

The Stromberg Mixture Control on the C-85 and C-90, Truths and Tales:

In the 1979 July issue of the West Coast Cessna 120/140 club newsletter, the then-president of the club did all who would listen a great big favor by not believing the all-wise mechanics who “knew” that the Stromberg mixture controls offered no advantages. Here is some of Doug’s report.

The Much-Maligned Stromberg Carburetor by Doug Williams

“The Stromberg mixture control works and works well.”

Those words, slightly altered, were Doug and Carol Williams great contribution to the high flyers, much appreciated by those affected by the knowledge they learned and passed along. (West Coast Newsletter.)

My wife Carol and I researched among knowledgeable AI’s, club gurus, old-timer mechanics, microfilm files, AD notes lists, and in the Cessna factory material in the club archives. The important findings are:

1. There is no AD nor a Service Letter to de-activate the Stromberg mixture control.
2. The mixture control is effective and works fine when properly used.
3. There are advantages.

Better climb rate at altitudes necessary to get over mountains.
Better speed at the higher altitudes because of higher RPM’s
Higher engine speed at high, hot takeoffs
Greater engine power during go-arounds at high, hot landings
And, they use less fuel

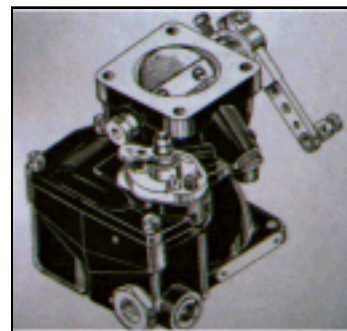
You will find that up until 6,000 feet or so, you will use very little leaning; but we have used as much as half the travel of the control on 11,000 feet takeoffs. We find the plane works best at 8,000 to 10,000 feet and in the midwest it is often cooler and smooth there when it is hot and bumpy below and some hangars in the west are “on the ground” at 6,000 MSL. Over the seven years of using our mixture control, we have found it to be reliable, and in some cases absolutely necessary---we could not have climbed out of some of the fields if we had been drowning the engine in “full rich”.

Don’t start using it without some investigation, for several things could be wrong with it (someone had taken a plate from Doug’s).

Why were they wired closed?

Some planes were purchased without the mixture control push-pull cable and label (it was an option and you could save a pound) because so many went to locations where they never expected the plane to see a mountain. Salesmen may have guided the purchasers in slicing “unnecessary things” off the plane in order to make the sale by stating: “.....you won’t need it the way you fly, so why get it?”. Student pilots when our planes were being built never saw or used a mixture control during training, and so knew of no advantage of having one. None of them flew over mountains, nor did anyone at Cessna.

By far, the majority were wired closed because of the old tale which still circulates that the mixture control “does nothing”. Recall that, in “those days”, density altitude was yet to be understood and there was no appreciation of how severe a change in density altitude could be caused by high temperatures. Later, when the plane was re-sold to someone where there were mountains and very hot days, the legend was in force.....and unchallenged and a great detriment.



A&X:

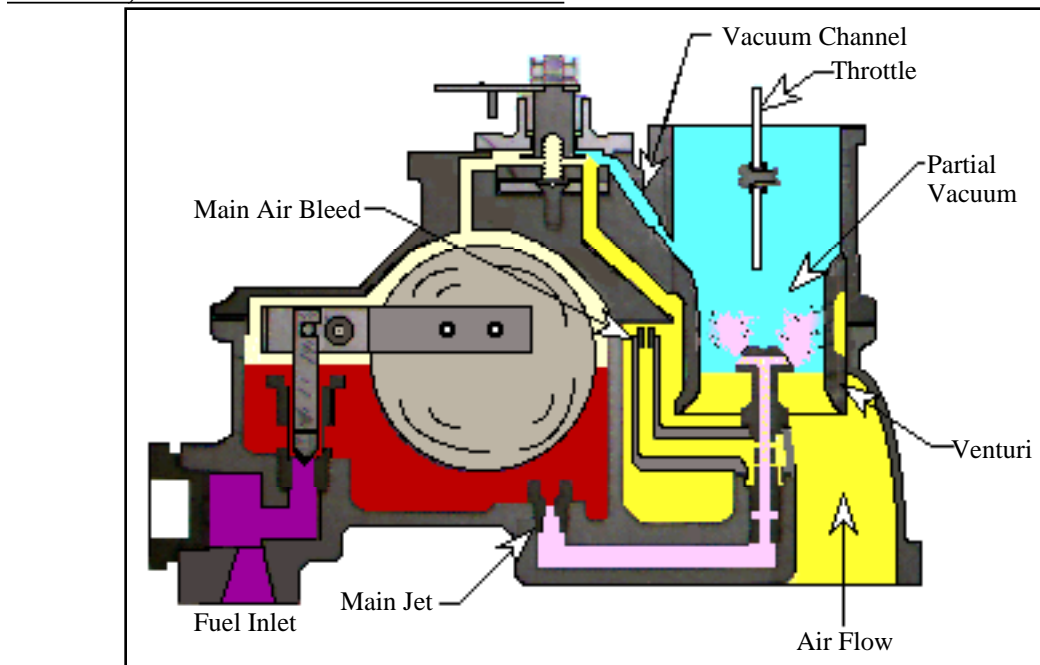
As always, discuss what you would like to do with your A&X and show this article to them. Many of them, trained on jets, lack this howto and most appreciate learning these facts.

Benefits:

The benefits of having a usable mixture control are these: 1) higher power, higher RPM's as you climb above the 5,000 foot density altitudes; 2) more power for high altitude takeoffs, landings, and go-arounds; 3) you could climb higher for cooler rides, with less turbulence and greater efficiency; 4) the ability to rise to altitudes for a greater margin to get over mountains; and 5) a reduced fuel usage.

For one of our members, it was a memorable day when he and another member were trying to get over the mountains headed to Oshkosh from California; in the years he had owned the plane, he had never used the mixture control. That day, struggling "up" and falling behind the others, his companion suggested he try the mixture control; he did, and the extra RPM's astounded him....he became a believer!

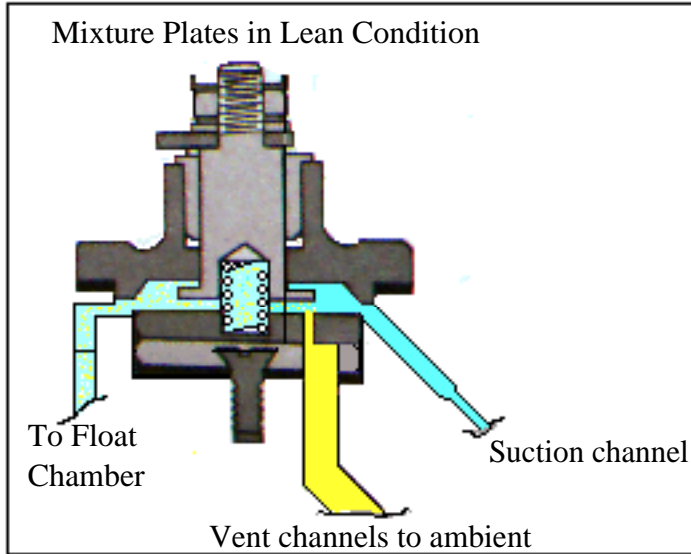
Function, how the mixture control works:



Just a tiny bit of carburetor lore. The float chamber is initially ported to near-ambient air pressure with that ambient pressure being picked off within a chamber between the venturi and the casting wall as seen here by the yellow channel to the mixture chamber. Air and atomized fuel rushing through the constriction known as a venturi in the throat of the carburetor creates a partial vacuum, and that vacuum can be used to create a back suction on the fuel in the float chamber. The difference in pressure between the fuel in the float chamber and the fuel at the exits of the fuel nozzle in the throat of the carburetor determines how much fuel is injected into the airstream of the carburetor.

The partial vacuum can modify the mixture by reducing the amount of fuel which is ejected from the nozzle and this is done by changing the proportions of ambient air and vacuum which are sent to the float chamber. The reduction of the magnitude in pressures between the fuel at the nozzle and the main pool of fuel reduces the rate at which the fuel flows into the carburetor throat and to the cylinders.

The concept that remains is how to accomplish the control of how much vacuum feedback to the carburetor's main pool of fuel. The ratio of the vacuum to ambient pressure is controlled by two round plates in the mixture control chamber; the top one having a series of holes, from a large to quite small, and the bottom plate has a single large hole.



The bottom plate in the mixture control does not rotate and has a single big hole through which the near-ambient air is meant to pass. The top plate rotates as you pull the mixture control knob. In the full rich position, the same-sized big holes of both plates are aligned, so ambient air is predominant in the float chamber. In this position, the pressure differential between the fuel in the chamber (at ambient) and the fuel at the nozzle is the greatest and so the mixture is rich. As the top plate of the mixture control is rotated toward lean, its large hole is blanked and progressively smaller holes coincide with the hole in the bottom plate, thereby increasing the ratio of lower pressure (vacuum) air

to the fuel chamber. As less and less ambient pressure air is let into the float chamber, the differential pressure between the fuel in the chamber and at the openings of the nozzle decreases, reducing the amount of fuel released from the nozzle, thereby leaning the mixture.

Removal of the Carburetor:

Sometimes, removing more than appears necessary is the best and easiest path and this is a true case. It is easier to take off the stack of components consisting of the airbox, carburetor, and induction spider (new hoses for the spider warranted?) and then, with the assembly on the bench, separate the carb from the air box and the induction spider. You can take the carb off the spider when on the plane, but the wrench work is very awkward.

Take it apart, possible faults of neglect:

Doug and Carol had the services of a thorough AI when they asked to have the mixture control hooked up and that AI did the right thing. Instead of just connecting the cable and removing the safety wire at the mixture control, he took the carburetor apart, there to find: Surprise!! there was no movable mixture control plate in it! If he had just hooked it up and found that it did nothing, it would have supported the old tale: "...that control doesn't do anything anyway..." and let it go at that. There is no hint in the manuals that the mixture control can be checked on the ground, even at sea level, and the Continental rep at Oshkosh misled attendees at the forums many times because he did not know this carburetor.

More reasons to take the carburetor apart to be sure include these findings. Other possible errors: 1) the parts can be installed incorrectly or may be missing; 2) the channels through which the ambient air and venturi vacuum are routed can become blocked with carbon; 3) the float chamber and/or the mixture control space are not leak-free because of faulty gaskets or the casting has become distorted and cannot seal; 4) the plates have been scratched such that they no longer are leak free between them and so must be re-smoothed; and 5) the holes in the mixture plates can become blocked with "dirt or blowback carbon". Take it apart and make sure it is all there and both chambers are properly sealed.

Another tidbit of physics to explain why scratches of the plate-to-plate interface can affect mixture control; some dense metals can have their surfaces made so flat, so smooth, that when you allow two with this characteristic to mate flat surface to flat surface, you cannot pull them apart and the interface is leak-free. They can be slid apart, but not pulled apart, and the plates in the mixture chamber are that type...leak free because of the flatness and smoothness of their surfaces. If they do not mate this way, you will have a leak between plates, altering the mixture you want.

The parts investment to take a look amount to about \$20 for the gasket set and \$1.40 and \$1.10 for the above and below gaskets, all available at Aircraft Spruce. In the stackup below, note the gaskets just for the

mixture control; under the bottom plate, around the stem, and between the cap and the carb body. All have to combine to provide the necessary sealed chamber.

Mixture parts stackup:

From the bottom up: gasket, bottom mixture plate, screw to hold bottom plate immobile, top plate, spring, stem, gasket, gasket, cover assembly, lever and rawstock (nuts, washers, screws). The gaskets serve to make the chamber leak-proof---if a leak is allowed, the differential pressure needed for mixture control disappears. The same is true for the gasket between halves of the casting for the carburetor but a leak there goofs not only the mixture control's function, but the mixture upstream of the nozzle. A main gasket showing signs of fuel weeping is a sign to get it fixed right away and to readjust the fuel level! The third hole in the bottom plate is to fit over a pin in the casting to prevent incorrect assembly, the same reasons the slot in the top plate and matching protrusions on item 15, the axle/stem, are there.

Control sensitivities and what to do about it:

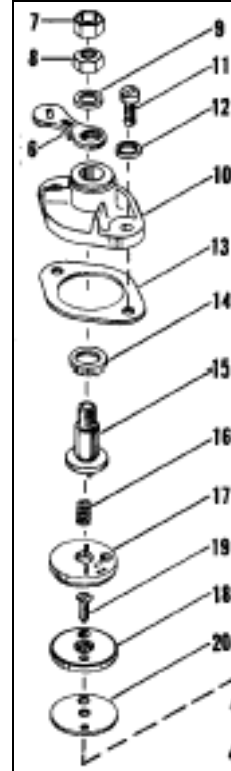
From discussions with others whose planes have the mixture control in working condition, some are put off using it by the error which Cessna made in the length of the mixture arm and therefore in the distance the control knob moves out for the mixture change to take effect. The wife of one owner was so startled by the sudden loss of engine power and noise at cruise the first time her husband pulled the mixture control too rapidly and too far that she edicted: never touch that thing again!

The movement Lean to Rich in the cockpit is just about an inch and is much too sensitive on the planes as built. Some of us were lucky enough to purchase planes which had modified control arms so that the control range movement in the cockpit was two inches instead of one. This lucky mod decreased the sensitivity and allowed more movement while sensing the trend. See page 9 for a figure of the extension and discuss with the A&X.

How to use the Mixture Control?

Over the years, several "how to" guidelines have been established. Those printed in the newsletters and the Continental manual work the best.

1. From the Continental manual. In stable level flight above 5,000 feet with the throttle set for cruise, move the mixture control toward lean and observe an increase in engine speed and then a decrease in engine speed as the mixture is pulled further; when the peak RPM setting has been determined, move the mixture control slightly toward the rich setting until the engine speed is just below peak. Go to full Rich below 5,000 feet. (Today, consider density altitude rather than just MSL.)
2. From the Stromberg overhaul manual. No comments.
3. Newsletter. In flight, when you want to adjust the mixture, pull the knob slowly back until you see a rise in engine RPM's. Continuing, you will observe the peak RPM setting and then push in slowly until you are just on the Rich side of peak.
4. Newsletter. In flight and stable, change from Both magnetos to either Left only or Right only and adjust the mixture control for peak RPM's. Then return to Both for the magnetos without changing the mixture control.
5. EGT-equipped planes. Pull the mixture control back slowly until the maximum temperature is observed and then advance the mixture control slightly to reduce the temperature from the peak.
6. From the Cessna 120/140 manual. Same as the Continental coverage.
7. Logic. Considering density altitude effects, if you are sitting at an airport where the temperature may have changed the density altitude higher than the magic "don't lean below 5,000 feet MSL", try it. If you get a speed increase, you have your answer.



Rumors and rumor killers:

1. For several years running, the Continental rep at the 120/140 forum at Oshkosh would give this response to this question:

Q. Can the Stromberg mixture control kill the engine on the ground?

A. There is a leak if the engine dies when you pull the mixture.

A. Wrong answer. Yes, it can kill the engine if pulled on when the engine is running at 1,800 or so...but it cannot or should not stop the engine when the throttle is at idle range. A leak would make the mixture control ineffective, making it unusable, but it is conceivable that plugged tubes or holes could cause a stoppage. See the colored figures.

2. Stromberg carburetor mixture controls should only be used above 5,000 feet (Continental C- manual).

A. Better would be to say: the mixture control will normally be ineffective below 5,000 ft above sea level at standard temperature and pressures but it should be used anytime its application improves the engine output, such as when the temperature and pressures are not at standards.

And in an old Stromberg manual, the note that one should never lean when at full power at low altitudes; rather, use the rich setting to keep the engine cooler and prevent pre-ignition in the cylinders. As the altitude increases, you can't achieve full power, so it is safe to lean. The other implication in this is: never lean at low altitudes at less than full power because you might go to full power while still in the lean condition and such a condition can rapidly cause pre-ignition and damage to the cylinders.

Apply it at runup and see if there is more engine power. To take off from a field at a physical 4,999 feet above sea level on a 90 degree day without using the mixture control is to rob you of performance that is always welcome.

Ground effects:

Time after time, authors have repeated the statement: "you can't kill an engine with the Stromberg mixture control". Wrong and double wrong. What you cannot do is kill the engine at IDLE with the mixture control but you can kill the engine with the mixture control and it serves as a good check before you leave the ground that the mixture control is effective.

How do you do the ground test and kill the engine on the ground, even at sea level? The first time you do this, be prepared for some odd noises. At about 1,800 RPM, pull out the mixture control all the way and hang on. There is the strangest gasping, jerking engine rundown that ends when the engine quits. What you have done is so leaned the mixture that the engine cannot run, and it never "catches up" from the leanness. For subsequent ground checks, you need not let it run all the way down but simply verify the dip in engine speed and then return to Rich. It works! And you won't doubt that it will work later at altitude. Don't forget to pull the throttle closed before restart if you do let it run down to a stop from the 1,800 setting!

Cessna states that the mixture control is ineffective below 5,000 feet. It isn't but they did not want you to use it for the reason above. Again that was before the effects of air density changes due to being high and hot were understood. It would be just as foolish to return the control to Rich if landing at a hot, high strip! It is unfortunate that Wichita has no mountain strips near it where all Cessnas would have to land and depart in July during tests. Their instructions would have been a lot more help based on experience.

With the high lead content 100LL, it would be nice if the mixture control was effective on the ground to keep the plugs clean but such is not to be with the Stromberg.

And in case you wonder why the Marvel mention in the Continental book has no such guideline about not using its mixture control below 5,000 AGL, look in the Mil-Spec AN 03-10-BD-1. It says "not normally used below 5,000 feet. One wonders.

Starting and Idle enrichment:

Our Stromberg carbs have no acceleration pump; some members swear they get better starting by exercising the throttle but there is nothing there, truly. Consequently, every little trick that enriches the mixture at startup will aid in quick starts. If the engine is turned over a few revolutions, slowly, ignition off, by hand, with the throttle closed, the engine will suck in the pure fuel which naturally filled the idle circuit. Turn the engine over rapidly by hand or rapidly with the starter and the benefit is lost because the pure fuel in the idle circuit becomes fuel of lesser density since it is mixed with bubbles of air due to the quick repeated action.

There is enough fuel in a tiny idle discharge chamber such that, when you hand prop the plane or otherwise turn it over, the first cylinder which applies an “inhale” suction will be provided with just the right amount of fuel to make that cylinder very rich. Wait a few seconds, turn the prop again, and there is another full slug of fuel for another cylinder. So, four slow

turns will load all the cylinders with rich fuel? No, some are purging the rich fuel into the exhaust....there is a limit to the rich benefit, quickly lost but for the best chance, this is “the way”.

Keeping the throttle closed goes against the grain, since everybody KNOWS that more throttle means more speed....but for our carbs, a nearly closed throttle means the richest possible mixture for starting. In the figure, both idle outlets are uncovered and contributing fuel, but with the throttle closed, the bottom idle outlet is covered by the throttle. As soon as the engine is running and will sustain running, the throttle should be opened just a bit more so that both idle nozzles feed fuel. If you open the throttle a bit too much, the richening effect does not occur since there is then insufficient suction to draw the idle circuit fuel into the carburetor from both holes and the much greater amount of air ingested severely leans the mixture going to the cylinders.

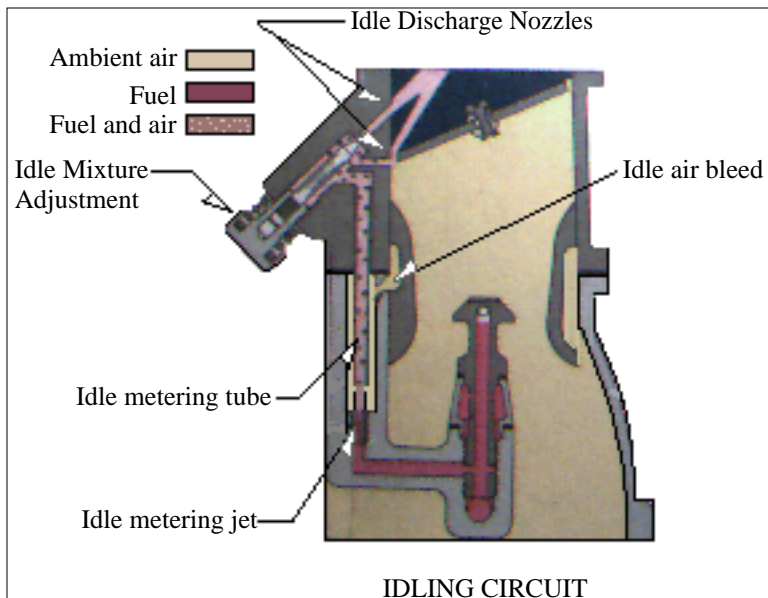
The great temptation when starting is to open up the throttle “a bit more.....”. But this leans the mixture because you reduce the effect of the idle fuel inlet balance. Do it like the book.

In the column (tube) for idle fuel are small holes which, after the first slug of fuel is discharged, allow air to enter the idle discharge tube to (my words) effectively decrease the viscosity of the fuel/air and allow it to move more readily as well as atomize more completely when it hits the slight vacuum in the carb above the throttle plate because the drops of air in the fuel explode when the streams hit the lower pressure zone above the throttle plate.

Cold Starting:

Information that may help for starting in cold climates.

If your engine is starting but then stopping, your secret is the primer. Read this and see if you are willing to change the sequence you use.



The colored figures show fuel flow paths when idling versus running at more than a 1,000 RPM's. From it, note that when the throttle is closed, the fuel for the idle system is held in a column around the idle discharge tube as well as in the idle air tube, and that tube leads to two outlets in the wall of the carb, one opening just above the throttle plate and the other nearly coincident with the plate edge and a bit below it. During idle with the throttle closed, all of the fuel is routed into the main airstream via the top idle orifice. Adjustment of the Idle Mixture Control Screw controls the mixture in this phase. As soon as you move the throttle in the slightest, the bottom idle port also delivers fuel into the airstream but it also allows passage of more air which makes the mixture less rich. But when starting in the cold, the mixture is still too lean until the engine warms a bit. Cold fuel does not atomize as fast as warm fuel, and cold air means it doesn't help either.

Best sequence?

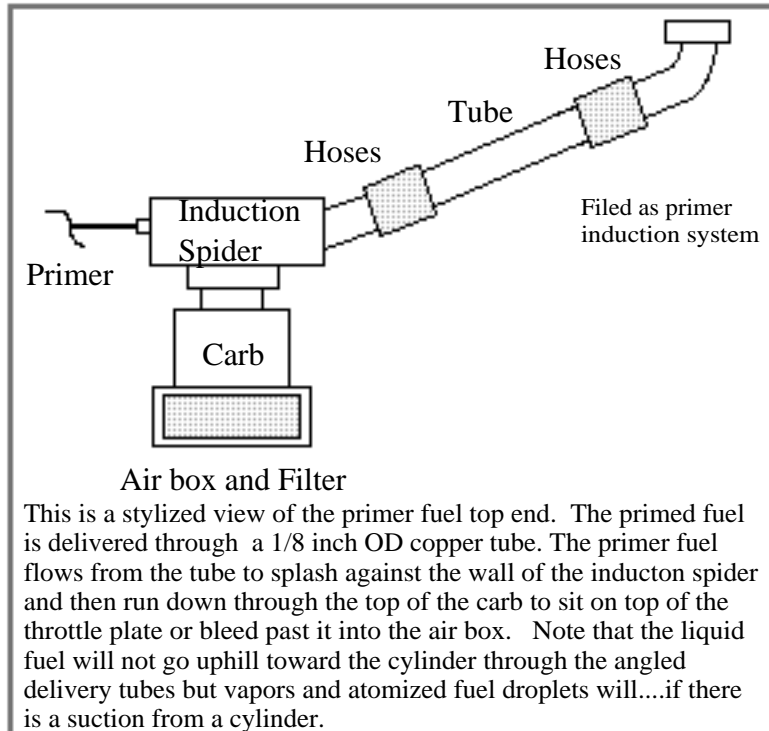
Turn it over by hand if you wish, slowly, with the throttle closed. Turn it a couple of cylinders worth, and repeat once more if you wish; more than that means that you have purged the first cylinders' inhalation of the rich mixture right out the exhaust. If you or the starter turns the prop fast, the benefit is lost because the idle air injection starts and reduces the fuel to air ratio in the idle circuit after the first few rotations.

Pulling on carb heat before starting is another way of gaining a bit; even though there is no heat initially, there will be some in very short order and that heated air helps several ways; it increases the rate of atomization of the fuel, the biggest benefit, plus it enrichens the mixture (heated air is less dense) and warms the induction system which helps atomization of the fuel. Taxi with it that way until runup.

Ignition on, throttle just cracked (some sources say closed) by pushing the control in an 1/8th inch, if you can deduce that. Primer unlocked and cocked by pulling it out, turn over the engine, prime once (or twice) AND REPEAT PRIMING AS REQUIRED TO KEEP THE ENGINE RUNNING.

You can get good at this, and finesse how fast you feed in the primer and how quickly you want to increase the throttle opening, but don't hurry to open the throttle since loss of the rich mixture hurts more than the rotational inertia helps.

If there is even a tiny delay between injecting fuel via the primer and turning the engine over with the ignition on, all that will happen is that most of the injected fuel will slide down the induction system, through the carb, not atomized, and pool in the air box chamber, there to await ignition from a backfire.



There are many sources who state: “..use the primer three or more times and then pull on the starter..”. Take a look at the diagram. The primer’s 1/8th diameter copper tube ends in a fitting which is coupled to the induction spider on its left side; the tiny stream of fuel is ejected from the tube and strikes the interior of the spider. I have yet to see a person who can make that fuel stick to the induction spider or make it run up hill closer to the cylinders...note that the induction tubes are angled up. Most of that fuel immediately runs down on top of the closed throttle or escapes past the throttle plate to the air box. Do what works best for you, but lots of primer fuel before turning the engine over does less good than any fuel injected during the engine turning over.

Depending on the plane and the primer, some in the midwest cold areas leave the primer halfway out until the engine is running smoothly. There are at least three types of primers on our planes and all have spring loaded valves (actually some have one and some have two) which require significant hydraulic force to open them for fuel passage. Nowhere is it stated that the suction from a piston is enough to open one or both, but...maybe. (Not all primers are the same and some will inject only the fuel which is gathered when you draw out the stem.) From one of the manufacturers, this test:

Vacuum Test:

Apply a vacuum of 20 inches of mercury to the discharge port of the primer pump and hold for two minutes. There shall not be more than 0.4 of an inch of leakage.

That is a terrific amount of vacuum, more than a piston creates during its suck cycle and for those primers with two valves, it would take more vacuum than the pistons can provide to open them and allow a “leak” which enriches the mixture.

Empty?

When you turn the fuel selector to Off and let the engine die of fuel “starvation”, all that happens is that the fuel in the carb is used up until its level is below the top of the nozzle far enough that the lower pressure in the carburetor from the venturi effect is no longer able to pull fuel out of the nozzle. The carb is not empty and cannot be made to be a true empty by running the engine until it quits.

There is no disadvantage to shutting off the fuel but there are the advantages in that it makes the engine not run if somebody came along and turned the prop (some people do) with a magneto hot, and it prevents any

leak if the needle does not provide a leakless seal. There is another old hangar tale out there about not running the fuel out by turning the selector to Off "because the fuel is necessary to keep the gasket wet and a wet gasket is necessary to prevent a leak". Nonsense. If you can see a wet gasket, fix the problem because correct operation depends on leak-free chambers. Body gasket leaks can also affect whether the mixture control works.

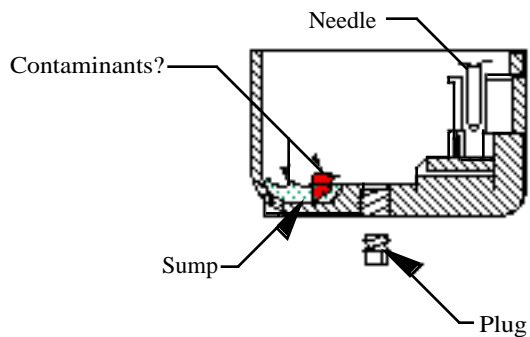
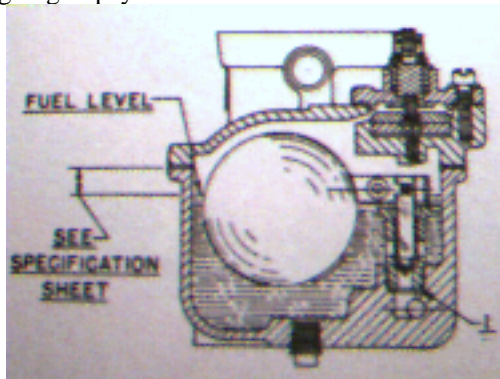
The reason I mention the hot magneto possibility so often is because I keep seeing more planes in which the toggle switches for the mags are reversed; in the beginning, for a reason never explained, all the switches are "upside down" according to American standards/habits. Consequently, Up was Off. The modified planes have mag switches with Up being On, and there is the high probability that a pilot of a plane used to one arrangement will believe he has turned the switches Off but really left them On.

The misguided Cessna-issued Service Bulletin SEB 99-19:

There is a late 1999 Cessna Service Bulletin which promotes "safety" by requesting an immediate confirmation that there are no contaminants in the carburetor and which further requests an annual confirmation. The owner or mechanic is to take the plug out of the bottom of the carburetor in order to "drain out any contaminates (sic..contaminants meant) in the bottom of the carburetor". Good idea, but no one in the creation or signature chain for the Service Bulletin ever looked at the carburetors in our planes because their statement is incorrect and the suggested purge cannot, can not remove all material in the bottom of the carburetor.

The reason this is a false promise and a misleading one at that? The top opening of the hole into which the plug fits ends up on a plateau inside the carburetor casting which is higher than the actual "bottom" sump of the carburetor! The relationship is indicated in the picture. Note the sump which would not be purged.

Cessna sent this notice of a Service Bulletin to the registered owners of the planes, but they did not send a copy of the service letter. Why? because Cessna charges for the service letters. They own the "copyright" of the service bulletins. It comes under the category like AD's of "although I made the mistake, you are going to pay for it".



There is always a segment of the float chamber which is below the top of the hole into which the plug is screwed. The intent of the service letter was commendable but the only way to be sure that the carburetor is clear of contaminants, liquid or otherwise, is to remove the carburetor and split its case and visually inspect it. If you can get the plug out at annual time and flush the carb, do so because it won't hurt, but don't depend on it to confirm that the carburetor is clear. When two pieces of metal are in tight contact for years, one can become welded to the other. A lot of plugs, not removed for 40 plus years, are in that category and trying to remove them with great force can damage the case. The penalty for damaging the case is \$500 plus for a new carb. Or take it off and do the inspection the right way. Gasket kits which include the body gasket \$30 to \$40, depending on the source, and the gaskets above and below the carb are less than \$2 each.

Leaky?

The carburetors were originally made with stainless steel needles; some leaked and some were lapped to not leak. Along came the magic Neoprene and the troubles of leaks were resolved by adaptation of Neoprene-

tipped needles plus matching new seats, none of which needed to be lapped. In '63, before the new fuels and experiments with alcohols in fuels, Bendix-Stromberg changed to a Delrin needle because it was cheaper to make and more consistent. Trouble was, many of them leaked as well but they, too, could be lapped and made to be leak-free. But, there is a magic in the lapping that they didn't tell anyone. Given that the correct seats are used with each type (the Neoprene-tipped and Delrin needles use the same seat, one with a radius and a taper at the annulus of contact of the needle, and the stainless needs to be matched with a sharp-edged seat) and careful lapping is done, each combination can be leak-free. See the "Stromberg Needles Tips" article on how to lap the Delrin so it seals as it was meant to; one of our members just found out that secret and passed it on for us.

More?

There are several more articles about how to set the fuel level in the Stromberg and the gasket set and the one for the extender. To make it a bit simpler, I have added just the figure portion of the extender to the end of this file.

From the Cessna 140A's Pilot's Operating Handbook:

Mixture Control:

If installed as optional equipment, the mixture control is to be always set at "full rich" for starting and takeoff purposes. Pulling out on the control leans the fuel mixture. The mixture control is not a device for cutting down fuel consumption but rather a device for obtaining better engine operation and performance at altitudes above 5,000 feet ASL. The mixture control should be used cautiously to lean mixtures to give maximum engine r.p.m. when flying above 5000 feet pressure altitude. Too lean a mixture will cause excessive engine heating and result in damage. (I added ASL for clarification).

And of course it does decrease the consumption as all of us who reconnected it will attest.

From the Continental handbook:

- a. If a Stromberg carburetor is installed leave mixture control in the "FULL RICH" position at altitudes less than 5,000 feet above sea level. If a Marvel Schebler carburetor is installed the mixture control may be adjusted to obtain best rich power at any cruising altitude.
- b. To obtain best rich power, move the mixture control toward the "LEAN" position and watch the tachometer closely to detect any change in engine speed. If speed decreases or remains unchanged return the control to the "FULL RICH" position. However, as the control is moved to lean mixture an increase in speed will ordinarily result if an automatic enrichment has occurred, due to decreased air pressure. Further control movement will cause a decrease in speed. When the position of maximum speed has been found, return the control toward the "RICH" position until engine R.P.M. decreases just perceptibly (sic, perceptibly meant). This setting produces the best power obtainable under existing atmospheric conditions with a slightly rich mixture to prevent overheating.
- c. If the mixture control is in any but "FULL RICH" position, change the setting, as described in paragraph 7-7b., for each change in altitude of power setting. If a Stromberg is installed return the mixture to "FULL RICH" position before letting down below an altitude of 5000 feet.

To prove that no one at the factory read the guideline, note the sentence: "However, as the control is moved to lean mixture an increase in speed will ordinarily result if an automatic enrichment has occurred, due to decreased air pressure. NONSENSE...the change results in an increase because the fuel to air mixture is leaner, not richer!!!

Your Opportunities:

You can make your plane better by inspecting the carburetor to ensure that the mixture control is in working order and then installing the push-pull control to use it. Since the mixture control was something that is listed on the Equipment List made for each plane when it was sold, its change to a working status does NOT need an STC nor a 337, but just a log book entry seconded by your A&X. At the time of "correction" of the mixture control system, you can purchase and install a new push-pull cable. Take advantage by installing a better length of throw as offered by the extension and by getting a better type of push-pull cable as well. Again, discuss with the A&X to make sure he will sign off on a vernier type

mixture control cable since its operation makes small adjustments so much easier and precise. The 150 type cable is also better than the original on the 120/140's. It makes a big difference in utility.

Addendum:

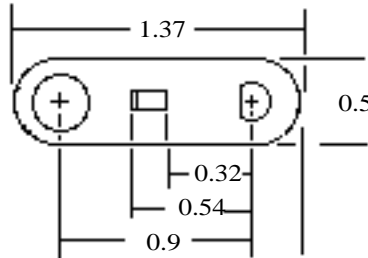
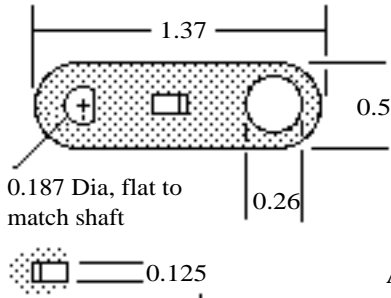
A gasket kit is getting more expensive with each new catalog, presently about \$30 in Spruce and \$40 from Precision. The gaskets for top and bottom are less than two dollars each, also in the Spruce catalog. See the companion article: Stromberg Gaskets ... If you get surprised and find you are not using an approved needle, or if the fuel level is wrong, see the articles on setting the level and the tools you need to do it. There is one on Needles and Tips and one on how to set the level and it includes how to make the tools to do that task.

And, on the same page as the parts for the Stromberg in the Spruce catalog, the offer of a manual for the carb at only \$12...what a bargain.

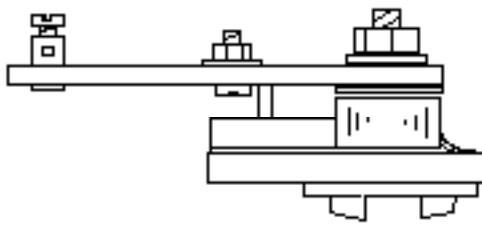
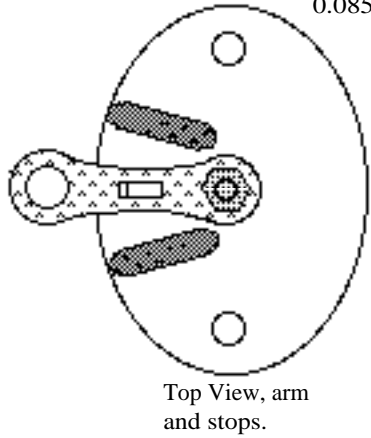
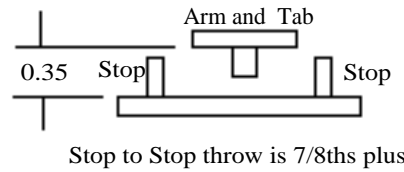
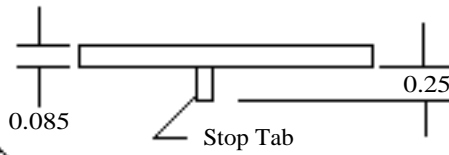
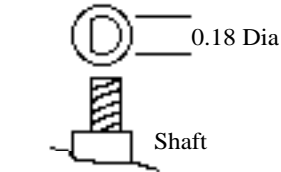
Thanks:

And a big thanks to Doug and Carol Williams for making the effort to find out whether the mixture control really worked and how well it worked. We all benefited.

**Stromberg
Mixture Control
Details/Assembly
and Lever Arm
Extender**

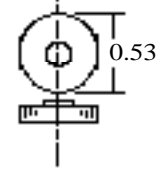


Actual part is wasp-waisted at 0.34 across the waist.



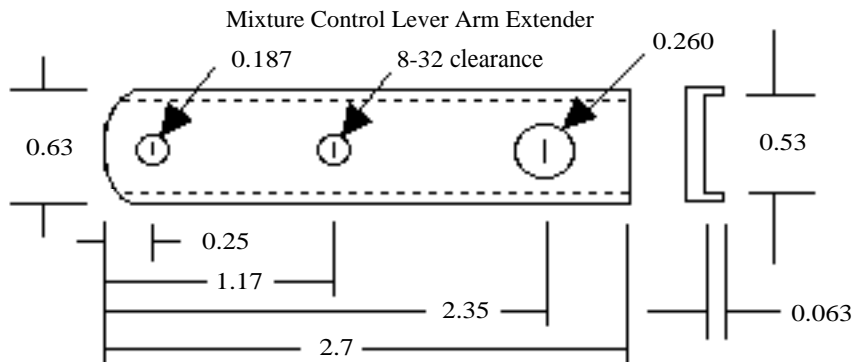
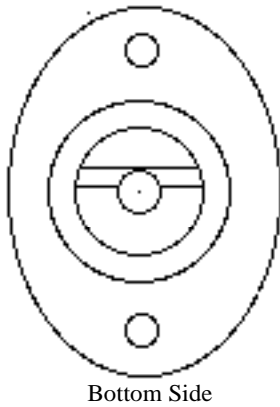
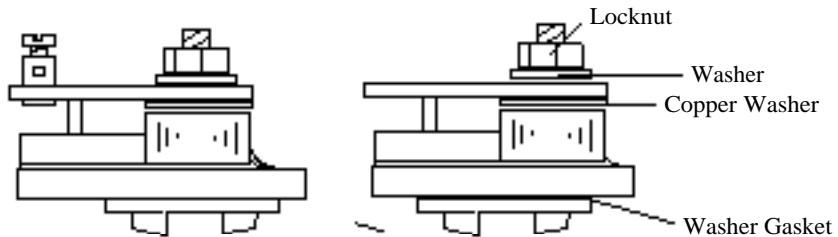
Showing Extender in Position

Spacer to fit inside the extender bottom side



Material: 4130 or Tool steel 0.125 thick. Finish Black
Break all sharp corners

Filed as Mixture
Details Mar '04
Neal F. Wright
1542 South Wolfe
Rd Sunnyvale CA
94087



Historical Information and Guidelines:

These tidbits from “Aircraft Propulsion and Powerplants” book, with content of the carb section by Stromberg and from a 1932 book on carburetors by Stromberg. In those days, they really explained what made a carb work and what the features were, most invisible from the outside. Although the Stromberg is a “simple” carburetor, it has lots of little items which cannot be viewed, all to make it work better and smoother.

Although not advertised as thoroughly as for the Marvel folks would rather one did not use the mixture control until about 3500 AGL. Note the comment later in this section: “and when flying at engine powers greater than cruising power” use full Rich. One of the most telling admonishments is the mention that if one is leaning at low altitudes and then goes to full throttle without first going to full Rich, quick damage can occur to the engine when leaned at that power. One of things the “rule” about not using the mixture control below 5,000 AGL is that the altitude ensures you won’t be able to get the same power that you could at sea level, and so there is more margin of safety to lean, even if you do go to full throttle.

From the books.

The function of a mixture control is to control the flow of fuel so the desired fuel to air (F/A) ratio can be maintained under those operating conditions where the mixture proportion tends to change because of changes in air density. The mixture ratio varies quite closely as the inverse square root of the air density. The density depends on two factors; the altitude of the plane and the temperature of the air. The density (weight per volume) of the air decreases in almost direct proportion to the altitude. At 20,000 feet, the air density is approximately 47 percent that of sea level, so the engine at 20,000 feet will provide about half the full throttle sea level power but only if the F/A ratio is held to the best band of 12 to 14. If the plane is flown with no mixture control, it will be unable to rise much above 10,000 because there is too much fuel for the air available.

Some general rules apply to the use of the mixture control of any engine equipped with a float type carb.

Full rich mixture should be used at altitudes less than 3,500 ASL, during all short flights at low altitude and when flying at engine powers greater than cruising power and when descending from altitude.

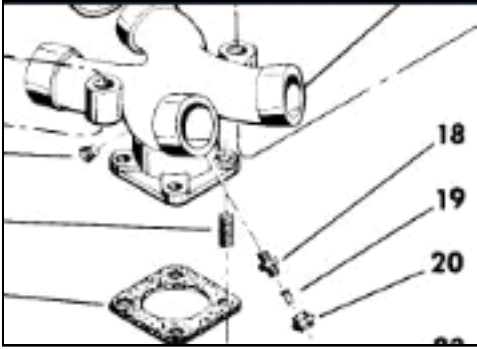
Most carbs are set to provide 3 to 8 percent more fuel than needed for maximum power at sea level. The extra fuel ensures that there is no pre-ignition at full throttle, the so-called “cooling” fuel portion.

A back suction type carb has a correction range of about 25,000 feet which is equivalent to reducing the main metering jet size about 36 percent.

The back suction type carb’s mixture control can control the mixture ratio over an altitude range of 25,000 but, if you design it to be effective from 0 to 5,000 feet, you lose a 5,000 foot capability at the high end.

It will be obvious that this range of control will only be possible if the main jet size is correct for ground operation.

If a metering jet is selected which gives ten percent richer mixture on the ground, depending on the mixture control to obtain the proper ground and low altitude flying settings, the remaining correction available for altitude use will be less than if the ground setting were obtained with a smaller jet and the altitude control in full rich.



All the talk about using the primer and not a hint anywhere that somewhere along the design path, Continental changed from the simple open-ended copper tube primer gasoline injection to the spider to a more sophisticated primer jet (nozzle, really) which was designed to better atomize the fuel by creating a spray as it leaves this nozzle. I have never seen one, but finding one sure offers a better and easier start, especially in the cold country.

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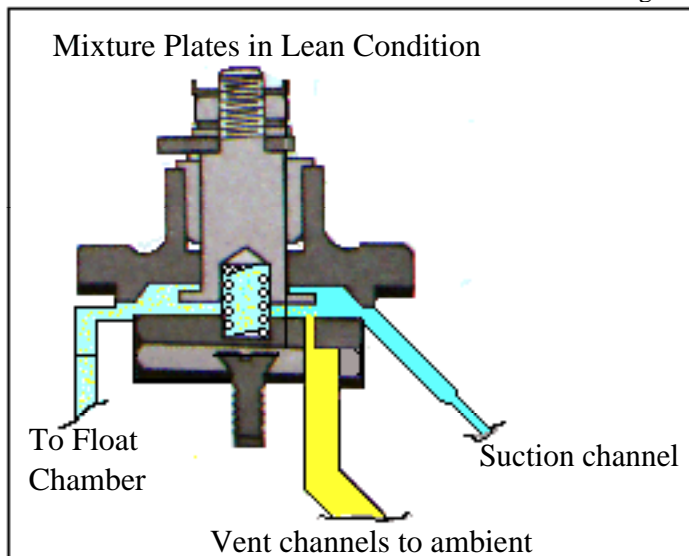
Neal

Modified: Nov 2005
 Filed as: Stromberg Mixture & Secrets of Operation

Neal F. Wright

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In the newsletter pp 14 June 2004, there is a special input by John C. suggesting that a member's fault with his engine running lean all the time in flight might be due to the big hole in one plate of the mixture control being clogged. Assessment is that it would be possible for that to happen and the result would be to have a lean mixture all the time when in the non-idle range of RPM's.



From John C.
BTW, have you ever seen a Stromberg where the mixture plates were gummed up in a way to make it run lean? Seems pretty impossible to me... Have to block the big hole in the plates but not the tiny passage to the venturi...

That does seem possible John. progressively clog by backfires?

Next version, add definitions of the sequence of atomized fuel vaporized fuel emulsion of fuel drops and air drops.