UNING H-D's KEIHIN :ARBURETORS

Joe Minton

Harley's been usin' Keihin carburetors for more than a ızen years now and most us still don't know how to ork with 'em. They aren't ıd carbs, but they get ssed a lot an' there have ien sound reasons for ing that, most of which ve nothin' to do with how od the carb is or can be. ow we're gonna tell you how they work and how to make them better.

HOW IT WORKS

The stock Harley carburetor has two gas supply circuits: the idle system and the main system. Below about one-quarter throttle, the idle system supplies most of the gas your engine burns. Gradually, the main system begins to supply gas as the throttle is opened farther and the engine breathes more air and needs more gas to mix with it. By the time the throttle is fully open, the main jet controls all the gas entering the engine. Because these two systems are independent, they can be tuned separately and that's how we're gonna treat them.

Idle System: Description

You have two controls over the idle system: the size of the idle jet and the setting of the idle-mixture screw. The idle jet is located in the float bowl under the rubber plug next to the main jet and has a number stamped on it. The number indicates the size of the hole in hundredths of a millimeter; thus a number 60 jet is 60-hundredths of a millimeter in diameter. The difference in how much gas will pass through a 60 jet when compared to an 88 jet is substantial—the 88 will pass more than twice as much gas!

Just after gas passes through the idle jet, it's mixed with air and becomes an air-gas froth. This gas-air mixture is easier to control than gas alone and will start moving more quickly when the demand suddenly increases. The amount of air that gets mixed with the idle jet's gas is controlled by a drilled hole that is the idle's air jet.

The idle-mixture screw is located at the top of the carb, just before the mounting flange. Since roughly 1978, these mixture screws have been hidden underneath an aluminum plug (to keep us from adjusting our Hogs so they'll run right). You can get this plug out by carefully drilling a small hole through it (it's about 100-thou thick), then prying it out. Be careful not to drill into the screw underneath. A piece of tape wrapped around the drill bit an eighth of an inch from the tip will let you know when you've gone far enough.

The mixture screw controls how much of the gas-air froth gets into the engine when it's at a dead idle. If you look in the carb, you

can see a small hole directly underneath the idle-mixture screw. The screw has a tapered tip that enters the hole you see and limits how much gas froth gets through it. Getting a good idle mixture is as easy as fiddling with this screw until the engine runs clean and smooth. Things are a bit more complicated above idle, though.

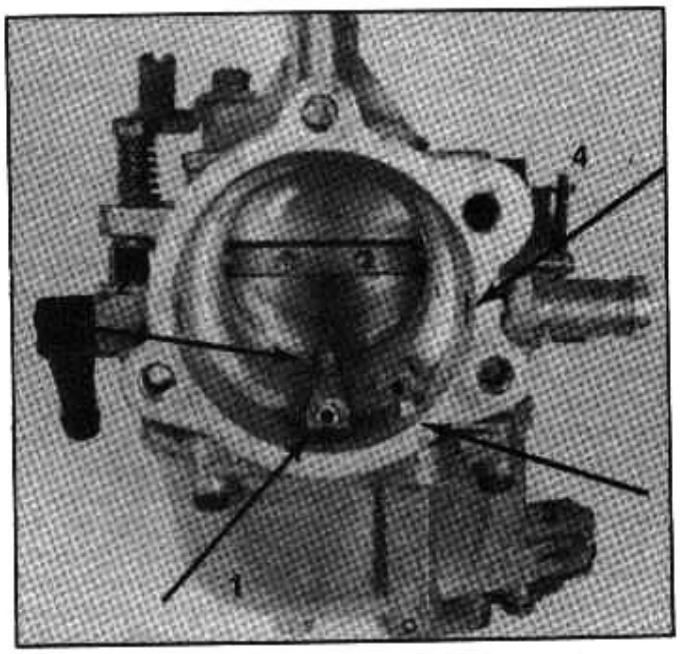
If you slowly open the throttle butterfly while you look at the area where the idle hole is, you'll be able to see a set of holes being uncovered by the throttle plate. Those holes are part of the transition circuit; they control the amount of gas that's added as the throttle is opened and before the main circuit fully takes control. The size, number, and position of these holes control the intermediate gas delivery (approx. ⅛ to ¼ throttle). Another control is the angle of the throttle plate itself. Different angles will uncover the intermediate holes at different throttle positions. You and I can't do a damned thing about either the holes or the angle of the plate, so if they aren't right for the needs of your engine, too bad. However, that rarely happens.

Idle System: Tuning

The idle jet can be wrong by a couple of sizes and still give a good idle. By turning the mixture screw you can make your engine idle with most any size idle jet. If the jet is wrong, though, off-idle performance will be awful. If the idle jet is too large, the engine will run rich as you roll the throttle open. If it's too small, the engine will "lean out."

If the jet's one size too rich, it's likely that it will still run okay, but the mileage will be down some and the transition from idle to throttle-open running won't be smooth. Two jets rich, and it'll load up, stagger, and blow black smoke.

One size lean will cause a hesitation as you slowly roll the throttle open. The mileage might be very good, but you'll probably find yourself using the accelerator pump a lot to get by the leanness on acceleration. Two sizes lean and the thing will buck and jump when it's cold and it might surge when you hold a steady throttle setting at cruising speed. Believe me, if your carb's idle jet is two sizes lean, you'll know something is wrong.



...re lookin' down the throat of a bored (40mm) and modified Keihin carb. The parts described in the text are: 1) the boss that needs to be modified (this one has been) so it won't mess up the vacuum signal to the main system spray bar; 2) the main system spray bar; 3) the tip of the accelerator-pump jet that's always pointed wrong; 4) the plugged hole where the choke shaft came through the carb (note that the mouth of the carb has been smoothed). This thing passes a lotta gas.

Before you can tell whether your carb's idle jet is the right one or not, you'll need to adjust the idle mixture. After warming your engine to normal running temperature, adjust the mixture screw until the idle's smooth and clean. If, while you're doing this, the idle speed creeps up, bring it down again with the speed screw. You can't get the idle mixture right with the engine running at two grand. The idle mixture will be correct if the engine idle speed drops when you turn the mixture screw either way.

The first time you do this, it'll probably take so much time that the engine will get too hot. So after you think the mixture adjustment is right, take a short ride to get the temperature back to normal and check the adjustment again.

One of the simplest ways to make a rough check for the correct idle jet is to count the number of turns the mixture screw must be opened to get a good idle. Keihins like to have their mixture screws ½ to 1¼ turns open. By the way, when you seat the mixture screw, do it gently or you can mess up the hole it seats in.

If you get best idle at less than the ½-turn open, the idle jet is too big. If it takes more than 1¼ turns, the jet will likely be too small. After you get the idle jet size right, you can refine the engine's response with the mixture screw. There'll be some leeway in the adjustment and you can use that to get the off-idle response just so.

When the idle jet is correct and the mixture screw is set properly, your Hog will idle smoothly and come off idle with no smoking or hesitation. Not only that, but it'll accelerate hard and get the best compromise between power and mileage.

Main System: Description

The main gas system is simpler than the idle system and easier to tune. Like the idle system, there's a supply of air that gets mixed with the gas coming through the main jet to make it easier to get things going when you open the loud handle. The main air jet is located in front of the main system's spray bar. Its that tube sticking out toward the air cleaner at the bottom of the carb's mouth. The main system spray bar sticks out of the floor of the carb in front of the butterfly and the main jet is screwed into the carb body just below the spray bar. Holes in the spray bar let air from the correction jet mix with the gas from the main jet.

When the flow of air through the throat of the carb is great enough, gas begins to flow out of this spray bar. The greater the air flow, the more gas that's pushed out of the spray bar by the pressure in the float bowl.

While it's simpler to talk about gas being "sucked" out of the spray bar, that isn't accurate and will get in the way of your under-

standing just how a carb really works. When air flows through your carb there's a pressure drop in the thoat. The faster the air moves, the greater the drop in pressure. It's the difference in pressure between the throat of the carb and the normal pressure in the float bowl that causes gas to flow out of the spray bar or idle holes. If you happen to pinch off the breather tube to your carb's float bowl, or point it into the wind, you can alter the pressure in the bowl and mess up the tune of your carb. A carb float-bowl breather should be in still air to make sure that it will work right.

Fuel begins to flow out of the main system's spray bar at about ⅛ throttle. It will now be delivered by both the idle system and the main system. As you open the throttle farther, the main system will deliver more of the gas needed, until at full throttle it delivers nearly all of it.

Remember that rubber plug I mentioned earlier? All the gas that goes through the Keihin carb must pass through the main jet first and the idle jet is fed by gas flowing through the main jet. If you leave that plug out, you'll bypass the main jet and your engine will run like it has the choke on, so be sure that plug is in place.

Both the main air-correction jet and the spray bar are fixed and you can't change them very easily. Your control over your engine's full-throttle mixture strength is with the replaceable main jet.

Main System: Tuning

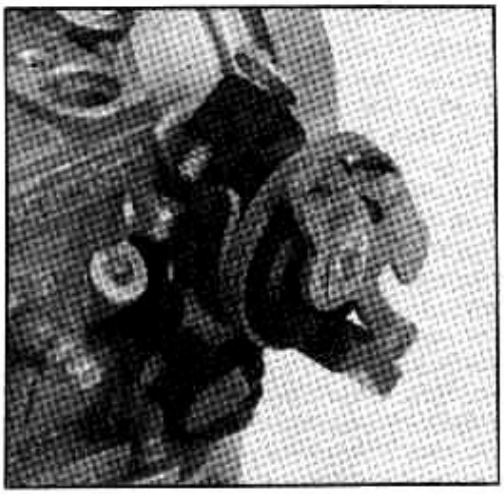
Find a place where you can get up to the national speed limit in safety. Put your scoot in a gear that will let it run near peak torque (3500-4500 rpm). As you accelerate at full throttle, suddenly shut down to ⅞ throttle. If the engine picks up speed, the main jet is too lean. If there's a hesitation before the engine clean up and runs smoothly, the jet is too large. If the engine simply slows down a bit, the jet is within one size of being right.

When you get your main jet to this point, the tuning gets a bit harder. Wait for a cool, dry day when the air is as thick as it's likely to be and make the same test again. If the jet you have falls between too rich and too lean, it should be all right, since few of us spend enough time at full throttle to worry about having the main jet perfect. If you want it just right, you can fiddle with sizes on either side of the one that seems right and if you truly notice a difference in response, speed, or mileage, go with the jet that gave it to you.

Harley does not have a complete line of main jets and you may have to drill a small one to get what you want. Jet-drilling isn't the best way to tune, so you should use factory jets when you can. However, if the next jet (up or down) is too big a jump, the drill will have to do.

Accelerator Pump: Description

All the Keihin carbs we've seen have worked much better after tuning the accelerator pump circuit. Remember how the amount of gas flowing out of the spray bar depends on the difference in pressure between the float bowl and the throat of the carb? And how that in turn depends on how fast the air is moving through the carb's throat? Well, when you open the throttle suddenly and the engine is running at low rpm, air moving through the wide-open carb will be goin' pretty slow. The pressure difference won't be very much and the damned thing will lean out, possibly so much that it won't get enough gas to run.



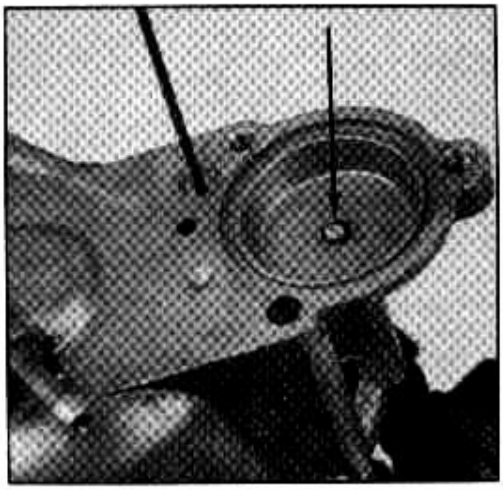
The drill bit shows where you have to drill the float bowl when I convert to the better, old-style accelerator pump and the arrow indicates the tip of the accelerator-pump rod. You should grind the rod so it's flush with the casting it sticks through.

Besides, when you open the throttle, you want power, not gas economy. The mixture strength that gives smooth running at cruise and good gas mileage is on the lean side and isn't best for maximum power. Between the normally lean cruisin' mixture and the fact that you are leaning it out more by yankin' the throttle open at low rpm, your engine isn't gonna work too well. That's where the accelerator pump comes in.

When you open the throttle from a low setting, the Keihin's accelerator pump forces gas into the throat of the carb. By the time the carb is at roughtly ¼-throttle the pump travel is used up and it's out of the circuit. At ¼-throttle, the velocity through the carb will be high enough so that the pump isn't needed.

The accelerator pump is operated by a rod attached to a spring-loaded bell crank mounted on the throttle butterfly shaft. When you open the throttle, the spring is wound up and forces the pump rod down. How far the rod travels determines how much gas is forced into the carb's throat. Early Keihins had a screw that could be moved to control the pump-rod throw and thus the amount of gas getting in the carb. Later carbs don't have the screw, but they still have the hole it went in. You can run a screw into the hole and get some control over how much the pump actually pumps.

The rod pushes on a rubber/fabric diaphragm mounted in the bottom of the float bowl. A series of passages and check valves



Photos by Joe Minton

running a screw into the accelerator-pump crank like we did, u can adjust the amount of gas pumped into the carb's throat with each stroke. If the pump delivers too much fuel, the engine will load up when ya grab a handful at low rpm.

in the bowl let the action of the diaphragm take gas from the bowl and force it through the pump jet and into the throat of the carb.

How much gas gets pumped depends on the stroke of the rod and how far open the throttle was when you opened it the rest of the way. How fast the pump's gas is delivered to the carb depends on the strength of the spring pushing on the pump rod and the size of the pump jet. You can control the rod-throw, and therefore the volume, with the limit screw (or the one you install). You can control the rate of delivery with the size of the pump jet. The volume and delivery rate aren't the only things you can control, though. There are more important problems with virtually every Keihin accelerator pump.

ccelerator Pump: Tuning

Every pump jet leaves the factory pointed so that all the gas is squirted into the rear cylinder. That leaves the rear jug too rich and the front one too lean when you open the throttle. The pump jet is a press fit in the float bowl and is hex-shaped. You can turn it with a small wrench. Start by removing the air cleaner so you can see into the throat of the carb. Operate the throttle—*no smoking*—and watch where the pump jet delivers the gas. See what I mean?

Now, remove the bowl and turn the jet the amount you think it needs to point into the center of the back of the manifold. Reinstall the bowl and check the jet's direction. The gas should hit in the middle of the throttle plate or the center of the back of the "y" manifold. This small change will do much to make your bike pull smoother and more strongly from low rpm.

Many of you have trouble with your engine loading up when you're puttin' around town, but experience no problems at interstate speeds. While this can be due to incorrect tuning of the idle circuit, it can also be caused by the accelerator pump working all on its own. It seems that if the pump rod's too long, it'll jiggle the diaphragm and cause it to dribble gas out the pump jet and lie on the floor of the carb. If the rod length is adjusted so that it's flush with the bottom of the bloat bowl (when the throttle is closed, of course), that won't happen. Shortening the rod doesn't have any noticeable effect on the way the pump circuit works, other than getting rid of a problem you may or may not have. Do it.

There are two pump jet sizes: 60 and 80. Like the idle jet, the number is also the diameter of the jet orifice in hundredths of a millimeter. The 60 is better than the 80. I'm convinced that a 50 would be better still. The size of the jet determines how long it takes to deliver one squirt of gas. The bigger the jet, the shorter the squirt will last. Also, a small jet will spray its gas into the carb when the throttle is opened slowly, while the larger jets will let it dribble along the floor of the carb where it won't do a lot of good.

You can't buy either jet unless you buy a float bowl, and ya can't get the early (prior to '77) one anymore, which had the 60 jet. You can, though, solder up an 80 and redrill it. A #76 drill will give you about a size 50 jet. You might have to clean the solder out of the large hole with a drill, but it's no big deal.

Kiehins installed on Harleys since 1980 will not refill their accelerator pumps as quickly as those made earlier. The earlier pump would refill in about half a second; the new one takes three. The early pump will allow you to get by without the choke and will help you catch the engine if you let the clutch out too fast at a light. The main difference is the pump housing bolted over the diaphragm on the bottom of the float bowl. If you drill a 1/16-inch hole in the bowl of one of the new carbs and install the old pump housing, you can have the old-style accelerator pump. Old-style pump housing is available from Andrews Products as a kit with instructions, or get the part alone from your Harley dealer. This is a good thing. Do it.

Other Things:

If you are overhauling a well-used Keihin, be sure that the mounting flange isn't warped. Check it against a flat surface such as a window and make it flat with a file or wet-or-dry paper on a flat surface. If you don't make it flat, it might leak air and drive you nuts from trying to figure out what's wrong.

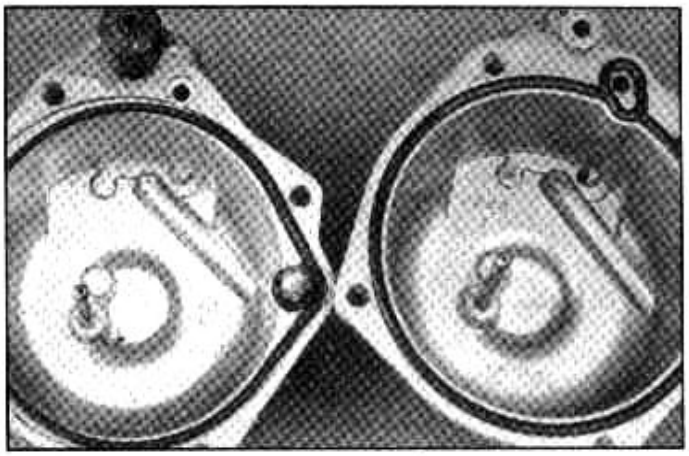
Most of us overlook our carb's float level. If it isn't right, you won't be able to tune the carb. If the gas level is too far off specifications, the carb will be too lean or rich at low throttle settings and you won't be able to tune it out. Check the level—ya only have to do it once. You'll find a float level diagram and instructions in your factory shop manual.

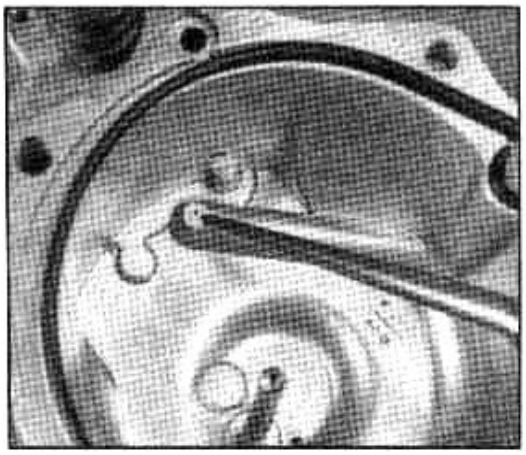
The difference in performance between a stock carb and one that's had these changes made will blow your mind. Your scoot will start easier, warm up quicker, accelerate better, run smoother, and make more power. It's cheaper than buying another carb and bolts up with all the stock parts. ■

HOW TO PUT OUT THE FIRE IN YOUR CARI

"Hey, bro, your right knee's on fire!"

By J.D. Chandler





Late-model shovelheads backfire through their carbs. It can be embarrassin'. I mean, ya roll up beside a chick at a light and start hittin' on her. Just when she's breathin' heavy and about to park her cage and go for a putt on your scoot, a ball of fire rolls out of the velocity stack, burns your knee, stops the engine and — she's gone!

Maybe you don't know it, but some bureaucrapper in DC is laughin' his ass off just thinkin' about what he's done to you. The feds wanted clean air and they didn't care who they put out of business to get it. "Clean air" has cost the stock Sportster a couple of seconds in the quarter and burned the pants off a bunch of us.

Ya don't have to live with balls-o'-fire comin' out the wrong end of your 1980-or-later shovel's carb. It can be fixed — easy.

The backfiring, the slow warm-ups, and a lot of the lousy acceleration of late-model shovels and Sporties comes from EPA carburetion. By the time Harley got the carb so that Uncle Sugar was satisified, the fucker would barely pass gas. Like I said, though, you can fix that.

Harley can take some of the blame, too. They haven't had sense enough to look down the throat of their carbs to see if the accelerator pump feeds both jugs or just one. (It feeds just the rear one and you can fix that, too.)

If all this fixin' sounds like too much work, relax. You can do it inside of the time it'll take ya to sip your way through a six-pack.

First thing ya gotta do is take off the air cleaner and check out which way the accelerator pump jet is pointed. Turn the fuel on and open the throttle all the way. When you do that you'll see fuel squirt from the pump jet, through the carb and into the Y-manifold. If your carb is like every one of the fuckers I've worked with, all the gas from the pump jet will go into the rear cylinder. If ya haven't sucked down too many suds to see straight, figure how much you'll have to turn the pump jet to make it point into the center of the manifold. The pump jet is pressed into the float bowl and can be turned with a small wrench. Later, when ya have the float bowl off, you'll be able to turn the jet until it's right.

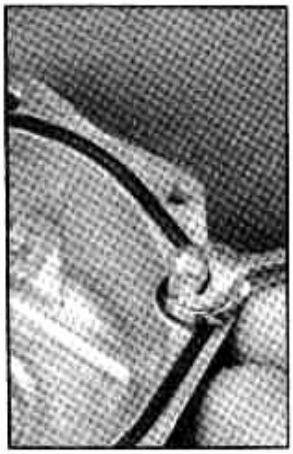
Scrape the empties off yer bench and lay down a clean rag to put the carb parts on. (Yer ol' lady might have one she's been savin' to wear to her mother's.) Take the float bowl off an' pay attention to where the accelerator-pump operating rod goes at both ends. It ain't no big deal if you look at where it goes before you drop it on the floor.

With the bowl off, you can get to the pump jet that's pressed into it. Now's the time to turn it as much as you think it needs to go. If, when you check it out later, it isn't just right, you can re-aim it in a few minutes now that ya know how.

Accelerator Pump: Turn the bowl over. Remove the piece bolted to the bottom of the float bowl. There'll be a rubber diaphragm and a coil spring under it. The spring goes between the diaphragm and the small part you just took off. You're gonna need the earlier version of this piece. Harley calls it "HOUSING, accelerator pump" and they give it part number 27364-76. It'll run ya under ten bucks and it replaces the piece of crap you got when you bought your scoot. Between this part and the changes you're about to make to the float bowl, you'll soon have a pre-EPA accelerator pump. Then when ya give yer Hog a boot in the butt, it'll move and not lay down on ya.

Now, turn the bowl back over so that you can look at its insides. See that little hole drilled on top of the accelerator-pump jet passage? That's part of the problem. That hole bleeds some of the pump's gas back into the bowl instead of getting it to the cylinders. You're gonna plug that fucker.

Before you mix a batch



Photos by J.D. Chandler

of epoxy, though, drill a hole (as shown in the photo) to feed gas to the new pump housing. Use a small drill no more than ⅛" in diameter. Be sure that you center the hole in the dimple on the bottom of the bowl. An O-ring (P/N 27360-76 — you'll need one) must seat around this hole and if you use a big drill or wander too much, you can screw it up. It really ain't no big deal if ya pay a little attention.

Mix the epoxy and put a drop over the tiny hole drilled by the factory. I use JB Weld. It works and won't run off or into the hole before it sets up. Set the bowl aside for the epoxy to cure.

When you put the carb back together, you'll have an accelerator pump that'll deliver more than twice what it would before. Instead of re-filling in three seconds through the wimpy hole you plugged, it'll do it faster that you can shut the throttle and get another run at it. Instead of bogging when you roll 'er on in top gear, yer scoot will haul ass!

Jetting:

Once the pump is straightened out, it's time to do something about getting gas into yer engine the rest of the time. The main reason for the backfiring through the carb is that the idle jet is too lean and the mixture-screw adjustment has made it even leaner. Not only that, but the fuckers in DC made Harley cover the idle-mixture screw with a plug. We're gonna fix both those problems — right now.

At the top and back of the carb, next to the mounting flange, there's a cast lug with a plug of aluminum in it. The idle-mixture screw is under that plug. Using the same drill bit ya used to make a hole in the float bowl, drill through the soft aluminum plug. If you go too far, ya might fuck up the screw, so put a piece of tape around the drill an eighth of an inch up from the tip to act as a marker. Drill through the center of the plug until you touch it with the tape. You can use the shank end of the drill to pry the plug out and expose the mixture screw.

Turn the carb over so you can get to the jets. Take the rubber plug out of the hole that the idle jet screws into. Use a small slot-type screwdriver to unscrew the idle jet. There will be a number on the jet (say, 50, for instance). Go to your Harley dealer and buy the next size up (or, in this case, a 52). These jets aren't listed in any one place and you might have to search through a couple of parts books to find what you need.

A lot of mechanics drill jets. That's a *second* choice because it ain't reliable. No two drilled holes are the same and it's easy as hell to make the one you have too big. If the jet's too big you can still get a good idle, but the off-idle response will suck. Your engine will load up and mileage will go completely to hell. Find the jet if you can. If you have to drill, get a drill bit that will just nick the hole and run it through with a pin vise instead of a drill motor.

Okay. You're almost done and it's time to put the carb together, get it on, and go out for another six-pack.

Put the new idle jet in and replace the rubber plug. Assemble the new pump jet housing onto the float bowl. Be sure that the spring is between the diaphragm and the pump jet housing, and that both the old and the new O-rings are in place.

Fit the float bowl to the carb body. You'll need to guide the accelerator-pump rod and its rubber boot into place as you install the float bowl. Check to see that the O-ring between the bowl and carb body is in its groove.

Be sure that the carb gasket (between the carb and manifold) is in good shape, or better yet, replace it. Before you bolt the carb on, run the mixture screw in until it bottoms (easy does it!) and back it out one-and-a-half turns. Bolt the carb on and hook up the cables and gas line.

Turn on the gas and check for leaks (there won't be any, but it looks good to say it on paper). Now, fucker, turn the throttle and just watch what happens! Remember how much gas it squirted before? Pretty different now, huh?

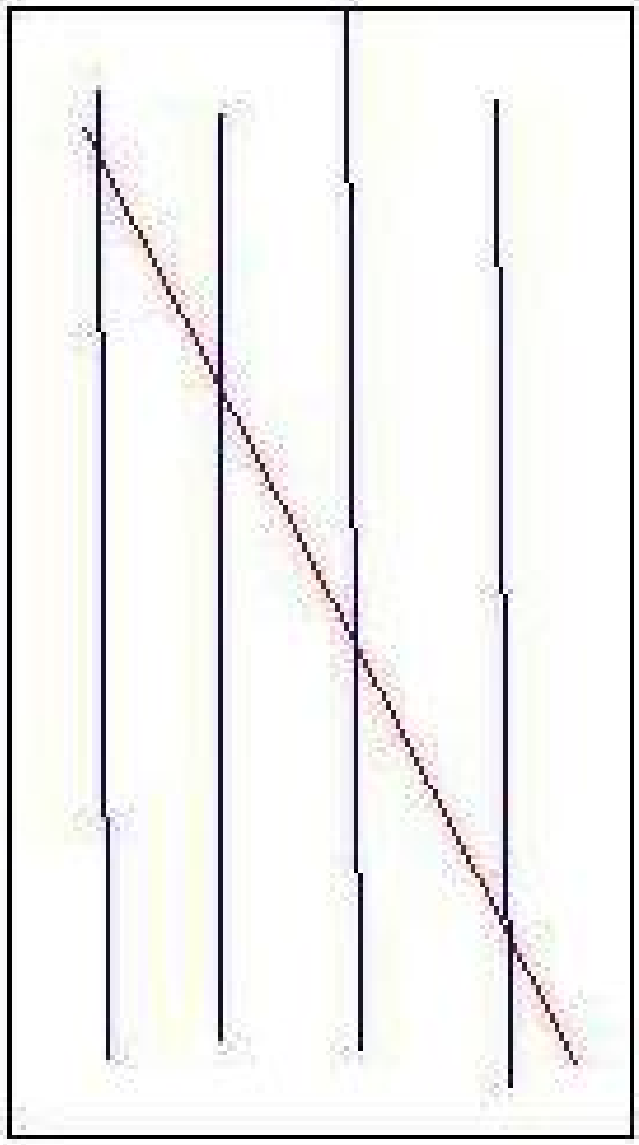
While you're drownin' your engine (and if you're not too fucked up to see), check where the pump is pointin'. If the gas stream isn't hitting the middle of the manifold and splattering into both jugs, take the float bowl off and move the jet a little more.

Fit the air cleaner and warm up the engine. When she's warm, adjust the mixture screw so that if you turn it either way, the idle speed drops. Or, putting it another way: You want to adjust the mixture screw for maximum idle speed. If the idle gets too high while you're doin' this, back it down with the speed screw over the throttle cables. Don't take all day doin' this, because if the engine gets too hot you won't get the adjustment right. Anyway, you'll want to recheck the mixture screw after you ride a few miles — just to be sure.

You just ain't gonna fuckin' believe you've got the same bike when you're through. It won't belch fire, it'll pull away smooth, and you'll have to get used to grabbin' the bars when you roll 'er on. ■

Rear Cylinder

Front Cylinder



Acc. Pump Nozzle

Air Intake