BACK TO BASICS #11: CARBURETOR TUNING

by F.E. OLD
Technical Editor

"Back to Basics", for those of you who are fairly new to the Register and TSO, is a series of articles designed to help the would-be back-yard mechanic cope with basic automotive maintenance procedures. Unlike most of the M.G. workshop manuals currently available, which assume that the reader is familiar with automotive fundamentals, we have tried in this series to assume nothing. Our aim has been to provide instructions which the rock bottom beginner can follow without too much difficulty.

We began way back in the June 1975 issue with a discussion of the basic tools needed for auto maintenance work. In August 1975, part two dealt with useful manuals and a comparison of British and American automotive terminology. Part three, in October 1975, covered engine lubrication, and part four, in April 1976, covered chassis lubrication. In August 1976, part five discussed the theory behind engine tuning and explained how to perform a compression test. In April 1977, part six took the reader through the procedure for adjusting valve lash or rocker arm clearance. Number seven, in August 1977, described the workings of the iginition system and explained how to clean and gap spark plugs. Part eight, in December 1977, explained how to service the distributor. In April 1978, part nine reviewed what had gone before, for readers just joining in, and mentioned a few things which had been omitted from earlier installments. In December 1978, part ten dealt with carburetion theory and described the S.U. carburetor. Now, about two and a half years later, #11 is finally finished and ready for the printers. The delay was mainly due to the fact that I found it very difficult to write a reasonably foolproof how-to article on the subject of S.U. carburetor tuning. What follows is my fifth or sixth attempt. It's far from perfect, but I don't want to delay publication any longer.

Incidentally, please don't ask me for copies of earlier installments, as I am not able to supply photocopies. Individual back issues of TSO may be ordered from the Register Librarian. See the Register Regalia page of TSO for details.

TOOLS

Most of the tools you'll need should already be in your M.G. tool box: wrenches in Whitworth and British Association sizes, screwdrivers, and pliers. To do a topnotch job you'll also need a PSW tool kit for the S.U. carburetor, which is sold as an "S.U. Tool Kit" by most of the T Series parts suppliers and may also be found at many foreign car parts stores. You might also want to obtain a Uni-Syn or similar synchronizing tool. You can get by without the PSW kit and the Uni-Sun, but they will certainly make life easier for you.

For cleaning the carbs you will need several clean, lint-free rags, a stiff brush, and some carburetor cleaning fluid. The most convenient type of cleaning fluid comes in aerosol cans, but you can also get it in bulk form if you prefer. Dentured alcohol can be used in a pinch, but it is not as effective.

PREPARATION

The average back-yard mechanic seems to have a carburetor fetish. When the engine isn't running right, out comes the screwdriver to adjust the carburetors. When he does what he naively thinks is a tune-up, the first things he attacks are the carburetors. When he has nothing better to do, he fiddles with the carburetors. This is wrong! Most cases of poor running are caused by malfunctions in other areas of the engine, not by the carburetors. The carbs should be the last items checked in a troubleshooting sequence unless you are experienced enough to know that they are the only possible cause of the engine's strange behavior.

Similarly, the carburetors should be the last items attended to in the course of a tuneup. Unless the compression checks out okay and rocker arm clearance, spark plug gap, breaker point gap and ignition timing are all correct, it will be useless to adjust the carbs. You may think you have adjusted them correctly, only to find you must do it all over again after you've adjusted the plugs, points and so on.

With the exception of the Y and YB, the cars we are dealing with in this series all have two carburetors. Dual-carburetor setups are especially sensitive to engine condition, and can be difficult if not impossible to tune properly if the rest of the tuneup sequence is not taken care of first. Even then, you will find carburetor tuning very difficult if in the course of the earlier tuneup procedures you discover that the engine is suffering badly from age. If, for example, during your compression test you find that compression in one cylinder is considerably lower than that of the others, then it will be very difficult to adjust the carburetor serving that cylinder. Or, if the automatic advance mechanism in the distributor is so badly worn that it can no longer fire the plugs consistantly at the right time, then carb tuning will be difficult and the resulting setting will quite probably not be correct over the entire rpm range.

These factors are important on single-carburetor models, but are not so critical. When all four cylinders draw through one carburetor, the effect on the carburetor of imperfections in one cylinder are not as strong. Let's consider one of the worst possible examples: an engine which produces a compression gauge reading of nearly zero on one cylinder (due probably to a burnt valve). That cylinder will draw very little air. On a single-carb engine this means about a 25% loss of air flow through the carb, which is bad enough, but on a dual-carb model it means a 50% loss of air flow through the carburetor serving that cylinder. That carburetor will be impossible to tune properly, so don't even bother to try until the cause of the compression loss is found and corrected. Obviously, this is an exaggerated example, but it serves to illustrate my point. Don't attempt to adjust the carburetor until you have tested the compression and found it satisfactory, gapped the spark plugs, inspected and adjusted the distributor, and set the valve lash to the recommended clearance.

EXTERNAL CLEANING

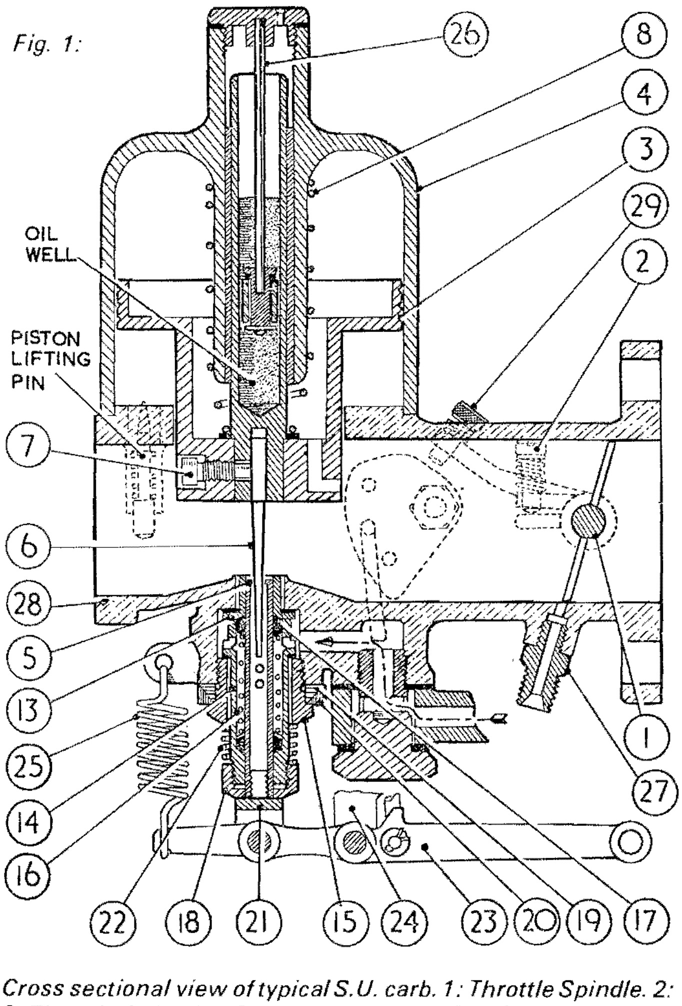
The most important cleaning will be done to individual parts as you disassemble and adjust the carburetor, but before you begin you should clean the outside of the carb as thoroughly as possible. This serves two purposes. First and most important, it precludes the possibility of dirt and grime on the outside of the assembly from getting inside. You won't be doing a great deal of disassembly, since this is a tuneup rather than a complete overhaul, but the parts you will be removing must be kept spotlessly clean. Secondly, it's no fun to work on anything which is covered with countless years' accmulation of gum, grit, oil and miscellaneous crud.

This is where the spray can of carburetor cleaner comes into play. Following the instructions on the can, spray the stuff all over the outside of the carb. Carb cleaner is pretty potent stuff, so be careful to keep it off your skin and off the car's paint. Allow the cleaner to soak into the grime for a short time, then use a stiff brush to loosen stubborn spots. If the instructions on the can say to rinse with water after cleaning, then do so, as some types of cleaner will eat into the aluminum diecastings of the carburetor if left for too long. In any case, it's a good idea to have a water supply handy for rinsing overspray off you and the paintwork.

When the outside of the carb is clean, remove the air cleaners (TF) or air cleaner ducts (all others). With the engine running at 2500 rpm or higher, spray the carb cleaner into as many corners of the carb's innards as you can reach. This will clean most of the gum, and carbon off the throttle bore, throttle plate, and lower part of the piston. Don't use up all the cleaner quite yet, though. You may need it later.

Now we're ready to start exploring the inner workings of the mysterious S.U. carburetor. The instructions which follow apply to the type H carbs used on the TB and later cars, and in the main to the type HV carbs used on the TA. We occasionally see the more modern type HS carbs fitted as replacements, easily identifiable by the fact that fuel is carried from the float chamber to the carb via a piece of tubing. While the same general tuneup principles apply to the type HS unit, detail differences exist which make the purchase of an S.U. tuning manual a good idea.

Fig. 1:



Cross sectional view of typical S.U. carb. 1: Throttle Spindle. 2: 2: Throttle Adjusting Screw. 3: Piston. 4: Suction Chamber. 5: Jet Opening. 6: Needle. 7: Needle Setscrew. 8: Piston Spring. 15: Jet Locking Screw. 18: Jet Adjusting Nut. 21: Jet Head. 22: Locking Spring. 23: Jet Lever. 24: Link. 25: Jet Return Spring. 26: Damper Rod. 28: Main Casting. 29: Fast Idle Screw.

THE FLOAT CHAMBERS

In order for the carburetor to meter out fuel accurately, the fuel level in the jet (fig.1, #5) must be kept more or less constant. This is controlled by the fuel level in the float chamber (fig.2) (or float bowl, as it is usually called in this country). The fuel level in the float chamber is in turn controlled by a float-operated needle valve (fig.2 #9) in the chamber lid. This works much like the shut-off valve in a toilet tank. When the fuel reaches the correct level in the chamber, the float (fig.2, #10) closes the valve and stops the flow of fuel into the chamber. When the fuel level drops, the float drops with it, allowing the valve to open. When the engine is running, the needle valve is constantly opening and closing to keep the fuel level approximately constant.

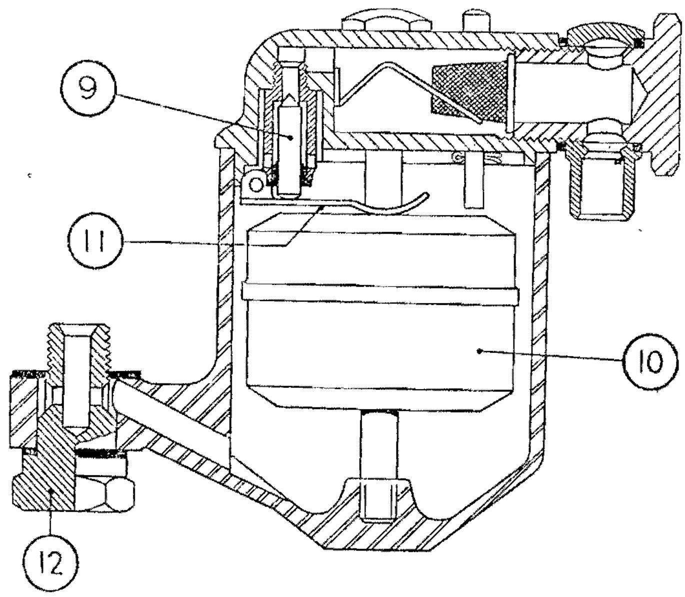


Fig. 2: The float chamber. 9: Needle Valve. 10: Float. 11: Float Lever. 12: Mounting Bolt.

FUEL LEVEL: The fuel level in the jet need not be exact, as normal jet adjustment will compensate for minor variations. However, the standard measurement for all type HV, H, and HS carbs is ⅜ inch (9.5mm) below the top surface of the jet bridge, and it should not deviate too much from that. The jet bridge is the flat surface on the bottom of the carburetor throat, against which the piston rests and through which the jet bore is drilled. Even with the suction chamber and piston (fig. 1, #3 & 4) removed and the jet in its fully lowered position, it is nearly impossible to measure the fuel level accurately at this point. Therefore, we substitute a purely mechanical measurement of the position of the float lever when the float valve is closed. This measurement is made between the lever and the chamber lid, as shown in figure four. For the type T2 chambers (2¼" diameter) used on all T and Y Type carburetors, the measurement should be $^{7}/_{16}$ inch (11.1mm). If this measurement is correct, then the float needle will close when the fuel level in the chamber and in the jet are correct.

In order to make this measurement you must first remove the chamber lid. Remove the large banjo bolt which attaches the fuel line to the lid. (fig. 2) remove the fuel line (save the fiber washers,) and remove the spring-loaded wire mesh filter from the bolt hole. Then remove the hold-down bolt which passes through the top of the lid (more washers to save), push the overflow pipe aside, and lift off the lid. Turn the lid upside

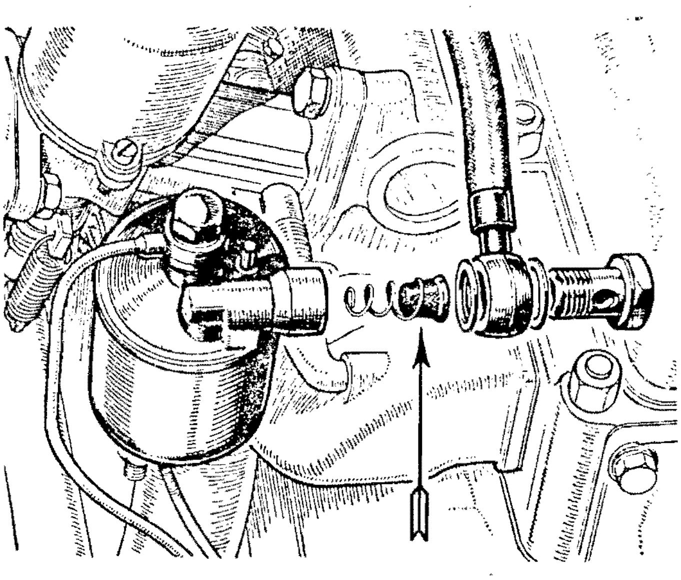


Fig. 3: To remove float chamber lid, detach fuel hose as shown, remove bolt in top of lid. Filter (arrow) must be cleaned.

down and you will see the float lever (fig. 2, #11) and, under it, the needle (fig. 2, #9) valve. Remove the pivot pin, lift off the lever, and lift out the needle. If its conical tip is grooved, you should install a new needle and seat. If you're not sure whether or not the old assembly is usable, insert the needle back into its seat and blow through the fuel line opening in the lid while holding the needle against the seat with light finger pressure. If no air leaks through the closed valve, then the old assembly is probably okay to use.

Examine the pivot pin, and install a new one if it is badly grooved where the float lever bears on it. Prior to 1955 the pin was a slip fit into the lugs on the lid, but most pins made since then are knurled on one end to provide a press fit. Either type is suitable, as long as it is not worn. The old type can fall out when the lid is removed from the float chamber, but is easy to remove for inspection. The new type won't fall out, but is more difficult to remove. Use a pin punch, nail, or stiff wire smaller in diameter than the pin to push it out from the end opposite the knurling. I like to reduce the diameter of the knurling with emory cloth or a fine file to make the whole disassembly and inspection process easier.

Also examine the float lever. If there is any obvicus damage, replace it with a new one. Both arms of the fork should be equally curved, and the portion of the lever between the fork and the pivot pin ears should be perfectly straight. The area where the lever bears on the needle valve may be shiny, but must not be deeply grooved. When you are satisfied that the needle valve, float lever and pivot pin are in satisfactory condition, assemble them back into the float chamber lid.

With the lid assembly still upside down, insert a 7/16" diameter rod between the lid and the inside curve of the forked end of the lever, as shown in figure three. A rod of the correct diameter is provided in the PSW tool kit, but a 7/16" dowel or a longish 7/16" bolt will do just as well. The lever should rest on the test rod and on the needle valve at the same time. If it doesn't, bend the lever carefully at the point where the curved fork joins the straight section, being careful to see that the straight section remains straight (see fig. 3). Also make sure both prongs of the curved fork rest equally on the test rod. It's very easy to twist the lever slightly out of kilter when you bend it.

The original type of valve needle was made of solid stainless steel, and with this type it's hard to make a mistake in the adjustment. However, in recent years this type has been superceded by a nylon-bodied needle with a spring-loaded pin inserted into the end which touches the float lever. The spring loading lessens the closing impact of the needle and prolongs its life, but it necessitates more care in adjustment. Do not push the lever down against the spring pressure in an attempt to make the fork rest on the test rod. The measurement must be made with the pin fully extended, supporting only the weight of the lever.

In service the setting will change gradually due to the wearing of the needle and the pivot pin, but this wear takes place very slowly. Given the low annual mileage travelled by most T and Y Types these days, once the float level is correctly set, you should never have to set it again. Still, it should be checked each time the carburetors are tuned.

Those of you who have factory workshop manuals (that should include all of you) may have noticed that in some of these manuals the use of a 3/8 in. test rod is specified instead of the 7/16in. rod specified by the S.U. Carburetter Company. I don't know why M.G. chose to deviate from the standard S.U. measurement, but in practice it doesn't really matter. Either dimension will provide a fuel level in the jet which is within the acceptable range, and there will normally be no difference in performance.

THE FLOAT Use a piece of wire with a small hook bent into one end to fish the float, (fig. 2, #10) out of the chamber. Dry off the outside of the float, then shake it vigorously. If it rattles, or if there is no sound at all, then the float is okay. The rattle is probably just a small blob of loose solder, and is nothing to worry about. If however, you hear the swish of liquid inside the float, then the float leaks.

To find the leak, submerge the float in a pan of very hot water. As the air heats up and expands it will be forced out of the hole or holes, and you will see bubbles in the water. Remove the float from the water, mark the holes, then put it back in the water and let it float. Keep the water very hot. This will speed the evaporation of the gasoline, and eventually your float will be empty. In really bad cases it may be necessary to boil the float all night, but under no circumstances should you try to hasten the evaporation by heating it with an open flame. The resulting rapid evaporation can cause the float to explode, ruining a potentially repairable float and peppering your tender bod with shrapnel.

Once the gasoline is driven out, the holes can be sealed with solder. Use a hot soldering iron, not a torch. However, this should be considered only a temporary repair. Chances are good that there are other thin spots waiting to break through, so you had best order a replacement float in the near future.

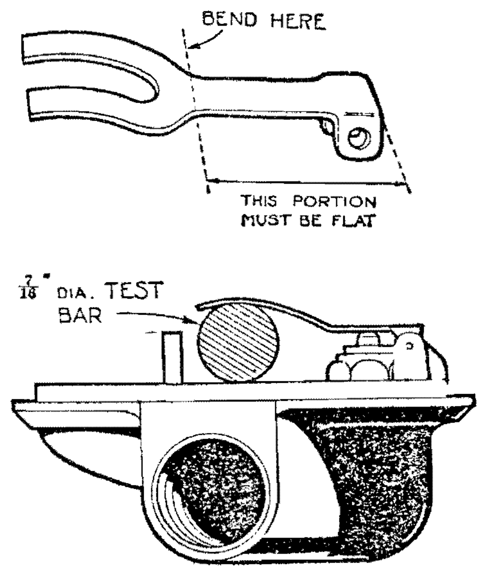


Fig. 4: Measure float level as shown at bottom, bend lever to correct as shown at top.

CLEANING Now examine the inside of the float chamber. Any grit inside the chamber indicates filtering problems, so check the condition of the wire mesh filters in the fuel pump and in the inlet union on the float chamber lid. Clean the filters if necessary, or install new ones if they are damaged or missing. Also consider cleaning out your fuel tank. If grit is present in the chamber, then it has probably also gotten into the small passageway which transfers fuel from the chamber to the main body of the carburetor. Remove the chamber by undoing the bolt which attaches it to the bottom of the carburetor. Don't lose the sealing washers! Rinse out the chamber thoroughly and attach it back to the carburetor.

REASSEMBLY Now the float chambers and lids may be reassembled. Drop the floats back into their chambers; it will be rather embarrassing later on if you leave them out. When you put on the lids, make sure all sealing washers are returned to their original positions. Use anti-sieze compound or grease on the banjo bolt and lid bolt threads to keep them from freezing in place. Tighten the bolts firmly, but don't overdo it as the threads in the diecast lid are easy to damage.

On all T and Y Types the carburetors are mounted in a "semi-downdraught" position, which means that they slope slightly downhill towards the engine. However, the mounting arms on the float chambers are arranged in such a way that the chambers are level, and this is the only position in which they will work properly. If your chambers are tilted just like the carbs, then someone has installed chambers meant for use on horizontally-mounted carburetors. Replace them with the correct type or you will have trouble with sticking floats, sticking needles, and fluctuating fuel level. Even with the correct chambers fitted, they will be exactly level only when the mounting arms are perpendicular to the carburetor body as viewed from above. This is easily adjusted by loosening the mounting bolt (fig.2, #12) under the carburetor body, rotating the chamber to the desired position, and retightening the bolt.

THE SUCTION CHAMBERS & PISTONS

The suction chamber assembly (fig.5) is the heart of the S.U. carburetor, and is the major design difference between the S.U. and most other types. It is the rise and fall of the piston under the influence of vacuum in the chamber which changes the size of the venturi and moves the needle in and out of the jet to tailor the fuel/air mixture to the engine's needs. If something goes wrong with this assembly, the carburetor won't work, so it should be cleaned and inspected every time the carbs are tuned, or at least once a year. The pistons are not interchangeable from one suction chamber to another, so I recommend that owners of dual-carb models work on one at a time.

DISASSEMBLY & CLEANING: To remove the suction chamber, first unscrew the cap at its very top. The cap may or may not have a rod and plunger assembly (the damper) attached to it. If it does, be careful not to bend the rod. Unscrew the two or three screws which secure the suction chamber to the main casting of the carburetor. If yours is a two-screw model, mark the chamber and the carb body so the chamber can be returned to the same position later on. This isn't necessary on three-screw models, since the screw holes will line up only when the chamber is in the proper position. Lift the chamber straight up, without rocking it, to avoid damaging the needle. As you lift, look underneath to see if there is a large coil spring (fig.1, #8) between the suction chamber and the piston. If so, don't let it fly away. Now lift the piston out of the carburetor body, again being careful of the needle. If you found a spring in the assembly, you may also find a steel thrust washer down inside the piston where the spring rests. Don't lose it.

Now examine the inside of the chamber and the outside diameter of the piston (Fig.6). Both must be spotlessly clean. If not, wipe them off with a rag dampened in gasoline. If the dirt seems to be baked on, use some of your carburetor cleaner to free it up, but use it sparingly and rinse it off quickly. Some types of cleaner will make the diecast aluminum "bloom" slightly if left on for too long. This isn't important on the outside of a carburetor, but can close up the critical clearance between the piston and the suction chamber.

When the parts are clean and dry, put a drop or two of oil on the steel piston rod (fig.6) and insert it into the suction chamber. Don't oil anything else! Move the piston in and out of the chamber slowly while spinning it, to distribute the oil evenly over the rod and its bore. While you do this, listen carefully for scraping sounds which indicate that the outer edge of the piston is rubbing on the chamber wall. If you do hear scraping sounds, try lining up the piston inside the chamber in its normal operating position, as determined by the keyway in the side of the piston and the original orientation of the chamber to the carb body. If the piston slides straight in and out in this position without scraping, then all is well. If not, you must look for the spots where interference occurs and correct them. Usually the problem will be a nick or burr on the surface of either the piston or the chamber, which must be worked down flush with the surrounding metal with a super-fine file or a scraper. Work only on the faulty area.

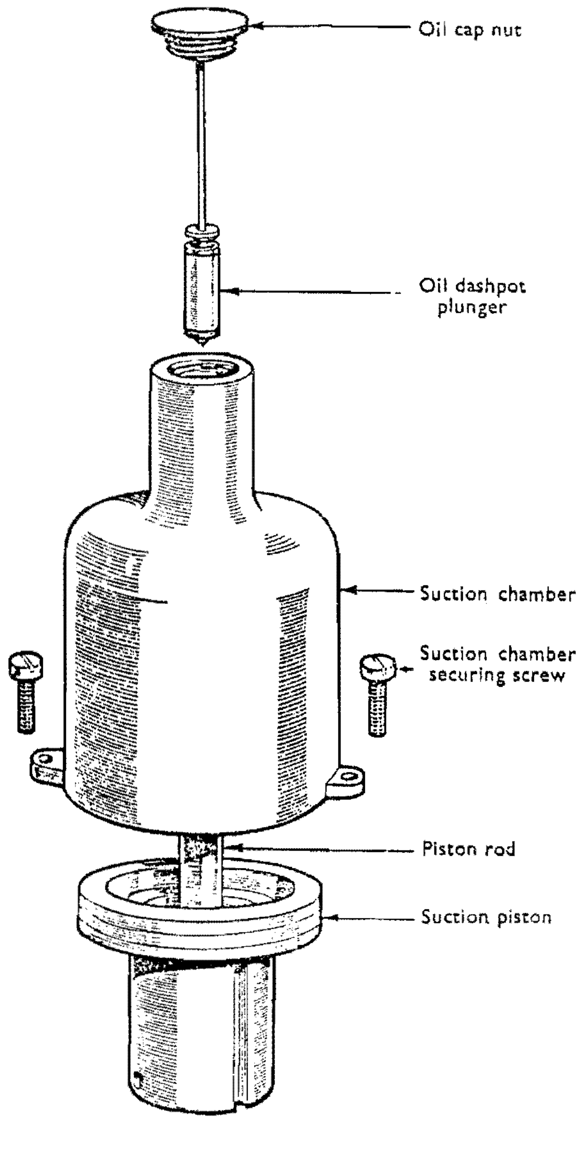


Fig. 5: The suction chamber assembly. Some models have no plunger (damper) under oil cap.

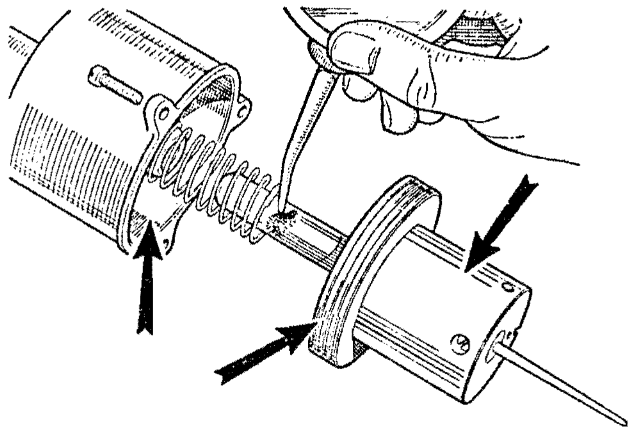


Fig. 6: Oil only piston rod. Surfaces at arrows must be clean and oil-free.

Wholesale rubbing with emory cloth or sandpaper over the entire surface will upset the clearance between piston and chamber, which will adversely effect the operation of the carburetor. On models with only two hold-down screws, try rotating the chamber 180° in relation to the piston, and test again. This may eliminate the scraping, precluding the need for work with scraper and file. Two-screw chambers will fit on the carb body in either position.

THE NEEDLE: When this is taken care of, again insert the piston into the chamber and spin it. This time watch the tip of the needle. If it wobbles as the piston spins, it is bent and should be replaced. If it seems to be straight, inspect it for shiny marks on one side. If there are any, this means that the needle has been scraping on the bore of the jet, usually due to an incorrectly centered jet assembly. This also calls for a new needle, since the scraping may have altered its diameter, upsetting its ability to meter fuel accurately. Ideally, you should also replace the jet, since the rubbing will have enlarged its opening, but we'll cover that later.

Now remove the needle by loosening the setscrew in the side of the piston near the bottom (fig.7). If the needle is stuck, you can grasp it with pliers, but only at the very tip (the last ⅛"). Pull straight out with a twisting motion, being careful not to bend it. You should see numbers and/or letters stamped on the shank of the needle (fig.7) where it fits into the piston. These indicate the size of the needle, and you should confirm that yours is the correct size for your car, as shown in table 1. If you find a non-standard needle, obtain the correct type unless you know there is a good reason for using a different type in your car. S.U. and M.G. provide recommendations for alternate weaker and richer needles for special conditions, but they are not normally needed. The richer needles are useful only for racing applications or when the car is driven without the air cleaner in place, and the weaker or leaner needles are required only if the majority of your driving is done 5000 feet or more above sea level. If you find yourself in either of these situations, see the shop manual for recommendations. Otherwise stick with the standard size for your car.

Now insert the needle into the piston so its shoulder is flush with the face of the piston, as shown in figure eight. Some older needles have a tapered or rounded shoulder as shown in the left hand example in that illustration, and this type is difficult to position correctly. All needles made in recent years have square shoulders and are easy to position in the piston. A straightedge held across the face of the piston for the square shoulder of the needle to but against will preclude the possibility of error. To prevent future sticking, it helps to put a very light smear of anti-sieze compound or grease on the shank of the needle before inserting it in the piston, and also on the threads of the setscrew. Tighten the screw firmly once the needle is in the correct position.

REASSEMBLY: Lower the piston into the carburetor body, being careful not to bend the needle or nick the outer edge of the piston. Install the spring and thrust washer, if your model requires them (see table 1). If one end of the spring has a smaller diameter than the other, then the smaller end should go towards the piston and a thrust washer should be used. If both ends are the same diameter, as is the case on most recently manufactured springs, then it doesn't matter which way the spring is inserted and no thrust washer is required. If, according to table 1, your car should have springs on the pistons but does not, then order some. The car will not run well without them due to an excessively weak mixture. Springs are color coded to indicate their strength, as shown in the table, so be sure to order the right ones.

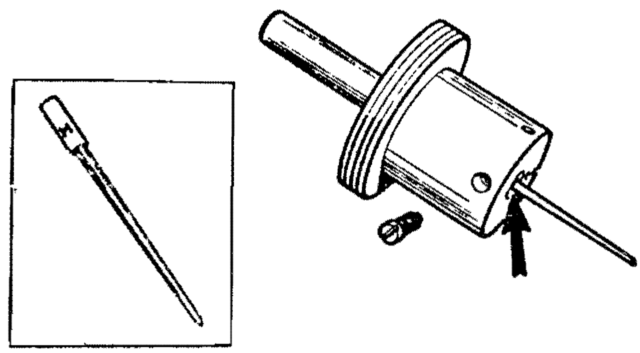


Fig. 7: Needle shoulder must be flush with piston face (arrow) except under certain conditions explained in text. Identification symbol is on shank (inset).

Put the suction chamber over the piston, being careful to align your index marks if it is a two-screw type. The chamber must be a good fit onto the carburetor body to prevent air leakage. No gasket or sealant is used, so make sure the mating surfaces are impeccably clean. Tighten the hold-down screws firmly, but don't get carried away. Overtightening can warp the chamber and cause the piston to rub.

THE DAMPER: Now turn your attention to the cap and damper assembly. The purpose of the damper is to slow down the rise of the piston when the throttle is opened suddenly. The resulting high vacuum over the jet enriches the mixture momentarily, serving much the same purpose as the acceleration pump found in most "normal" carburetors.

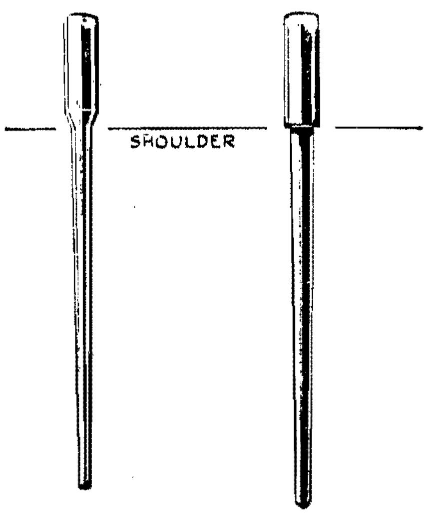


Fig. 8: Shoulder is easy to identify on late needles (right), difficult on older ones (left).

Dampers were used on all TDs, all Ys, and most TCs and most TFs, but not on TAs, TBs, early TCs and early TFs. The dampers improve acceleration from low speeds, so you may want to retrofit them to your carbs if you don't already have them. Damperless carbs are equipped with a plain brass cap at the top of the suction chamber.

Examine the cap to see if it has a small (1/16") vent hole in it, then examine the suction chamber to see if it has a 3/16" vent hole inside the small top section just below the threads for the cap. You must have one or the other, but not both. The carburetors used on most T and Y Types have no vent hole inside the chamber neck, and these must be fitted with vented caps. The TF carburetor is the so-called "dustproof" type with the vent hole in the chamber neck, and dustproof carbs may have been used as replacements on earlier models. Dustproof carbs must have non-vented caps. If you find yourself with the wrong type of cap, drill a 1/16" hole in the cap or plug up the existing hole, depending on which is required, or orser new parts.

Now fill the hollow piston rod to within ½" of the top with SAE 20 motor oil, as shown in figure nine. Insert the damper and screw down the cap firmly. These caps tend to loosen due to vibration and the action of the dampers, so don't be too gentle. Unvented caps must have a sealing washer under them, but check to see that it is really there, as they are easily lost. Washers are not required on vented caps, but it's a good idea to use them anyway.

If your car has two carburetors, as do all but the Y and YB, you must now repeat the whole procedure on the suction chamber assembly from the second carb. The mixing of needles, springs and dampers from one carb to the other is not critical, but under no circumstances should you switch the piston from one carb to the suction chamber of the other. Pistons and chambers are assembled into matched sets by selective fit to ensure the correct clearance between them. Don't mix them up. However, it is perfectly okay to switch the complete chamber/piston assembly from one carb to the other.

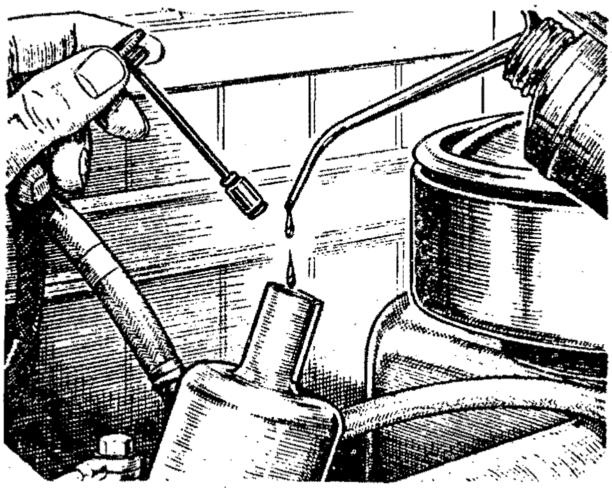


Fig. 9: Fill piston rod to within ½ in. of top with SAE 20 oil.

CENTERING THE JETS

After the suction assembly has been cleaned and refitted to the carburetor, you must make sure the jet is centered in relation to the needle. The entire length of the needle must be able to enter the jet without touching the sides of the jet opening. If it does touch, the needle and jet will both wear at the point of contact. The resulting enlargement of the jet opening and reduction of the needle diameter will diminish the carburetor's ability to meter out fuel accurately, and in really bad cases the friction between needle and jet can cause the piston to get stuck in one position. Neither condition is desirable. The mounting of the jet assembly in the bottom of the carburetor is designed in such a way as to allow enough lateral movement for centering purposes. Once the correct position is found, the assembly is locked into place by a large nut.

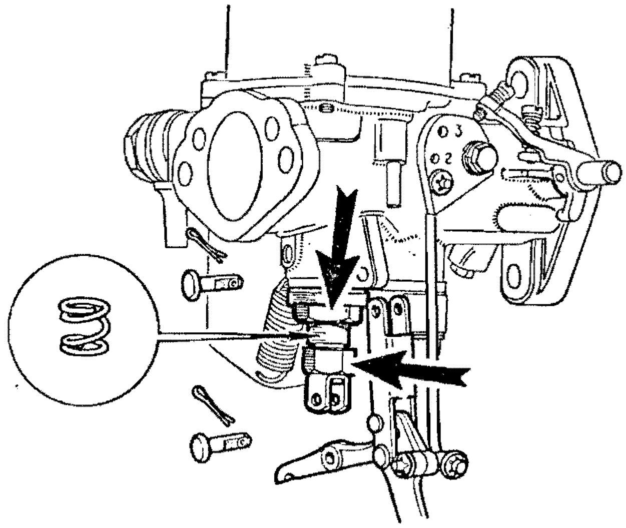


Fig. 10: Parts to be disconnected prior to jet centering. Jet locking screw is at upper arrow, adjusting nut at lower one. Note cam-type fast idle control (not T Type).

PREPARATION & INSPECTION: On dual-carb models, disconnect the linkage between the two jet levers by removing the clevis pin from one of its forked ends. The rod may be left hanging from the other jet lever. Disconnect the choke cable from the rear jet lever. Unhook the tension spring from the jet lever, remove the clevis pin which attaches the lever to the jet head, and swing the lever out of the way. Mark the side of the jet head facing away from the engine so it can be returned to the same position, then grasp the jet head and pull the jet straight down out of the carburetor. Unscrew the jet adjusting nut, remove the locking spring, and screw the nut back on as far as it will go (fig. 10).

Now inspect the jet. Its outside diameter should be smooth, with no sign of grooves or uneven diameter. If such defects are present, the jet should be replaced. If the opening at the top of the jet is abviously oblong instead of round, this too is reason for replacement. Think back to your earlier examination of the needle. If it was shiny on one side, indicating that it had been rubbing on the jet, then assume the jet is worn and replace it and the needle.

The standard jet for all T and Y Types has a .090 in. opening, but you will occasionally find that some misguided previous owner has mistakenly installed a larger jet (usually .100 in.). Jets are sometimes marked with a "9" on the jet head, identifying a .090 in. jet, or with a "1" to identify a .100 in. jet. If you can find no such markings on your jet, use a 3/32" drill as a crude gauge. It should be impossible to insert the shank of the drill into a .090 in. jet (don't force it). If the drill will fit into the jet, then the jet is either very worn or the wrong size. In either case, get a new one.

Put a very light smear of petroleum jelly on the outside of the jet, then insert it back into the carburetor. Push it up until the jet head abuts against the adjusting nut. Make sure the side you marked earlier is facing the right direction if you are re-using the old jet. If you are installing a new jet, just rotate it until the jet head is correctly positioned to accept the jet lever. In either case, keep the jet in that position throughout the rest of the tuning procedure. The opening in the top of the jet is not always exactly concentric with the body of the jet. If, after centering it, you rotate the jet 180°, you may find that it is no longer correctly centered on the needle.

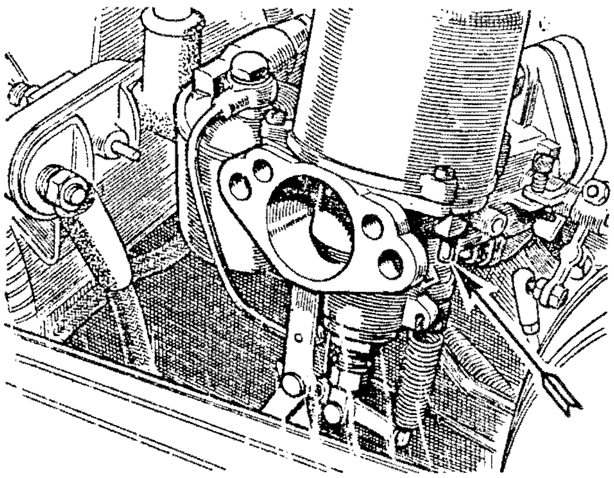


Fig. 11: Piston is lifted by pushing up pin shown at arrow (TF) or by inserting wire through vent hole in same position (earlier models).

CENTERING: If you still have the air cleaner ducting off, reach into the mouth of the carburetor, lift the piston a bit, and let it drop. If the air cleaner is in place, you can still lift the piston. The TF carbs have lifting pins in the flange under the suction chamber, as shown in figure eleven. Simply push the pin up as far as it will go, then let go. Earlier carburetors do not have lifting pins, but they do have vent holes in approximately the same position. Insert a nail or stiff wire into the vent hole to lift the piston.

Fig. 12: Piston may also be lifted with knife blade if air cleaner is removed.

No matter how you go about lifting the piston, when you let it go it should drop against the jet bridge with a metallic click. Some pistons have spring-loaded bumper pins in their undersides to soften the impact of the piston hitting the jet bridge, but you will still hear a soft click. If you hear a click, then the jet is centered correctly and need not be fiddled with. If you don't hear the click, then the needle is rubbing on the jet and preventing the piston from dropping freely to the jet bridge. This jet needs to be re-centered.

Slacken off the large jet locking nut until it is just possible to rotate the bottom of the jet bearing (the threaded piece onto which the jet adjusting nut screws) by finger pressure. Insert a thin screwdriver or similar implement into the top of the suction chamber and push down gently on the piston rod (fig. 13). At the same time, wiggle the jet assembly gently to help it move, while keeping some pressure against the jet head to

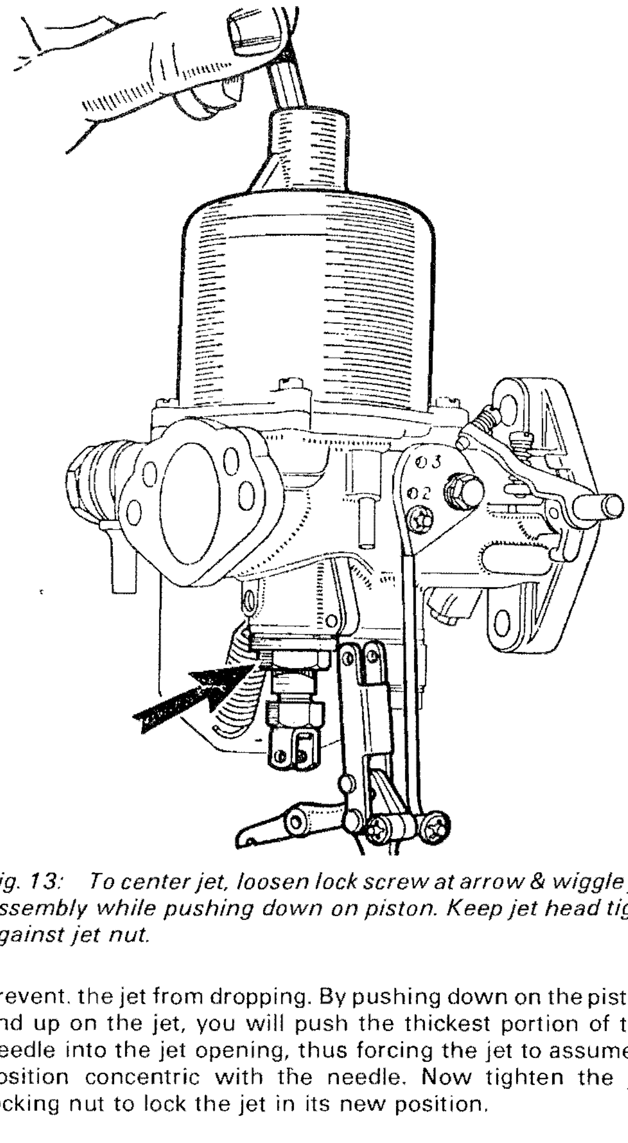


Fig. 13: To center jet, loosen lock screw at arrow & wiggle jet assembly while pushing down on piston. Keep jet head tight against jet nut.

prevent the jet from dropping. By pushing down on the piston and up on the jet, you will push the thickest portion of the needle into the jet opening, thus forcing the jet to assume a position concentric with the needle. Now tighten the jet locking nut to lock the jet in its new position.

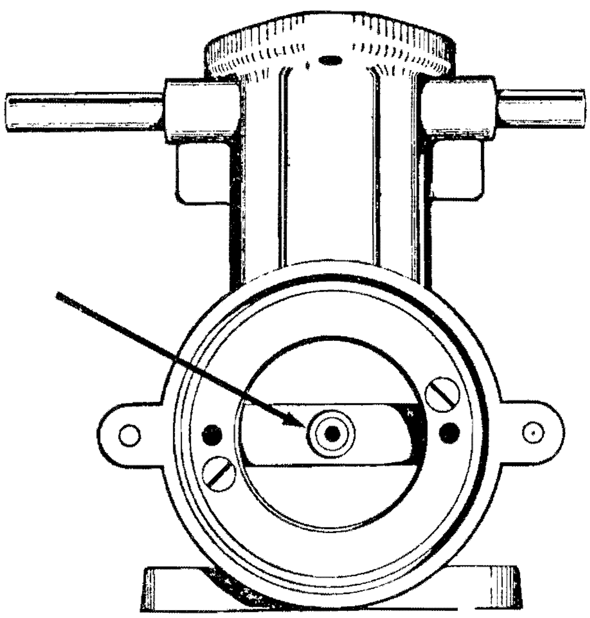


Fig. 14: Jet may appear off-center even when correctly centered. Concentricity with needle, not with carb body, is goal.

M.G. T & Y-SERIES CARBURETOR SPECIFICATIONS				
M.G. Model	S.U. Type	Spec. No.	Needle	Spring
TA	two HV3	AUC 374	AC	—
TB/TC	two H2	AUC 429	ES	—
TD	two H2	AUC 549	ES	—
TD Mk. II	two H4	AUC 578	LS1	red
TF/TF 1500	two H4	AUC 728	GJ	blue
YA/YB	one H2	AUC 456	FI	—
YT	two H2	AUC 480	ES	—

Table 1: T&Y Type carburetor specifications.

Lift the piston again and let it drop to see if you get the necessary soft click, still holding the jet tight against the adjusting nut. If not, loosen the locking nut and try again. If you are unsuccessful after several tries, withdraw the jet, remove the adjusting nut, and reinsert the jet. With the adjusting nut removed, you will be able to push the jet up higher than before. This makes the centering action more positive. When you think you finally have it right, test your work by listening to the click with the jet in the fully up position and again with the jet fully down. If the click has a sharper sound when the jet is down, you have to try again. Repeat the whole procedure on the other carburetor if yours is a dual-carb model.

Now remove the jet again, unscrew the jet adjusting nut, replace the spring, and replace the nut. Screw the nut up as far as it will go, then back off one full turn, or six flats. This is a reasonable starting point for the final jet adjustment, which we will get to in a little while. Insert the jet again and push it up tight against the adjusting nut.

An explanation of the term "flats" might be in order here, since we have just used it and will use it more often as we proceed. The jet adjusting nut is six-sided, so we can say that it has six flats. If we begin with one flat facing us, then turn the nut $^1/_6$ of a turn so the next flat faces us, we will have turned the nut on flat. Thus one flat equals a sixth of a turn, three flats equals half a turn, six flats is a full turn, and so on. We will also speak in terms of so many flats up or so many flats down, not clockwise or counter-clockwise, in or out, or anything else equally fuzzy. Up means up towards the carburetor, and down means down away from the carburetor. You can't go wrong unless the car is upside down, in which case tuning the carbs won't do a bit of good.

You should go through this entire centering procedure if this is the first time you have given the carbs a thorough going over or if you are fitting new needles or jets, and then perhaps once a year after this if the car is used often. In between, it will be sufficient simply to raise the piston and listen for that all-important metallic click without going through all the bother of disconnecting the jet levers, removing the springs, and so forth.

SYNCHRONIZATION

One of the major goals of a tuneup is to ensure that all cylinders are doing approximately the same amount of work. If the engine has two carburetors, this cannot be achieved unless both carbs are doing the same amount of work. The throttles must be set to operate in unison so that the same amount of air is drawn through both carbs. This is called synchronization of the carbs, and will be dealt with in this section. It is also necessary to ensure that both carbs mix the same amount of fuel with the incoming air. This is called mixture adjustment, and will be dealt with in the next section. Mixture strength is determined in part by the amount of air passing over the jet opening, and this airflow is controlled by the throttle setting, so it should be obvious that the throttles must be synchronized before the mixture can be adjusted. For reasons known only to their authors, several of the tuning manuals deal with synchronization and mixture adjustment in reverse order. The carbs must be synchronized first, regardless of what your favorite manual might seem to imply. Naturally, synchronization is unnecessary on single-carb engines, so Y and YB owners may skip this section and move right along to mixture adjustment.

Some tuning manuals recommend a very simple synchronization procedure which consists basically of starting with the throttles in the fully closed position and turning both adjusting screws down equal amounts. This ensures that both throttle butterfly valves are rotated the same number of degrees away from their fully closed position, but it does not guarantee that the flow of air past the butterflies will be equal even though that is the ultimate objective of synchronization. Even when a throttle butterfly is fully closed, there is always a small gap between its outside diameter and the inside diameter of the throttle bore. Thus a small amount of air can get past the butterfly even when it is closed. Unfortunately, the size of that gap (and therefore the airflow through the gap) is never identical on any two carburetors. For example, one carb might allow an airflow of 5 cfm (cubic feet per minute) past the closed butterfly, while the other may allow 20 cfm. If we then rotate both butterflies the same amount, say 5° from fully closed, the second carb will still flow more air than the first even though both butterflies were opened exactly the same amount. These carbs might be synchronized statically (engine at rest), but they are certainly not synchronized dynamically (in relation to actual airflow with the engine running).

Static synchronization can be used to obtain a preliminary setting if you are installing carbs and are tuning them from scratch, or if some previous tuner has really botched up the adjustment. The procedure is simple, so I'll describe it just in case you need it. However, if you are tuning a car which has been running reasonably well all along, you can assume the throttles are already synchronized reasonably well. If so, skip static synchronization and go on to the dynamic synchronization procedure which I will explain in a moment.

STATIC METHOD: Begin by loosening one clamp bolt on one of the flexible couplings on the short spindle which connects the two throttles (fig.15). You should now be able to open and close the throttle on one carb without affecting the other throttle. Back the fast idle or slow running control screw (fig. 19) on the front carb all the way out so it won't prevent the throttle from closing completely. Now unscrew the throttle adjusting screw (fig.15) on one carb out until it no longer touches the abutment on the carburetor body. Then screw it back in until it will just barely hold a piece of paper between its tip and the abutment. Finally, turn the screw in one additional full turn. Do the same on the other carburetor. Both throttle butterflies are now open approximately the same amount. If you were to retighten the spindle clamp bolt both butterflies would then open and close in unison, and would be statically synchronized. But, as I explained earlier, it is unlikely that equal amounts of air will flow past both butterflies. This must now be confirmed by dynamic testing.

DYNAMIC METHOD: As implied above, this method involves actual measurement of the airflow through both carburetors while the engine is running. Most S.U. tuning

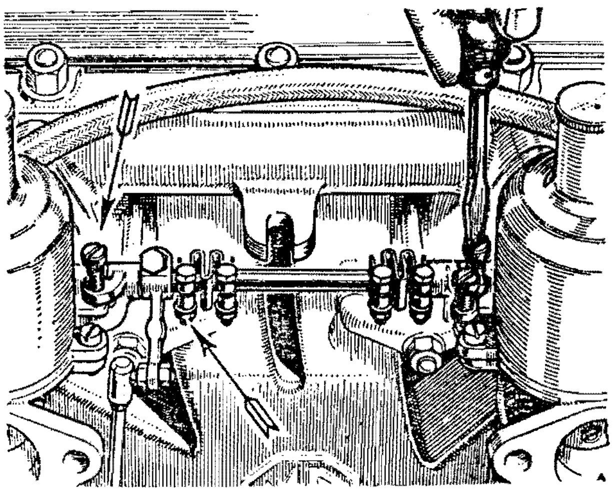


Fig. 15: Synchronization & idling speed are adjusted by screws ahown at screwdriver & upper left arrow. Spindle clamp at lower arrow must be loosened prior to synchronization. (TD shown).

manuals suggest that you use a piece of tubing as a crude stethescope. With the engine running, hold one end of the tubing to your ear and the other end at the intake of one carburetor (fig.16). You should hear a hissing sound caused by the air rushing past the end of the tube. Now move the tube to the other carb, being sure to hold it in the same position relative to the opening. If both carburetors are drawing the same amount of air, there should be no difference in the loudness or pitch of the hissing you hear through the tube as you move from one carb to the other. Unfortunately, many people find it difficult to discern small differences in volume, so this method may not work for you. Add to this the fact that you will also hear an assortment of burbles, pops, sputters and other indecipherable sounds, all which make it difficult to gauge the loudness of the hissing accurately. I recommend that you use this method of testing only if you are unable to do better.

Fig. 16: Synchronization may be tested using rubber tube as stethescope, but Uni-Syn is more accurate.

There are several devices available which make the job easier and more accurate. The PSW tool kit includes a means of measuring the rise and fall of the pistons in the suction chambers. If both pistons are at the same level at any given engine speed, then both carburetors are drawing the same amount of air and are dynamically synchronized. The Uni-Syn and similar gauges fit over the intake end of the carburetor and measure vacuum at that point. When the readings are identical for both carbs, then both are drawing the same volume of air and are dynamically synchronized.

Regardless of which of these tools you use, it's hard to go wrong if you follow the manufacturer's instructions carefully. Loosen the throttle connecting spindle clamp bolt as described earlier and turn the throttle adjusting screws in or out as necessary to make any corrections which may be required. When you are satisfied that the airflow is identical through both carburetors, retighten the clamp bolt on the throttle connecting spindle. Finally, adjust the idling speed to between 700rpm and 800rpm by turning both throttle adjusting screws in or out exactly the same amount. Once the throttles are sychronized, any change in the setting of one adjusting screw must be duplicated exactly at the other screw.

MIXTURE ADJUSTMENT

Now that the carbs are clean inside and out, the float levels are adjusted to specs, the jets are centered, and the throttles are synchronized, you are ready to adjust the mixture. This is the part of the S.U. tuning procedure which seems to baffle so many owners and which has contributed greatly to the S.U. carburetor's underserved bad reputation in this country. A large part of the problem may be the way the procedure is described in most workshop manuals. However, be warned that the procedure described in the manual is essentially correct, whether or not you understand it as written. Regardless of what you may have heard (usually second or third hand), there is no simple tuning secret discovered by a little old mechanic in Moosedip, Alaska, and whispered on his deathbed to an ancient trapper friend who disappeared into the tundra never to be seen again (or any of several variations on that same theme, some of which are even more absurd). There is nothing wrong with the method described in the manual, but there is a great deal wrong with the way it is described. I'll try to do better.

If you analyze the procedure carefully, you will find that it isn't really all that much different from adjusting the idling mixture on a "normal" fixed-venturi carburetor. The major difference is that on most other carbs you turn a screw to change the mixture, while on a S.U. you turn a nut. The S.U. has one very big advantage over other types in that it provides the means for testing the adjustment to make sure it is correct. There's no easy way to do this on most other carbs.

PREPARATION: Mixture adjustment may be accomplished with the air cleaners on or off, according to your preference, but there are advantages to leaving them on as you will learn later. Disconnect the choke cable from the rear jet lever, if you haven't done so already, otherwise a tight cable can prevent the jet head from butting against the jet adjusting nut. On dual-carb models also disconnect the linkage between the two jet levers by removing the pin from one of its forked ends.

If you didn't do so after centering the jets, screw the jet adjusting nuts to their topmost position, then lower them one full turn (six flats). Make sure the jet heads are right up tight against the adjusting nuts. This is a good preliminary setting for the jets, and ensures that both jets on dual-carb engines start off in the same position.

Now start the engine again and let it run until thoroughly warmed up. Adjust the idling speed if necessary to bring it into the 700rpm-800rpm range. Remember on dual-carb models to turn both throttle adjusting screws equally.

ADJUSTMENT: The jets must now be moved either up or down by turning their adjusting nuts until the fastest possible idling speed is achieved without altering the setting of the throttle screws (fig.17). The initial setting of six flats down will usually provide too lean a mixture, so begin by turning the jet adjusting nuts down one flat at a time to enrich the mixture. On dual-carb models turn both nuts exactly the same amount. The engine should gradually speed up as you enrich the mixture, but will eventually reach a point when it begins to slow down again due to an overly rich mixture. When it does, turn the nuts back up again until the highest idling speed is reached again.

In the rare case where the initial setting (6 flats down) is too rich, you will hear the idling speed start to drop pff immediately as you lower the jet nuts. In this case, screw the nuts back up evenly to weaken the mixture. The engine will speed up as you approach the correct setting, but continue to screw the nuts up until the speed starts to drop off due to a weak mixture. Now proceed as in the preceding paragraph. Not all tuners will agree on this, but I find that it is usually easier to start off with the mixture a bit lean, then work from there towards the correct mixture.

The mixture should now be approximately correct for the speed at which the engine is running. However, that speed will now be somewhat higher than the ideal 700-800rpm, so turn the throttle adjusting screws out a bit to bring the idle back down. The mixture may now be slightly too rich for the reduced idling speed, so raise the jet adjusting nuts a bit. As before, the aim is to adjust the jets for the highest possible idling speed at the new throttle setting. You may have to go back and forth between jet nuts and throttle screw several times, but in the end you will reach a point where the idling speed does not exceed the recommended range when you readjust the jet nuts.

This process may seem a bit tedious, but I recommend it if this is your first attempt at S.U. tuning because it forces you to become familiar with the functions of the throttle screws and jet nuts and their interrelationship. The experienced tuner may use a shortcut, which is simply to start off by adjusting the throttle screws until the engine is idling as slowly as possible without stalling. This should be somewhere around 500rpm or so. Then, as the jet nuts are adjusted for the correct mixture, the idling speed will not climb so far above the 700-800rpm range and not so much fiddling will be necessary.

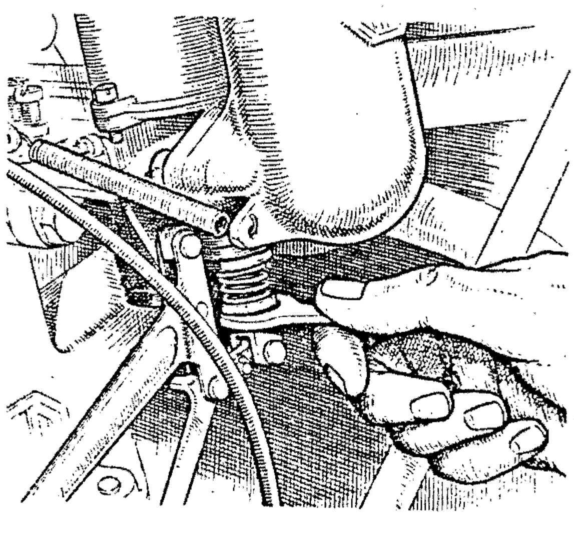


Fig. 17: Raise jet nut to weaken mixture, lower it to enrich mixture. Nut can usually be turned with fingers, but may require wrench (Y/YB shown).

As you go through the above procedure, keep several things in mind. On dual-carb models it is imperative that you move both throttle screws the same amount when you adjust the idling speed, and that you move both jet nuts the same number of flats when you adjust the mixture. It is also important to understand that it is the position of the jet relative to the tapered needle which determines the mixture strength, and it is the jet nut which determines the position of the jet. The jet must move up and down with the nut as you turn it, otherwise you will turn the nut all day without having any effect on the mixture. Normally the tension of the jet lever spring will keep the jet head tight up against the nut, but if not then you will have to help it along with your finger pressure. Refer to the last section of this article for several possible cures. If the springs are not able to pull the jets up against the adjusting as you tune the carbs, then neither will they do so when you push the choke knob back in after a cold start. This means trouble.

Often it is possible to turn the jet adjusting nuts with your fingers. If not, use the jet wrench supplied with the PSW tool kit or available separately from T Series and foreign parts suppliers. You may find it awkward to use the wrench with pancake-type air cleaners in place. If so, remove them. You may also find it helpful to remove the jet lever springs so you'll have more room to swing the wrench. If you remove the springs, you **must** use your fingers to hold the jets hard up against the adjusting nuts. It helps to have three hands, but few of us are so equipped.

If you were adjusting the mixture on a "normal" fixed-venturi carburetor, your job would be done at this point. In fact, even on the S.U. the mixture should be very close to correct if you have followed instructions carefully. However, the S.U.'s unique variable-venturi construction provides the means for testing your adjustment and fine-tuning it to a degree not possible on most other carburetors. This is particularly handy for owners of dual-carb models, as it allows you to ensure that both carbs are providing the same mixture strength.

TESTING & FINE-TUNING: Some manuals tell you to listen carefully to the sound of the exhaust while the engine idles. If the sound is uneven in a sort of non-rhythmical or "splashy" pattern, then the mixture is too lean and should be enriched by screwing the jet adjusting nuts down a bit. If the sound is uneven in a rhythmical pattern, and if the exhaust pipe throws out black smoke, then the mixture is too rich and the jet nuts need to be raised. Personally, I feel much the same about this as I do about trying to sychronize the throttles by holding a piece of tubing to the ear. It's too easy to misinterpret all the strange sounds you might hear. Also, on dual-carb models the exhaust can sound pretty good even though one carb is running lean and the other is running rich, thanks to the small degree of balancing which takes place between the two halves of the intake manifold.

The preferred method, which is considerably more accurate, is to lift the piston a specified amount and observe the effect of this on the idling speed. The lifting of the piston is carried out exactly as it was in the section dealing with jet centering. However, unless you have the air cleaners off and can actually observe the movement of the piston, you have to be very careful. Probe upward with the lifting pin, nail or whatever until you feel it actually come into contact with the bottom of the piston, then push farther to actually lift the piston. Learn to differentiate between pin (or nail) movement and piston movement, because the two are not necessarily the same. This is particularly important if your carbs have lifting pins, because you have to take up a lot of free play in the pin before the piston actually starts to move.

Now we will have to deal with single-carb and dual-carb models individually, because the rest of the testing and fine-tuning procedure varies slightly depending on which setup you have.

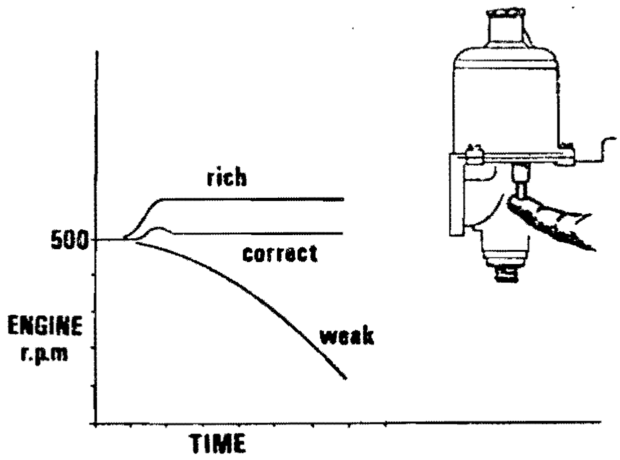


Fig. 18: Engine speed should react as shown when piston is lifted 1/32 in.

On single-carb models, use your lifting pin, nail knife blade or whatever to lift the piston about 1/32 of an inch (0.8mm). This need not be by precise measurement, but be aware that it amounts to only a slight nudge upwards. Lifting the piston increases the size of the venturi. The throttle is still in the closed position, so the actual airflow through the venturi is unchanged. The resulting decreased vacuum at the jet opening weakens the mixture slightly. If you have adjusted the jet position correctly, the engine should speed up for a moment, but should almost immediately settle back to only veryslightly above the original idling speed. If the jet setting is too low, giving a rich mixture, the idling speed will increase noticeably and stay there without dropping off. If the setting is too lean (jet too high), then the idling speed will drop off and the engine may stall. Figure eighteen depicts these reactions graphically. Adjust the jet up or down as indicated by the results of the test. Move the nut one flat at a time, testing again after each change, until you get the correct response when you raise the piston.

A variation on this theme is possible, and can be used to confirm your findings if you are unsure of yourself. Lift the piston very slowly to a height of ¼ inch. By the time you reach 1/32" the engine should have reacted as described above for a correct setting: a slight increase in speed followed by settling back almost to the original idling speed. As you continue to lift the piston, thereby weakening the mixture even more, the engine should begin to slow down. By the time you have lifted the piston the full ¼", the engine should stall. If it begins to slow down or stalls after only 1/32", then the mixture is too lean. If it continues to run at ¼", then the mixture is too rich.

For dual-carb models the procedure is essentially the same, but the reaction to lifting the piston on one carb of the pair is not as dramatic because only two cylinders are affected. Also, because of the balancing effect of the mainfold, a change in jet position on one carb may necessitate a change on the other carb as well. even though the second carb may have tested out okay the first time you tried it.

It doesn't matter which carb you begin with, but for the sake of labeling convenience we'll call them "first" and "second". Lift the first carb's piston 1/32" as described earlier and listen for a change in idling speed. If the setting is correct, the rpms will either remain unchanged or will rise very slightly before dropping back to normal. If too rich, the engine will speed up and stay speeded up. If too lean, the speed will drop off and the engine will run very rough, although it probably won't die unless the mixture is extremely weak. Again, refer to figure eighteen. Before you make any adjustments, go on to the second carburetor and test it.

If both carbs react in the same way, with both testing out either too rich or too lean, then adjust both jet nuts one flat at a time in the same direction until the engine reacts correctly to your lifting of the piston. If one carb test out too rich while the other is too lean, adjust the nuts one flat at a time in opposite directions. Remember, you must move the nut and jet up to weaken the mixture, down to enrich it. In either case, test after each adjustment.

By turning both jet nuts equal amounts you may be lucky enough to reach a point where both carbs are just right. If so, stop. Don't fiddle with them any more. However, it is more likely that you will come to a point where one carb tests okay but the other is still a little bit off. In this case, leave the good one alone for the time being and continue adjusting and testing the other one. When it finally tests okay, go back to the first carb and test it agian. You may have to make a minor adjustment to compensate for the adjustments made to the other carb.

In any event, the goal is to get exactly the same reaction from both carbs when you lift the pistons individually. The key to success is to work slowly, moving the adjusting nuts equal amounts and testing after every adjustment until at least one of the carbs tests okay, then make whatever minor adjustments are necessary to bring the other carb up to snuff. If you try to adjust one carb all at once, then go to the other one, you will probably waste a lot of time going back and forth correcting the setting on the first carb to compensate for changes made on the second, which were made to compensate for changes made on the first, and so on *ad infinitum.*

CLOSING UP: When you are satisified that the mixture is set correctly, install the jet lever return springs and any other miscellaneous parts you removed in the course of the tuning procedure. On dual-carb models leave the rod which connects the two jet levels disconnected for the time being. If you had the air cleaner off while you tuned, put them back on now. Most air cleaners restrict airflow at least slightly, so the mixture may now be a bit too rich. This can be determined by lifting the pistons as already described, then adjusting the jet nuts accordingly. It will usually be necessary to raise the nuts a flat or two after installing the air cleaners. This isn't necessary if you tuned the carbs with the air cleaner in place.

CHOKE & FAST IDLE ADJUSTMENT

TA, TB and TC carburetors have two separate controls to aid in cold starting: the choke or "mixture control" which provides an enriched mixture when the dashboard knob is pulled, and the hand throttle or "slow running control" which increases the idling speed when its dashboard knob is turned. The TD, TF and Y Types have only one control knob combining both functions. The jet control lever and fast idle rocking lever (front carb only on dual setups) are interconnected in such a way that when the choke knob is pulled the mixture strength and idling speed are increased simultaneously. The adjustment of both types is essentially identical.

CHOKE: On dual-carb models the connecting rod which links the two jet levers must be adjusted so that both jets are lowered simultaneously. First make sure both jet heads are tight up against their adjusting nuts, then adjust the length of the connecting rod so the clevis pin can be inserted without altering the position of the lever. Pull back the rear jet lever and release it slowly to see if the return springs are able to pull both jet heads tight up against the adjusting nuts. If not, figure out why. A drop of oil on each of the clevis pins (three per carb) often helps, and should be applied in any event to prevent wear. For obvious reasons, there is no jet lever connecting rod to adjust on single-carb models, but you should still lubricate the clevis pins and make sure the jet head returns tight against the adjusting nut when the jet lever is released. The choke cable is designed to pull the jet levers to the choked position, not to push them back to the normal running position. It's up to the return springs to do that.

Now reconnect the choke cable to its jet lever, leaving enough slack to allow the knob to be pulled out about 1/8" before the jet lever begins to move. If the cable is connected without any slack, it can prevent the jet levers (and therefore the jets) from returning to their normal running positions when the knob is pushed in. Operate the choke knob several times to make sure everything works smoothly. If you find that the choke knob slips out of the detents which hold it in intermediate positions, loosen the cable connection at the jet lever, twist the stranded wire inner cable one turn clockwise (as viewed from the engine compartment end of the cable), and retighten the grub screw. The resulting torsional tension on the cable will tend to keep the knob locked into the detents. Make sure you still have adequate slack in the cable after you've done this.

FAST IDLE: To adjust the slow running control on early models or the fast idle linkage on later cars, turn the adjusting screw until there is about .016 in. (.4mm) clearance between the screw tip and the rocking lever. Make sure you turn the right screw, or you will upset the synchronization on dual-carb models or the idling speed on single-carb models. On the TA, TB and TC the screw you want is the rearmost one on the front carb. On the TD, TF and YT it's the screw closest to you as you face the side of the engine, again on the front carburetor (fig.19). On the Y and YB it's also the screw closest to you, but on the only carb. The purpose of the small gap is to ensure that the fast idle mechanism can't hold the throttle slightly open even when the knob is in full off position.

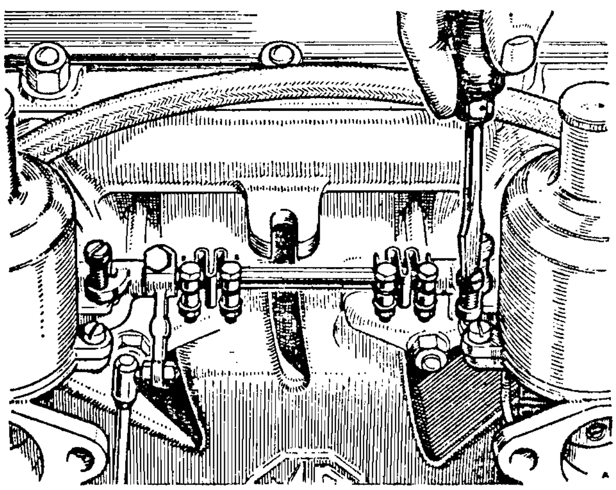


Fig. 19: Allow .016 in. clearance between tip of fast idle screw and rocking lever (TD shown).

The adjustment isn't critical on early models with a separate slow running control knob. The gap should be no less than .016 in. for the reason just stated, but it may be a great deal more than .016 in. if you don't mind having to twiddle the control knob a lot before anything happens. If you find that you have too much gap even with the adjusting screw turned down hard, then turn it back out a bit and take enough slack out of the slow running control cable to give you a useful range of adjustment at the screw. Conversely, if you can't get a wide enough gap even with the screw all the way out, then add a bit of slack to the cable. On later models with a single knob controlling both functions, the gap should not vary very much from .016 in. if the mixture and fast idle functions are to be properly coordinated. If your car has been retrofitted with carburetors manufactured much after the T Series era, you may find that the fast idle is controlled by a snail-shaped cam rather than by the older rocking lever. On this type the gap between the adjusting screw tip and the cam should still be 016 in., but in this case a slightly wider gap will do no harm.

COMMON PROBLEMS

There are a number of problems that can crop up as you tune your carburetors, some of which will make accurate tuning dificult or even impossible. While it is beyond the scope of the "Back To Basics" series to instruct you in a complete carburetor overhaul, I feel I should at least point out some of the more common problems and their remedies.

INABILITY TO ACHIEVE SLOW IDLE: You may find it impossible to slow the idling speed down to the recommended 700-800rpm range no matter how far you back off the throttle adjusting screws. This is usually caused by air leaking into the induction system somewhere between the throttle butterflies and the valves. Grasp the ends of the throttle spindles where they protrude from the carburetors and try to wiggle them around. If they seem to be loose in their bores, then you have found at least part of the problem. New spindles should be installed, and in bad cases it may even be necessary to install bushings in the carburetor body to bring the spindle bores back to standard. The correct (new) clearance between spindle and bore is only .0025 in. Wear occurs rapidly if the spindles aren't oiled frequently enough. It helps to oil them while the engine is idling, so the oil will be sucked into the spindle bores by manifold vacuum.

Defective gaskets between the manifold and the carburetor or between the manifold and the cylinder head are another common source of air leakage. To test for this, brush or squirt oil all around the joint sealed by the gasket. When (or if) the oil fills the leaking area of the gasket, the idling speed will slow down for a moment. A much less messy method is to direct the flow of gas from an unlighted propane torch all around the joint. When you find the leaky spot, the gas will be sucked in by manifold vacuum and the idling speed will increase.

In rare instances one of the core plugs at the ends of the balance tube on the manifold may come loose, allowing air to be sucked into the system. Leaks at the plugs can usually be sealed with silicone sealant or hardening gasket cement, but the only permanent cure is to install a new plug.

Regardless of the source, any air leaking into the system without being controlled by the throttle will make it impossible to adjust the carbs correctly. To compensate for the extra air, you will have to adjust the jet nuts down an abnormal distance to get a smooth idle. Unfortunately, the effects of manifold vacuum on those leaks at different engine speeds and under different load conditions almost guarantees that the mixture won't be right at any speed except idle. The consequences of this can be far more devastating than the simple annoyance of not being able to get the engine to idle slowly.

If you find any leaks, don't try to cure them by tightening the manifold nuts or carburetor flange bolts unless they are obviously loose. Overtightening can strip or break the manifold clamp studs, which are none too strong, and will almost certainly warp the carburetor mounting flanges. The only sure cure for a leaking gasket is a new gasket.

It sometimes happens when a new throttle spindle is installed that the throttle stop arm is pinned on in the wrong position. Normally there is plenty of clearance between the arm and the abutment on the carburetor body, but if the arm is incorrectly positioned there may be no clearance with the result that the throttle cannot close far enough to achieve slow idle. The only proper cure for this is to fit another new spindle, this time being more careful (or more knowledgeable) about the positioning of the throttle arm. Not only does this arm serve to hold the idle speed adjusting screw, but the end opposite the screw also serves as a stop (against the bottom of the same abutment) when the throttle is fully open. The arm should be positioned on the spindle so the throttle butterfly is perfectly aligned with the throttle bore (in other words, wide open) when the end of the arm opposite the adjusting screw is hard up against the underside of the abutment.

If the throttle arm is the cause of your problems you can still use the engine without fear of damaging it. You may not be able to achieve a slow idle, but at least in this case all the airflow is controlled by the throttle. The mixture setting will remain satisfactory throughout the whole range of throttle openings, unlike the situation caused by leaky gaskets.

INABILITY TO ACHIEVE LEAN ENOUGH MIXTURE: If you discover that it is impossible to achieve a lean enough mixture even with the jet nut screwed up as far as it will go, suspect either an incorrectly positioned needle, incorrectly adjusted float level, a leaky float valve, or a leaky upper jet cork gland washer. The first three items have already been discussed, but go through those procedures again if you are unsure of yourself.

Jet leakage is not likely to affect both carburetors equally on a dual-carb engine, but it can happen. If the lower spring-loaded gland washer leaks, the errant fuel drips out around the bottom of the jet assembly. This wastes fuel and is a potential fire hazzard, but has no effect on the mixture except in unusually bad cases. If, on the other hand, there is leakage past the upper spring-loaded cork washer or past the copper washer which fits between the upper half of the jet bearing and the carb body, then the excess fuel is sucked into the airstream to enrich the mixture. This is most pronounced at idling speeds when vacuum at the jet opening is highest, and can make it impossible to achieve a lean enough mixture. Even if you are able to position the jet nut high enough, the mixture at higher speeds will then be too lean, with serious consequences in severe cases. If fuel drips from the bottom of the jet assembly (mere surface dampness may be disregarded), then the top washer is probably also bad. Both should be replaced. See figure 20 for an exploded view of the jet assembly, which may be removed from the carburetor by unscrewing the large jet locking nut. Be sure to recenter the jet before you tighten the locking nut again.

If the carburetors are impossible to set lean enough, and if none of the faults mentioned above are in evidence, then it is permissible to change the position of the needle in the piston. As explained earlier, the standard position is with the squared shoulder of the shank flush with the surface of the piston. If you can't get a lean enough mixture, set the neddle (both of them on dual-carb models) so the shoulder protrudes $^{1}/_{32}$ in. beyond the face of the piston. This enables you to lower the jet adjusting nut by about the same amount, which will usually provide a satisfactory range of adjustment.

JET NUT POSITION NOT EQUAL ON BOTH CARBS: Although we began the mixture adjusting procedure with both jet nuts six flats down from their topmost position, by the time the mixture is correct you will probably find that the final positions are not the same for both nuts. For example, one may be two turns down from the top and the other three turns down. This is perfectly okay. Even with new carburetors there can be a difference of as much as one turn (6 flats) between the two nuts, due usually to slight differences in needle position or internal tolerances. On older carbs the factor comes into play, and the variation in nut position may be even greater. As a rule of thumb, all is okay as long as the difference amounts to no more than two full turns (12 flats). If the final setting results in a difference greater than that, then suspect incorrect float level, incorrect needle setting, or a leaky jet as described earlier. If none of those conditions exist, it is probably just a matter of extreme old age or extreme neglect, and the only cure is to rebuild the carburetors.

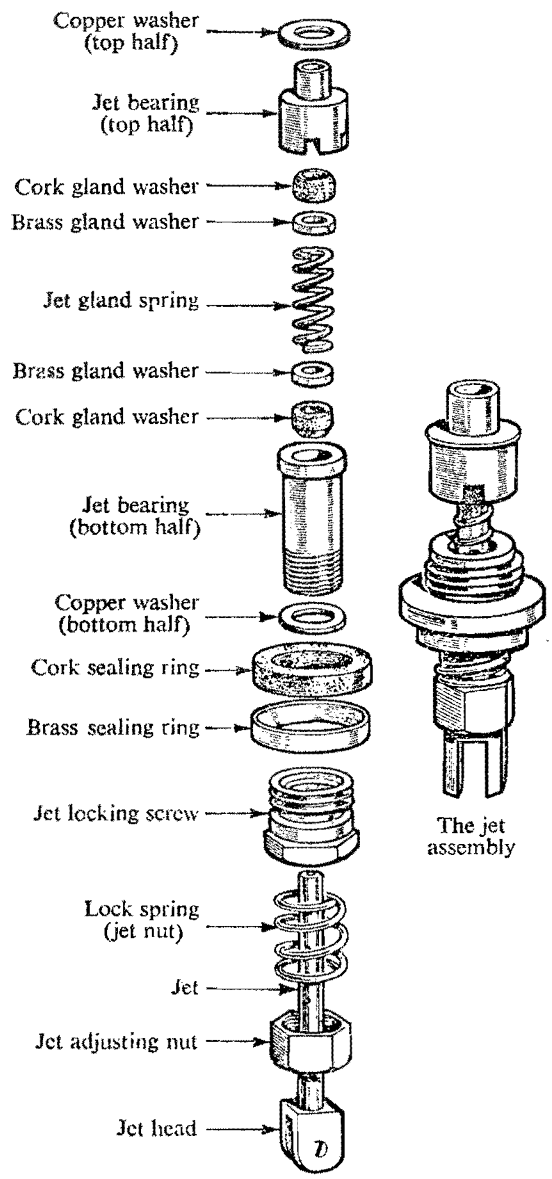


Fig 20: The Jet Assembly

STICKING JET: If, while you were adjusting the mixture, you found that the return spring was unable to keep the jet head tight up against the adjusting nut, then something is causing that jet to stick. This often can be cured by pulling the jet lever back as far as it will go, smearing a dab of petroleum jelly on the shaft of the jet, then working the lever back and forth to distribute the grease evenly. If that doesn't do the trick, unhook the jet lever and withdraw the jet. If there is a burr or similar blemish on the shaft of the jet, work it down with a very fine file, crocus cloth, or 600 grit sandpaper. Don't remove a lot of material from the jet, or the seals will no longer be able to do their job. Lubricate the jet as described above and all should be well. It's also possible that some misguided former owner has substituted weaker return springs, or that the original springs have lost their tension.

POOR COLD STARTING: If your M.G. is difficult to start in cold weather, make sure the ignition equipment is in good order before you start fiddling with the carburetors. At least 99% of all cold starting problems are caused by the ignition system, not by the induction system, so make sure the points and plugs are adjusted correctly and that you have a good fat spark. If the ignition system is okay, then examine the jets and jet linkage. The rich mixture required to start a cold engine is provided for on the S.U. carburetor by the moveable jet. When the choke knob is pulled, the lever lowers the jet in relation to the tapered needle. This creates a larger jet opening and thus a richer mixture. When the jet lever is pulled back to the fullest extent of its travel, the jet head should drop away from its adjusting nut between 5/16 in. and 3/8 in. If it doesn't, your problem may be that the carburetor isn't able to supply a rich enough mixture at full choke. This usually occurs when the jet nut is set quite a way down from its topmost position, say four or five full turns. The "fully choked" position of the jet lever is controlled by a lug on the lever which hits the pressed steel link on which the lever pivots. The "unchoked" position is controlled by the jet head hitting the jet adjusting nut. Thus, the lower the setting of the jet nut, the less the available jet movement and the weaker the mixture in the fully choked mode.

If, when you adjust the mixture, you find that the final position of the jet nut is quite far below its topmost position, then measure the available jet travel as described above. If it is less than 5/16 in., you may increase it by repositioning the needle as much as 1/16 in. deeper into the piston. This allows the jet nut to be raised as equal amount, which in turn increases the available jet travel. On dual-carb models it is best to set both needles the same way even if one doesn't seem to need it. One needle set with the shoulder flush with the piston and the other recessed by 1/16 in. or so will not have any effect on the tunability of the carbs, but this can conceal other faults (jet seal leakage, improper float level, etc.) which might later be brought to light by large differences in the heights of the adjusting nuts.

If recessing the needle into the piston still doesn't provide the required amount of jet travel, screw the jet adjusting nut as far up as it will go. Now the total available travel should be about 7/16 in. If not, you may as a last resort file a small amount off the lug on the jet lever where it contacts the pressed steel link. This will allow the lever to be pulled farther back, but don't get carried away with this cure or the jet may be pulled too far out of its bearings in the full choke position.

Owners of very early TAs and earlier models should note that jet assemblies manufactured prior to 1937 provided a maximum jet travel of only 5/16 in. with the jet nut screwed all the way up. With the jet nut in the normal running position, the available jet travel for cold starting is quite small on these early models.

TESTING ABNORMALITIES: On dual-carb models a certain combination of errors in or omissions from the tuning procedure can lead you down a path so frustrating that you will want to swear off S.U. carburetors forever. The tale of woe begins when you either neglect to synchronize the throttles or don't do it correctly, so that one throttle is open quite a lot more than the other. It is possible under these conditions to adjust the jet nuts in such a way that the idle will be fairly smooth, but only by setting the jet in a very lean position on the first carb (the one with the wider throttle setting) and in a very rich position on the second carb (the one with the small throttle setting). The resulting smooth isle will fool you into thinking these settings are correct, when in fact they are very wrong.

Then, when you lift the piston to test the first carburetor, the engine speed will not change even though the mixture supplied by that carb is in fact extremely lean. Again you are fooled into thinking the mixture is correct. In reality, lifting the piston does not weaken the already excessively lean mixture enough to have any effect on the engine. On the other hand, when you lift the piston on the second carb the engine will slow down dramatically, perhaps even stalling, which leads you to believe the mixture is set too lean even though it is in fact very rich. Your natural reaction is to try to enrich the apparently weak mixture by lowering the jet even more, making things worse instead of better. The farther down you turn the nut, the worse the situation becomes, leading you to lower the jet even more to correct what still tests out as a weak mixture. Seem impossible? Try it some afternoon when you have nothing better to do.

The obvious way to avoid this particular path to insanity is never to attempt mixture adjustment without first confirming that the throttles are synchronized. Never rely on the static method of sychronization by itself, as it isn't accurate enough. Dynamic synchronization is the only accurate method, even if your only measuring gauge is a piece of rubber hose. The use of a Uni-Syn or similar vacuum gauge designed for the purpose is highly recommended.

SHORTCUTS

I hope that by following the instructions layed out earlier the rock-bottom beginner will be able to tune his much-neglected carburetors. Once you are familiar with the procedure, and once the carbs are properly tuned, subsequent tuneups should go considerably faster. As long as you resist the tempation to fiddle with them between tuneups, they should perform satisfactorily for a long time. At the next tuneup they should require only cleaning, testing, and possibly very minor adjustment. The procedure should go something like this:

CLEANING: Always clean the exterior of the carbs as described earlier, if for no other reason than to keep your hands from getting too grimy and transferring some of that grime to the carb's delicate innards.

FLOAT CHAMBERS: Blow through the fuel inlet as described to test the seating of the valve, then use your test rod to confirm the float level setting. It shouldn't need adjustment; anything between 7/16 in. and 3/8 in. is acceptable. Shake the float to test for leaks, and clean out the chamber.

SUCTION CHAMBERS: Clean and test for free piston movement as described earlier. Inspect the needle for wear as described, but don't remove it unless it needs to be replaced. If you did your first tuneup right, you should know what size it is and should have positioned it correctly.

JET CENTERING: Unless you left the jet locking screws loose during your previous tuneup, or unless you have just had to replace the needle and/or jet, the jet should still be properly centered. Test it just to make sure. Screw the jet nuts all the way up, but count the number of flats so you can return them to their original positions. If you hear that telltale click as the piston drops, screw the nuts back down the correct number of flats and go on to the next step. If not, center the jets as described earlier.

SYNCHRONIZATION: Unless you have fiddled with the throttle screws since your last tuneup, the throttles should still be synchronized. Test with your rubber hose, Uni-Syn, or whatever. If okay, go on to the next step, If not, loosen the spindle clamp and twiddle the adjusting screws until the throttles are again synchronized. In any event, they should still be close enough that you can omit the routine with the piece of paper and go straight to the rubber hose or Uni-Syn. Set the idling speed to 700-800rpm.

MIXTURE: The mixture should still be close to perfect unless you fiddled between tuneups or unless you had to adjust the float level, jet centering or synchronization in one of the steps above. Test it by lifting the pistons, making sure the jet heads are tight against the adjusting nuts. If okay, go on to the next step. If not, disconnect the choke cable and jet lever connecting rod and proceed as described under "Mixture Adjustment: Testing and Fine Tuning". If you have trouble getting it right, go through the complete mixture adjustment procedure as if you were starting from scratch.

CHOKE & FAST IDLE: These settings won't need attention unless you altered the throttle screw settings or had to adjust the mixture. Check the choke cable slack, the fit of the jet lever connecting rod, and the fast idle screw gap, but don't bother to change them unless necessary.