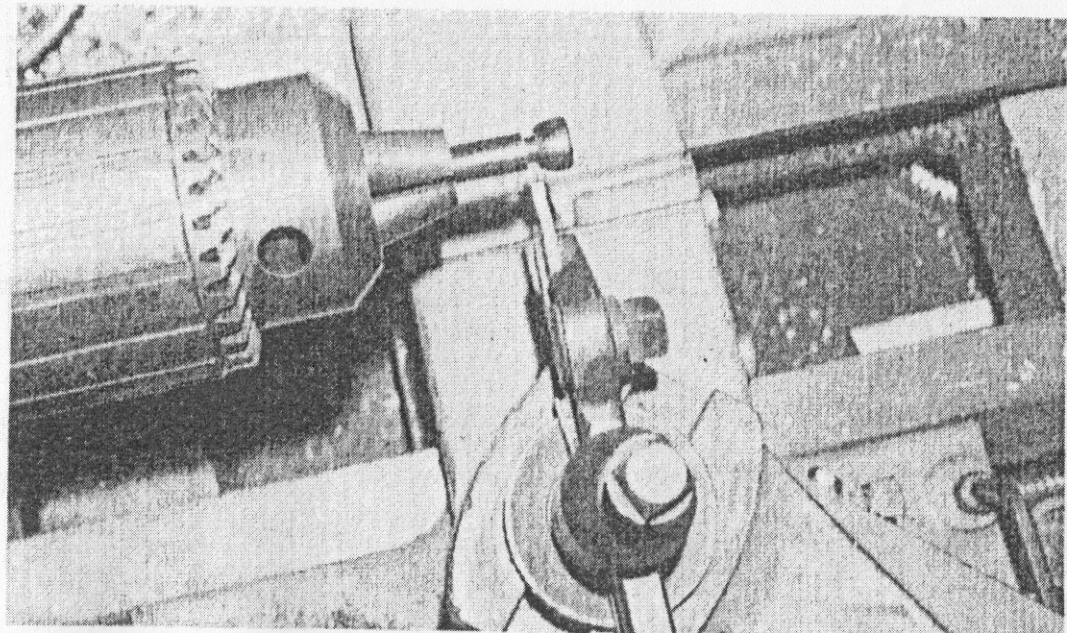


Figure 13



In the beginning, the Competition Department offered the "C" camshaft as a mild street/race unit. With the widespread availability of better gasoline, this camshaft has been dropped as it is now possible for higher compression ratios to be used and thus more camshaft timing and lift.

The "D" camshaft is now suggested for street/race use, but there must be an increase in the compression ratio. The minimum compression ratio is 10.0 to 1. Without this increase in compression, the r.p.m. range below 3500 will be very sluggish. The power range on the "D" camshaft is between 3500 r.p.m. and 5500 r.p.m. The timing of the "D" camshaft is as follows:

Inlet opens 33° BTDC — Inlet closes 71° ABDC

Exhaust opens 71° BBDC — Exhaust closes 33° ATDC

Duration is 284° — Total lift at the valve is .393

When using a degree wheel, the checking clearance is .010 at the camshaft.

The rocker arm adjustment is .014 hot.

The next step in camshafts is the "F." This is a full racing type camshaft and is not recommended for street use. The power range is from 4000 to 6000 r.p.m. The minimum compression is 11.7 to 1. The timing and other specifics of the "F" camshaft are as follows:

Inlet opens 39° BTDC — Inlet closes 81° ABDC

Exhaust opens 81° BBDC — Exhaust closes 39° ATDC

Duration is 300° — Total lift at the valve is .432

When using a degree wheel, the checking clearance is .010 at the camshaft.

The rocker arm adjustment is .014 hot.

The latest camshaft for the TR-3, 4, 4A is the G-3. This camshaft is quite radical with a high lift and fast opening rates. The power range is 4200 to 6500 r.p.m. The minimum compression is 11.7 to 1. This camshaft is also strictly for racing purposes. The timing and specifications are as follows:

Inlet opens 51° BTDC — Inlet closes 79° ABDC

Exhaust opens 79° BBDC — Exhaust closes 51° ATDC

Duration is 309° — Total lift at the valve is .499

When using a degree wheel, the checking clearance is .011 at the camshaft.

The rocker arm adjustment is .016 hot.

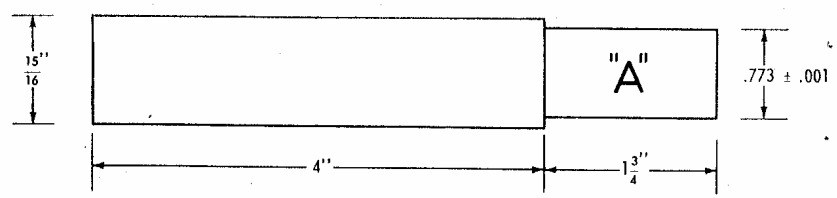
All of the camshafts furnished by Triumph through its Dealer organization have been carefully checked for truth and accuracy according to the timing diagram supplied with each unit. There are copies of these camshafts being made. But you cannot replace the original article with a copy. BEWARE OF IMITATIONS. (See carburetor section for needle recommendations).

Now, each Triumph camshaft furnished as an option for the TR-3, TR-4 or SPITFIRE is ground with the latest type, new equipment. However, the cam will only do the job if you follow the instructions. Be sure to install new cam followers. Install a new timing chain and tensioner if there is the slightest doubt as to its ability to do an accurate job.

The camshaft timing diagram is included with each camshaft, and is a straightforward information sheet with but one exception . . . YOU MUST DO YOUR DEGREEING FROM THE CAMSHAFT — NOT FROM THE VALVE. The cam cannot make allowances for improper rocker geometry, mis-ratioed rocker arms, flexing in push rods, etc., etc. The only accurate method is from the camshaft itself.

It must be pointed out that improper rocker geometry will alter the camshaft lift timing, wherein a different lift ratio is applied at some other than the specified degrees of crankshaft rotation. Everything must work together. The difference between a horse and a goat is more than a pair of horns. . . .

Figure 15 is a drawing for making up a dummy push rod which is used in degreeing the camshaft.



DUMMY PUSHROD

FIGURE 15

MATERIAL — STEEL
APPLICATION — TR-4

AREA "A" TO FIT INSIDE BORE OF CAM FOLLOWER

R. W. KASTNER 8/18/64

One last piece of advice . . . coat the camshaft all over with a good lubricant such as Lubriplate or S.T.P. before installation. The most critical period for wear on a new cam is the first few minutes of running.

Adjust the rocker clearance hot in the following manner:

Adjust number 8 when number 1 is full open
Adjust number 7 when number 2 is full open
Adjust number 6 when number 3 is full open
Adjust number 5 when number 4 is full open
Adjust number 4 when number 5 is full open
Adjust number 3 when number 6 is full open
Adjust number 2 when number 7 is full open
Adjust number 1 when number 8 is full open

CARBURETORS

The S.U. and the new Stromberg carburetors are very similar in design, except that the latter uses a more easily adjustable jet screw, and instead of a machine fit on the piston and dashpot, utilizes a diaphragm arrangement. The diaphragm gives a more accurate air depression and raising of the piston than the S.U., but some trouble will be experienced in procuring different needle shapes. We will deal first with the needles.

The simplest method is to make up a small .006″ shim tube that will slip over the S.U. needle shank. As the difference in diameter between S.U. and Stromberg needles is .013″, there will only be .0005″ difference, which will not hinder the fitting to the Stromberg piston.

Wrap a small piece of .006″ brass shim stock around the shank or fitted end of an S.U. needle; remove the formed tube of shim stock, and cut it in half down the length of the tube. Now fit the S.U. needle to the Stromberg piston, and slide the half-tube of shim stock in next to the needle shank opposite the piston set screw. This will force the needle up tight on the shim stock when the set screw is tightened, and center the smaller needle shank. There is not a definite needle correlation between S.U. and Stromberg carburetors, because of the more accurate lift of the latter's piston. But the method described will put you close to the correct mixture the first time without making up special needles.

Make certain that the top bearing of the jet in the Stromberg carburetor does not stand proud of the carburetor body. This can be adjusted with small shim washers under the jet bearing head. Should you experience a lack of fuel in the float chamber, increase the needle and seat size to .225″ diameter, the stock size being .175″.

Other than thinning the throttle shafts and throttle butterflies, there is not much else that needs to be done in the carburetor area. If you have thinned out the throttle shafts, be certain that you solder the butterfly retaining screws into position.

The S.U. carburetors use a small coil spring to hold the jet head up in its correct position. These springs have a tendency to become brittle when exposed for some length of time to the additional heat from the optional exhaust system.

Replace these springs with old fashioned soft shop wire. You will normally have the adjusting nut turned down approximately 14 flats. Set the adjusting nuts down 12 flats, then replace the springs with the wire and tighten the wire up by twisting the ends. After the wire is tight, turn down the additional two flats of the adjusting nuts, and you'll have a fitting that is very tight and will not lose its adjustment. It is best to have two loops of the wire — not just one.

The following are S.U. needle recommendations for the various Triumph racing camshafts:

	Lean	*Standard*	*Rich*
'C' CAMSHAFT	S.M.	R.H.	R.G.
'D' CAMSHAFT	R.H.	R.G.	R.F.
'F' CAMSHAFT	R.G.	R.A.	R.B.
G-3 CAMSHAFT	R.G.	R.F.	R.B.

DISTRIBUTOR

The original factory distributor has been used in all of the modifications detailed in this book. The Triumph Competition Department has attempted to tie together a basic engine that does not require the purchase of several expensive pieces. The distributor is a good example.

True, there are possibilities in different advance curves, but as the average owner interested in racing HIS Triumph does not have the type of equipment at hand to work with, your author has also foregone his equipment so that you might duplicate the results achieved, without adding too much to the racing budget. The standard static ignition timing of 10 degrees is a good starting point, and you will not finish more than just a couple of degrees one way or the other from this. Quality of fuel and compression ratio dictate the timing that can be carried without detonation. Tests must be made with each individual engine as no two are exactly alike. One of the best methods is to power time on a chassis dyno in 3rd gear at approximately 5000 rpm. Remove the distributor cam and lube the weights of the mechanical advance mechanism. Check to see that the springs operate satisfactorily, re-install the cam and tighten up well. Lube the cam shaft with Lubriplate or other lubricant designed for this purpose. Install new points and condenser. Make certain that the point plate does not wobble. Should this occur, changes are made at the same time with the ignition timing and erratic running or power loss may be experienced.

Do not start a race with a new set of points. The rubbing block which bears on the distributor cam wears quite rapidly for the first hundred or so miles, and in wearing allows the points to close up, thus retarding the timing. Check out the distributor cap carefully for cracks or wear on the contacts due to mis-aligned rotors, then button up the assembly.

It is extremely important that you check out your distributor to find the total advance. This can be best accomplished by checking in a distributor machine. It is worth the cost of a few dollars. Knowing the amount of distributor advance can easily save you from over-advancing the engine and thus blowing up the complete works.

When speaking of total advance, we are speaking of that advance provided through the mechanical advance mechanism and also that advance as installed static at the crankshaft.

When the compression is raised to 10.2, the maximum total advance should be 30 degrees. When the compression is raised to 10.2 to 11.2, the total advance should not exceed 28 degrees. When the compression is raised above 11.2, the total advance should not exceed 26 degrees.

For those wishing to make a slight improvement in power with a full racing engine, a slight improvement can be made with an advance curve that gives a total of 26 degrees at 4000 r.p.m. and increases one degree for each additional 500 r.p.m. up to 6500 r.p.m.

IGNITION WIRING

Replace the standard ignition wiring with a full metal thread type wire. Make certain there are no radio supressors in the high tension lines. Check the spark plug connectors to see that they are tight, yet will rotate on the spark plug. If the connectors are too tight, they will loosen the threaded end of the spark plug, and the entire end and connector could fall off at a very embarrassing moment. Keep the wiring clean.

THROTTLE LINKAGE

The standard linkage as fitted is a good reliable system that given just a little upkeep and care, will last indefinitely. Inspect the ball joints so that they are kept from becoming too loose, possibly allowing the link to drop off. (Again, an embarrassing moment!)

There is an adjustment on the end of each link that will allow you to tighten up the ball end, after a certain length of time has passed and wear of the ball set in. Carefully test the linkage before deciding that it's okay for racing. If the ball end is too tight, sticking occurs and usually you cannot get full throttle.

When you are quite certain that everything is as tight as possible, with complete freedom of the system, peen or punch mark the ends of each link.

Remove the linkage at least three times a year, and disassemble completely. Check the small springs in the end of each link carefully. If they fail, so does the entire system. These springs keep tension on the ball end.

OTHER ENGINE PARTS

Drill the heads of the bolts that hold the generator mounting plate to the cylinder block. These bolts are run straight through the block wall, and the loss of one can produce a fantastic oil leak which is very difficult to repair in a hurry around the hot exhaust headers. Safety wire these bolts. Drill the front, bottom generator bolt and safety wire this bolt after installing the generator.

Drill and safety wire the camshaft bearing bolts on the left side of the block. Drill and safety wire the oil gallery bolts on the same side.

Wrap all of the water hoses with plastic ignition tape. This will prevent scuffing and damage from spillage of lubricants, gasoline, etc. Remove the thermostat and open the bellows to the full-open point. Break the bellows so that the flap cannot close. Re-install the thermostat. This will slow the warm-up of the engine and is not suggested for street use.

Racing engines must be at the correct temperature and keeping the thermostat in position, though broken at the full open point, guarantees the amount of restriction in the water system. You must have a restriction in the system or the water pump will force the coolant through the radiator too fast for proper cooling to take place, and the engine can overheat very quickly.

Do not use a new fan belt, and do not have the belt adjusted too tight. This can cost you a race as easily as running out of gasoline. Fan belts tend to stretch a good deal during the first hundred or so miles. Bargain with a friend for a good used belt, or fit a new belt for practice, then re-adjust it. If the belt is too tight this will literally eat up horsepower, and possibly ruin the belt with consequent overheating . . . and 'bang'.

FUEL PUMP

Install the optional electric fuel pump — Part #V010. This is best mounted in the trunk compartment, or on the vertical panel just to the rear of the driver's seat. In either of these locations only short lengths of hose will be needed. Also the pump will be exposed to unheated air, thus retarding the possibility of vapor lock or pre-heating of the fuel.

The standard mechanical pump is quite adequate for racing, but is objected to primarily because of its location on the engine where the fuel is heated just before going to the carburetors.

Fuel temperature is very important. Locate your lines so that there will be a minimum of heat exchanged.

The mechanical pump utilizes a small neoprene seal to retain oil in the pump body. Should this seal wear excessively oil will seep by and be forced out the pump breather hole. You can lose an enormous amount of oil in a very short length of time from this failure. So, invest in the optional pump and get the safety and advantages of cooler fuel supply.

When installing the electric fuel pump remove the old mechanical type, and make up a plate of steel or aluminum to fit the opening where the mechanical pump was bolted to the engine block.

SPARK PLUGS

The Triumph Competition Department has been using the Champion spark plugs exclusively for the past two years as these units have shown themselves to be the most reliable and able to produce clean firing under the most adverse conditions.

If your engine has a compression of approximately 10 to 1, it is recommended that the L66Y plug gapped at .022 be fitted. This is a racing type plug, but can be used quite successfully with street/race engines. Although the heat range is considerably cooler than a normal street plug, this plug will give all the benefits of a hot plug, but will not burn up under high pressure use in a modified engine.

For the full racing engine, there is a choice of two plugs. The particular choice is made on the weather and engine configuration. Generally with a full out engine using a compression ratio in excess of 11.7, the best plug will generally be the L61Y. This is the coldest recommended and the coldest we have found necessary.

If the weather is quite cool, or you are running-in the engine, or if the engine is oiling up slightly, the slightly warmer plug, L64Y, should be fitted. This type plug normally does not turn the chocolate color (except in street use) so often described in tuning manuals, but instead will have a slightly yellow or tan color. This color might not cover the entire ceramic as the projected nose does have a tendency to be washed by the incoming charge.

If you are getting little black specks on the ceramic, this is generally an indication that you have all the ignition timing that you can stand and that you are getting a slight amount of detonation. If you find tiny silver colored balls on the ceramic, this is the sign of heavy detonation and you should immediately retard the timing.

Be certain that you do not overtighten the spark plugs. They need only be tight enough to hold the plug in the cylinder head and make a good contact. This will amount to about 10 to 15 pounds torque. Do not throw away your plugs just because you have a race or two on them. These plugs will last quite a long time and should only need cleaning and refiling to make them as good as new.

TIRES

There sometimes seems to be some mysterious genie who establishes correct tire pressures. . . . I can only assume this when I see people driving a TR-4 asking other drivers, who are competing in a SPITFIRE. . . . "What are you running for tire pressure?" Silly . . .? You bet it is!

With the TR-3, 4 and the beam axle TR-4A the following pressures are recommended as a starting point: front 42 pounds, rear 39 pounds. With the I.R.S. TR-4A it is recommended: front 28 pounds, rear 30 pounds. This recommendation is made considering that you are fitting any of the normal racing type tires in the 900 to 950 range. In the Competition Department we have been using the 920 Indy Firestone racing tires and have found them to give exceptionally good results.

If the front end does not respond as it should — it understeers — then INCREASE the front tire pressure by about 3 lbs. This additional pressure will tend to stop the tire from rolling; you will have a larger patch of tire in contact with the track with the obvious benefits.

If the back end comes out too fast and you seem to be broadsliding every turn instead of driving through, increase the rear pressure by about 3 lbs. and increase the front 1 or 2 lbs. The increase in the rear pressure will stop the oversteer, but will make the additional pressure in the front necessary to counteract any understeer that may develop.

Increases of 3 lb. increments will make fantastic differences in the handling of your TR. They should not be made hit or miss. Sure . . . the car feels better with low pressures . . . but that's because you aren't going fast enough.

You gain in speed through the corners, and feel just as comfortable if the tires are STICKING. Remember: the only thing that keeps the car on the road is a little tire patch approximately 5″ long and 7″ wide. When you use low pressure you are allowing the tire to roll, and you loose part of this patch. When this happens, you lose traction and off you go into the weeds.

Another point. Racing tires will build up excessive heat if under-inflated.

Check with your racing tire distributor — he has the answers. Be right . . . instead of asking silly questions.

The standard steel disc wheel and the wire wheel are fine for street or minor competition use, but when fitted with the wide, soft racing tires the tire bite can cause a lot of flexing in the wheel which will not only limit the length of time the tire can stick, but the life of the wheel as well.

It is recommended that the alloy racing wheels be fitted for racing purposes. These wheels are made of high grade material and as they are turned on a lathe, the rim periphery is very smooth and accurate. These wheels are available in rim widths varying from 5 to 6 inches. Use the maximum width allowed for you car under racing regulations. The wider the wheel the better the chance you have of keeping a larger portion of the tread in contact with the road and, therefore, a better bite and handling.

The alloy wheels are approximately 7 pounds lighter than a wire wheel and extension and are approximately 3 pounds lighter than the standard steel disc wheel. Obviously any decrease in the unsprung weight is going to be an advantage in road handling.

Torque the wheel nuts to 55 ft./lbs.

ANTI-SWAY BAR

The standard factory fitting — Part #510584 — is recommended for both street and racing use. It will assist in keeping the rear wheel in contact with the road, and will induce understeer. The larger the bar diameter, the quicker the bite coming out of a corner . . . and the more understeer.

As fitting the No-Spin Differential Unit — Part #V011 — will also increase understeer, it will pay you to test different settings on the shock absorbers, and with or without the anti-sway bar to arrive at perfect cornering power.

I have been using a bar of 11/16″ diameter on my test car, and found that the cornering power was greatly increased.

The bar is a real necessity on high-speed tracks. You can use a general rule that the faster the track, the more understeer, this being applied by increasing shock settings and installing a larger diameter sway bar.

In most racing applications it will be necessary to change the front wheel camber to ½ to 1 degree NEGATIVE camber. This job is best left to competent front-end man who will be familiar with the technique.

Be certain to set the toe-in to 1/16″ to zero after the camber is adjusted.

One last note — the normal fittings and rubber pieces from the standard-size sway bar can easily be modified to accept a larger diameter bar.

TORQUE RODS

The rear axle torque rods are an absolute MUST for a competition machine. This special torque rod will very much limit the spring wind up and as a result give superior acceleration from a standing start. The rods will come into effect while cornering, and by limiting the spring wind up, will at the same time stop any tendency for rear axle steering. You will also find that braking, and reduction of the nose dive on hard straight-line braking, will be greatly improved. The torque rods are bolted up under the rear spring "U" bolt plate. With the rod in the direct middle of the spring line, arc-weld the forward end to the chassis frame. The rubber grommets in the torque rods are pre-set and should not be tightened further. Overtightening will in some cases produce wheel hop and also a loud squeak on cornering.

NON-SLIP DIFFERENTIAL AND REAR AXLE RATIOS

We have found that the 4.55 axle ratio is the best for good acceleration, and when mated with the overdrive allows the use of this ratio on any track. For the most part, your competitors find it necessary to gear for the longest straight, and by doing so, reduce their acceleration out of each corner. We still have the good short course acceleration, yet always have top overdrive to fall back on. When the car is without overdrive, and straightaway speeds do not exceed 110 mph, I suggest the 4.3 ratio. When installing the rear end limited slip unit be certain that you install the axle spacer button. The end float of the rear axles must be set and this cannot be done without the spacer. Due to the additional heat and force that is applied to the ring and pinion, I recommend that you use General Motors Positraction rear axle lube.

STREET TUNING THE TR-4

Although the majority of the optional equipment we have mentioned, which is available ONLY from your local Triumph Dealer, has been specially designed for racing purposes, there are some items that can be put to good use in building a 'hot' street car.

Before starting to modify your Triumph remember . . . it is very difficult to return a modified part back to its original configuration. Therefore, the outlay of money to return the car to stock condition will doubtless cost more than your investment to 'hop it up'.

Be sure in your own mind that you are prepared to tolerate some of the disadvantages of a 'hot' motor car BEFORE you go on a modification campaign.

The easiest way to more power — and the cheapest — is through compression. The Triumph engine will take up to 10.2 to 1 compression without any increase in measurable wear. Consequently this is the ratio, we'll work with.

Remove the cylinder head, strip out the valves and springs. With aid from a competent automotive machine shop, mill .090″ from the cylinder head face. After milling, wash out the entire cylinder head very carefully, INCLUDING the water jackets. Shavings from the milling operation will sometimes clog up the water passages and cause overheating.

Smooth off the sharp corners on the combustion chambers — be certain to blend in the sharp edge that will be around the intake valve. Grind the valves in the normal manner, and re-install with a new set of standard or the optional valve springs.

We recommend fitting the 'D' camshaft. Install new cam followers. The camshaft will align very close to the original timing marks, and present no problem in maintaining the correct camshaft timing. Lube the cam generously with Sta-Lube or Lubriplate grease.

Check the distributor end float for the proper clearance (TR-4 Workshop Manual specification).

Polish out the intake manifold and intake passages of the cylinder head. Although this work will not give a great power increase at the lower rpm used in street driving, the job is well worth doing, and provides the satisfaction of doing a complete and proper job. You will find that with the optional camshaft fitted, more fuel will need to be available. So install a pair of R.H. needles in the S.U. carburetors.

The modifications so far detailed will give you approximately 120 horsepower, with fine reliability.

Should you wish to carry out further modifications, install the optional exhaust header system. This unit will increase the power by approximately 6 horsepower, which will be utilized all through the power range as it will allow the camshaft to operate more efficiently.

You may find it necessary to adjust the carburetors after the header installation by two flats or so on the rich side.

The next step, particularly if your Triumph is fitted with overdrive, is to fit an optional gear ratio.

I would suggest the 4.3 with overdrive, and 4.1 with standard transmission. The increase in acceleration will be very noticeable. Now that things are working well in the power department, some thought should be given to improving the handling.

For those a little short of ready cash, the first installation should be the anti-sway bar. Next the competition springs, then the Koni shocks.

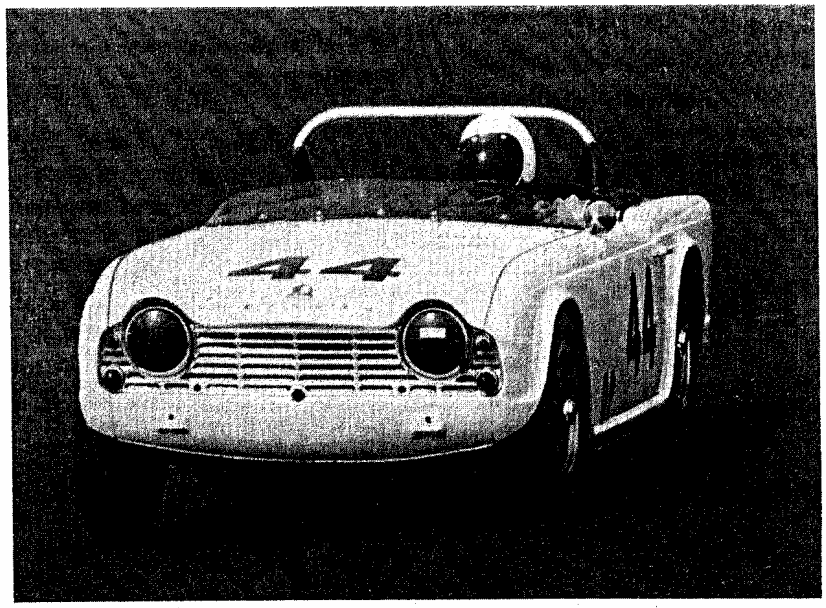
If money is not a problem by all means install the No-Spin Differential assembly. The torque rods are real frosting on the cake, and will definitely help in the autocross, gymkhana and ¼-mile acceleration contests.

If you find yourself consistently using higher revs than normal, install the oil cooler. The oil cooler is particularly advised for those living in the more tropical or desert areas. The more muscle in the engine, the more heat will need to be transferred. Make certain that you keep the cooling system clean and in good condition. Do not remove the thermostat.

Keep track of things in general, and you will have a great time driving your Triumph.

As a potential or actual competitor with a Triumph, British Leyland Motors Inc. is keenly interested in your performances and progress. Feel free at any time to write to the company, detailing your successes. And should you require advice or assistance in any way, write to:

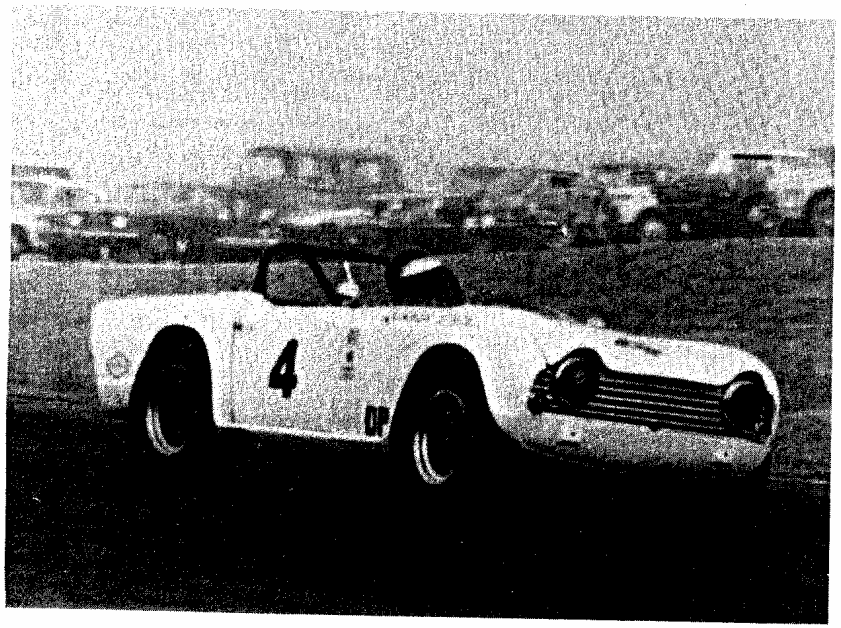
BRITISH LEYLAND MOTORS INC.
Competition Department
East of Mississippi — 600 Willow Tree Road, Leonia, N.J. 07605
West of Mississippi — P.O. Box 1557, Gardena, Calif. 90249



BOB TULLIUS IN HIS TR-4

In the preparation of this booklet every effort has been made to insure accuracy, and all of the suggested modifications have been tested in actual competition over a period of time. However, readers will appreciate that in any modification of a motor vehicle, and in automobile competition itself, certain risks are inevitably involved.

Only those who believe that they are mechanically competent to undertake the suggested procedures are advised to do so, as the Company cannot assume responsibility for damage or injury incurred as a result of following any of the procedures set forth in this booklet.



JOHN KELLY, 1968 D PRODUCTION CHAMPION

TR-4/4A

SCCA Class E Production National Champion.....1962

SCCA Class D Production National Champion.....1963

First, Second, Fourth in Class (GT 11) SEBRING 12-Hour Grand Prix of Endurance.....1963

SCCA Class D Production National Champion.....1964

American Road Race of Champions — D Production....1964

American Road Race of Champions — D Production....1965

American Road Race of Champions — D Production....1968

APPENDIX I

TR-4A COMPETITION PREPARATION

by R. W. Kastner

In addition to the IRS suspension there are several minor changes in the structure and small components of the TR-4A when compared to the standard TR-4.

FRONT SUSPENSION

The lower "A" frame on the TR-4A is connected to the chassis frame with an intermediary bracket. This additional bracket allows adjustment of the front suspension without bending of the components. Shims are added or taken out between the bracket face and the chassis point to adjust caster and camber. Equal amounts of shims behind each bracket adjust the camber while the shims to the rear only adjust the caster. It is recommended that the front camber be set to ½ to ¾ degrees *negative*. The caster to be set at 3-5 degrees *positive*. The toe-in set at zero.

The above setting should not be established until all other suspension parts have been replaced as necessary per the following instructions.

It is recommended that the standard front shock absorbers be replaced with the Koni shock part number V-443. These can be ordered through your local Triumph dealer. The Koni is adjustable when additional stiffness is called for and thus makes the installation of great value.

This particular shock has a rubber bumper in the dust cover which acts as the suspension stop. It is necessary to remove the rubber stop before making any adjustment. Do not fit any shock absorbers that do not have a bump stop incorporated. For initial set-up adjust the Koni shocks to 3 half turns. (This adjustment for *racing* only).

The front springs should be replaced with Triumph springs part number 201899. These springs are wound to the left and therefore easily distinguished from the normal spring unit. The latest production run of the TR-4A has a spacer over the top of the front spring which must be removed.

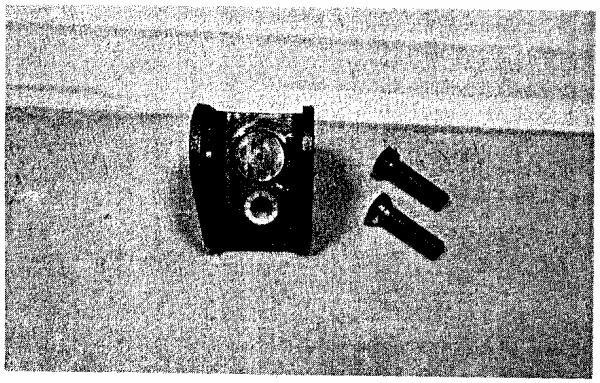


Figure 1.

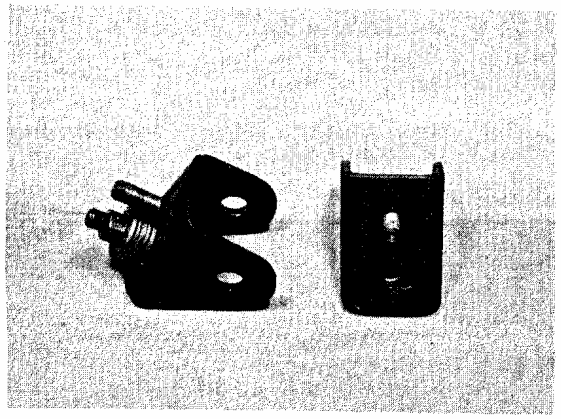


Figure 2.

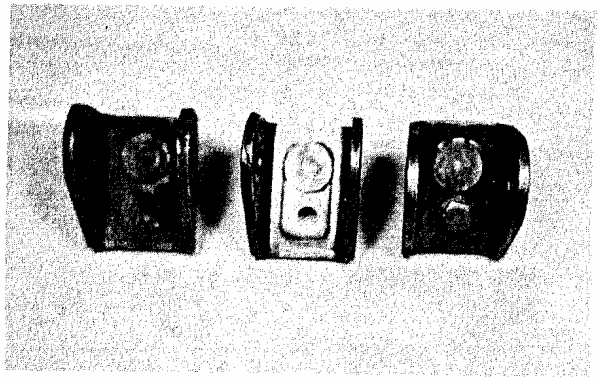


Figure 3.

Due to the fantastic increase in cornering power with the most modern tire designs it is highly recommended that the brackets which hold the lower "A" frame to the chassis be modified.

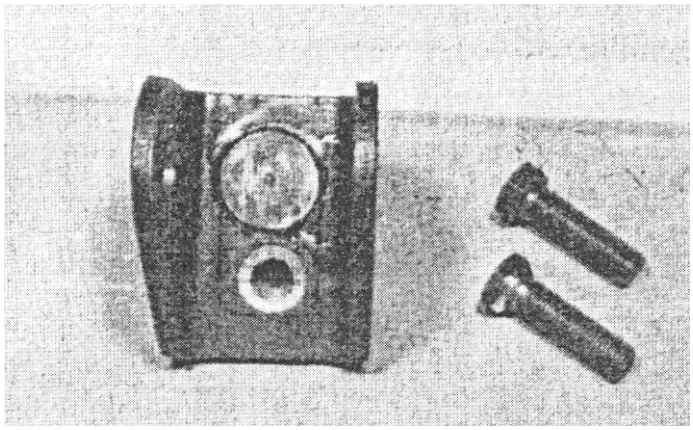
Study the photos as listed figures 1, 2, and 3. Figure one shows a bracket drilled and chamfered ready for the addition of the prescribed extra bolt. Drill a ⅜″ Dia. hole and chamfer as shown in figure 1 at 45 degrees with a counter sink tool. Tool the under-side of a ⅜″ x 1½″ S.A.E. bolt of good quality at the same angle. This tooling is best performed in a lathe. The under-side of the bolt head then should mate with the angle of the chamfer made on the bracket. The bottom bolt in figure 1 shows a bolt completed as described above.

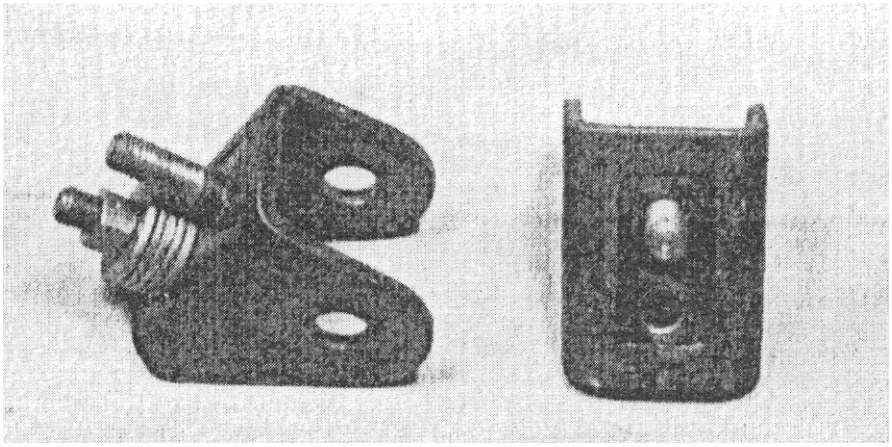
Slip the bolt into the bracket, slide over several washers on the back side, install a nut and tighten up. This configuration is shown in figure 2. Braze the bolt head to the bracket. Remove the nut and washers. Before installing the bracket make up a back up plate for the chassis frame of 3/32″ mild steel. Drill the plates and frame mount to accept the bracket bolts. Make up all four brackets in this manner and install with the bracket in the normal position then put the steel back up plate on the inner side of the frame. Use good quality bolts and nuts and apply "locktight" after the suspension has been adjusted. Figure 3 shows a standard bracket on the left, the drilled unit in the center, and the modified bracket on the right.

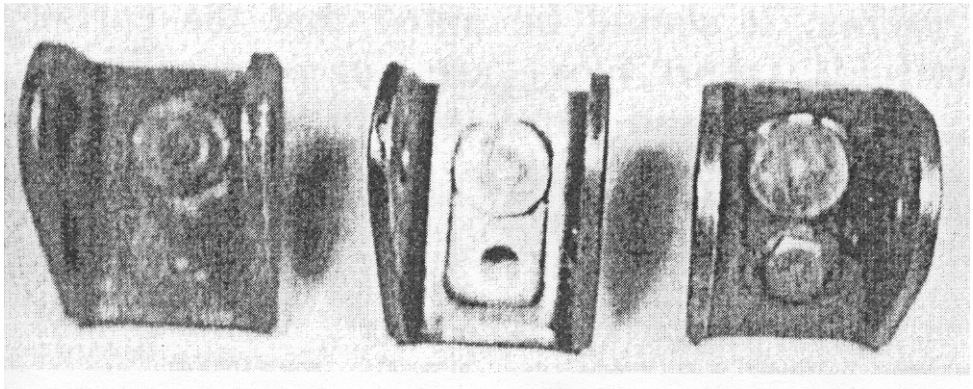
REAR SUSPENSION

It is recommended that the outer rear stub axle be removed and magnafluxed every four races. The disassembly is very simple and well worth the time involved. It has been found that when fitted with extra wide racing tires and a limited slip differential the axle loadings are increased a fantastic amount. Careful attention must be paid to these components.

The very latest production TR-4A cars are fitted with a special treated outer axle that is considerably stronger than the earlier type and will stand the rigors of racing although it too should be checked often as suggested above. It is possible to tell the latest axle from the earlier axle by paying close attention to the threaded end of the stub. The later type shows a bluish color on the steel at the point where the threads stop and the machining starts for the hub. If you find that your axles do not have the bluish color as described order from your dealer axle number 137478 and replace. This change is necessary only if racing tires and a limited slip are installed but is recommended for high speed cornering work of any type.







Remove the inner axle shafts and check the axle keys for signs of wear. Replace the keys at about the same periods as the magnafluxing of the outer stub axle units. Lathe tool steel bits make a very good replacement and will last almost indefinitely. Careful attention must be paid to the four "U" joints of the rear axles. Make certain that the nuts are tight and in good or new condition. It is best to replace the nuts each time after removal. It is very important that the rear hubs be set up as described in the section on axles, bearings and hubs.

When reinstalling the axle assembly be certain to torque the nuts on the six studs of the control arm to 12-14 pounds *only*. Do not overtighten or you may strip the threads from the aluminum control arm. The inner axle shaft nut should be tightened 90 to 100 lbs. The outer hub should be tightened 100 to 110 lbs.

Special rear springs part number V-449, are available from Triumph and are a must for proper handling under racing conditions. These springs are considerably stronger than the stock units and therefore it is *not* recommended that they be fitted for street use. The ride will be greatly affected by the installation of these springs and make street driving quite uncomfortable. The rear wheel camber is adjusted only by making the springs shorter or longer. There is no normal camber adjustment. The special springs should give your TR-4A 0 to ¾ degree negative camber. If the camber is more than this figure shim up the springs with spacers to bring the camber into the range listed. These figures are specified with the car in racing trim. (Bumpers and top removed).

The rear wheel alignment should be set to ⅛″ *toe out*. This is adjusted by adding or subtracting shims from the point where the control arm bolts to the chassis frame. It has been found that there sometimes is a change in the camber setting when shims are added to the inner control arm point only, but there is not a specified pack that can be recommended. Be certain to recheck the camber after setting the toe out position.

Remove the rear shocks and dismantle by removing the damper valve and the top cover. Pump out the existing oil. The standard shock has a valve with a steel colored spring (grey). These valves should be replaced with valves from the competition TR-4 shock which have a spring that is a dull copper or bronze color. In lieu of these valves the standard TR-4 or TR-3 valves which have a bright copper color spring can be installed. Fill the shock with #40 weight racing oil. Be certain to pump all the air from the shock. This is done by moving the lever up and down while holding the shock absorber in a vertical position until all signs of air bubbles have ceased. Refit the shock absorbers fitting an additional nut behand the threaded plate which holds the shock to the chassis frame.

DIFFERENTIAL

The TR-4A differential accepts the normal range of TR axle ratios and the limited slip without modification to any components. The latest type limited slip has a thrust button installed and for fitting to the TR-4A *this button must be removed*. To remove the thrust button it is necessary to separate the halves of the limited slip but does not require any special tools. Be certain that the case is reassembled with the marks on the case in alignment.

BRAKES

It is recommended that the pressure residual valve part number 116197 be fitted in the hydraulic system. This valve should be fitted before the "T" fitting on the left frame rail near the engine oil filter. It is *not* recommended that the 10″ rear brakes be installed as the normal fitting has been found more than sufficient. The larger brakes disturb the braking ratio considerably which usually results in the rear brakes locking up. Remove the dust covers from the front disc brakes. Install competition type front brake pads. Normal rear brake lining is sufficient.

ELECTRICAL

The TR-4A is a *negative* ground vehicle. This must be remembered when changing the coil or battery. If you should suffer a failure of the regulator or generator be certain that the proper replacement is used.

VALVE SPRINGS

Use the recommended competition spring set. Part # V015.

CARBURETORS

Earlier models of the TR-4A were fitted with the Stromberg CD 175 carburetors while the latest production are fitted with S.U. units. Either type is permissible in S.C.C.A. racing. It should be noted that the earlier type TR-3 and TR-4 intake manifolds (short type) are *not* permissible as this manifold was never fitted to the TR-4 and therefore can not take advantage of the update rule. This manifold is pictured in figure 12 at the top of page 21 in the Competition Preparation Manual.

REAR AXLES, BEARINGS AND HUBS

TO DISMANTLE:

Remove the outer hub nut and washer then draw off the hub. The rear hub bearing assembly will be removed with the hub. Remove the key and

TO ASSEMBLE:

Press the outer hub bearing cone up to the shoulder on the hub. Press the outer and inner hub bearing outer races up to the shoulders in the bearing housing. Install the inner and outer oil seals. Feed the stoneguard, bearing spacer, inner cone of the inner hub bearing, and a new collapsible spacer onto the stub axle shaft. Fit the key with the inner end in line with the two indentations on the shoulder of the keyway. Pack the spaces between the bearing rollers and the recess in the bearing housing with high temperature bearing grease.

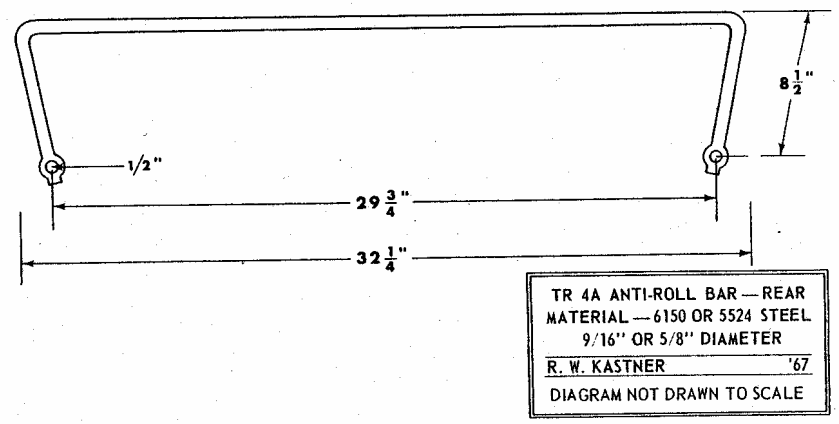
IMPORTANT: Carefully wipe the grease from the roller faces and be certain you do not turn the bearing or hub after installation as the film of grease on the rollers can give an improper end float setting. Be certain that the outer race for each bearing is dry with no grease on its face. After the end float has been established you may then turn the hub which will in turn grease up both the rollers and the outer cone from the lubricant packed into the bearing.

Pass the bearing housing assembly over the stubshaft so the inner hub bearing outer race engages with the inner cone. Be careful — avoid damage to the lip of the oil seal. Feed the hub onto the stubshaft followed by the washer and the nut. Torque to 100 to 110 pounds. Wind the adjuster nut up against the stoneguard until it is finger tight. Mount a dial indicator on the hub with the stylus of the indicator passing through the provided hole in the hub and resting on the flange machined surface of the bearing housing.

Move the bearing housing away from the indicator as far as possible, use a rocking motion to insure a full contact between the bearing parts. Now zero the indicator with a rocking motion. Push the bearing housing as far as possible towards the indicator. Note the reading. Tighten the adjusting nut one flat at a time while carefully watching the indicator. As the nut is tightened the end float will diminish. When the total float is between .002 and .004 secure the assembly with the lock nut and tab washer.

WARNING: If the end float has been reduced below .002 the collapsible spacer *must* be replaced. Merely slacking back the nut is *not satisfactory*. The axle bearing unit is now complete and may be reinstalled in the chassis.

REAR ANTI-ROLL BAR (RACING SPECIFICATION)



Installation of this rear anti-roll bar will induce oversteer and is recommended if the balance of the suspension system has been attended to as described in the competition preparation manual. It is of particular advantage if the car is fitted with the non-slip differential unit as the anti-roll bar will negate the understeer that is normally produced when the non-slip unit is fitted. Increasing the diameter of the roll bar or shortening of the leg length of the roll bar will increase the amount of oversteer. Start with a 9/16-inch bar and only fit a larger diameter if it is found that excessive understeer is present. Fitting of front and rear anti-roll bars will tend to reduce the body roll considerably which is desirable if the steering stays at a near neutral condition. Oversteer can be corrected by fitting a front anti-roll bar, or, if one is already fitted, increasing the diameter of the front bar.

Make up two brackets of mild steel 3/16-inch x 1½-inch x 3-inch to hold the roll bar to the frame. These brackets will be bent to 90-degrees with each leg measuring 1½-inch long. Drill one leg of the bracket for the special cage bracket No. 121793. These cage brackets are used in the normal front sway bar kit and hold the rubber bushing block in place. Purchase two of the cage brackets. Purchase two of the rubber bushing blocks No. 121791, Slide the rubber over the sway bar and push on the cage bracket. Bolt up the steel 90-degree angle brackets previously made up.

Make up or purchase two steel washers 2¼-inch diameter with a ⅜-inch center hole and 3/32-inch or ⅛-inch thick. Make up or purchase two washers 1½-inch diameter with a ⅜-inch center hole and a 3/32-inch or ⅛-inch thick. Weld the smaller washer to the larger with the center holes in alignment. You will need one of these assemblies for each side.

From 1/8-inch steel stock make up two brackets bent at 90-degrees which are 1½-inch wide, one leg being 2¼-inch long and the other leg being 1¾-inch long. Drill a ⅜-inch hole in the long leg 1-inch from the end. Drill a 7/16-inch hole ½-inch from the end of the short leg. These brackets will hold the sway bar link to the bottom of the trailing arms.

Slide the welded washer assembly through the rear coil spring and into the cast hole in the trailing arm which is directly under the spring. Slide a ⅜-inch bolt through the center hole of the washer, fit up the steel bracket with the odd length legs to the bottom of the control arm and tighten up tight. The short leg should be towards the inside of the control arm and parallel to the drive shaft. Purchase two front anti-roll bar links No. 121797 and fit these to the brackets under the trailing arm. The link is fitted on the outside of the bracket. Fit up the sway bar to the links with all the rubber grommets and special washers. Tighten up fully.

With the vehicle on the ground in normal running condition, camber and especially weight, push the sway bar back up against the frame until brackets holding the rubber bushing and special cage are flush with the frame member.

See that the links are perpendicular to the ground then mark the frame so that the brackets can be removed and welded into place. After the welding, reinstall the sway bar onto the brackets and the job is completed.

PARTS LIST

2	121793	Cage Brackets
2	121791	Rubber Bushing Block
2	121797	Roll Bar Links

ENGINE

All engine modifications as described in the early pages of this book apply unless specifically mentioned in this amendment.

When other data concerning the modification to chassis or drive line is finalized the information will be made through the competition department. This information will be published in the T.S.O.A. Bulletin. It is recommended that you join the T.S.O.A. so that all information will reach you as quickly as possible. Membership is $5.00.

WRITE: T.S.O.A.
600 Willow Tree Road
Leonia, New Jersey 07605

NOTES

REAR ANTI-ROLL BAR (RACING SPECIFICATION)