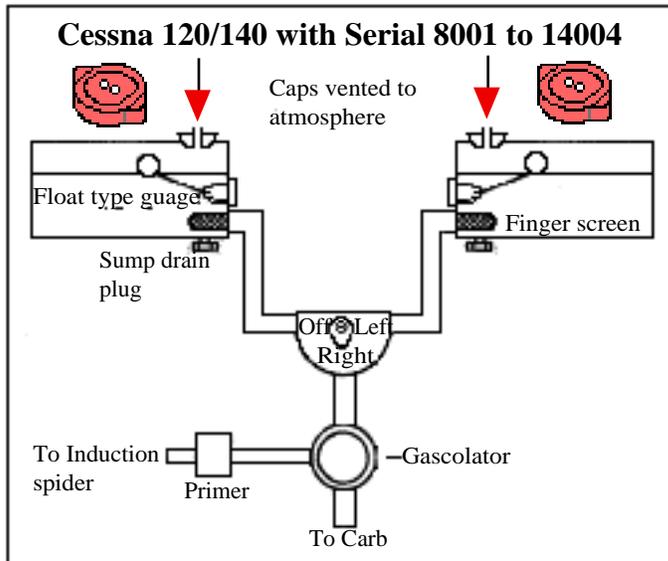


## Major 120/140/140A Fuel Systems:

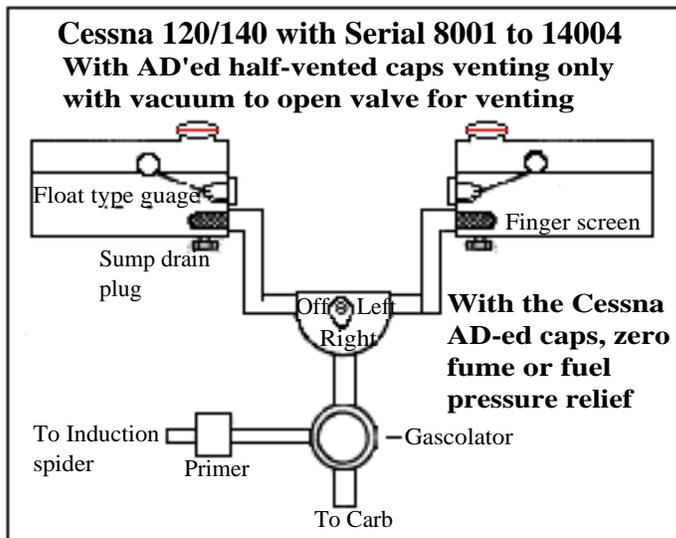
### The Original 120/140 System, Serial 8001 through 14004:



The first 120/140 fuel system with gas caps which had two holes in them. The selector is the three-way type, with Left, Right, or Off positions. Free exchange of air or vapor, no pressures.

A complaint of long standing is that water can be injected through the holes during a hard rain. Some use tuna cans as a temporary expedient if the plane is outside (they blow off if forgotten) and others use the fabric windshield cover with the extensions which cover the caps and part of the cabin top.

Note that the selector is the three way type.



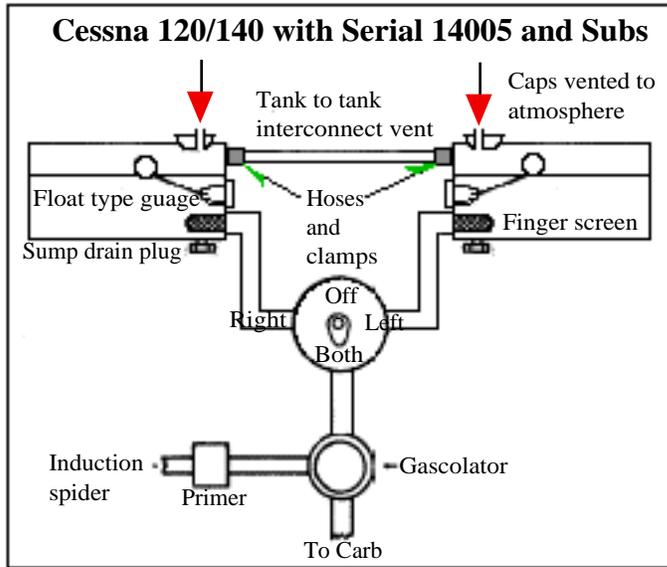
At the left with the AD'ed caps meant only for the A model which require a vacuum caused by fuel usage to open the valve and allow venting. On some 120/140 planes, the vacuum plus the attitude can reduce the hydraulic head to a value which is insufficient to provide fuel to the carburetor and the engine quits on climbout.

Being half-vented caps, they allow no pressure relief outward if the fuel heats up and expands. The tank has to absorb this pressure, causing tin-canning when extreme and perhaps flooded carbs when the pressure overcomes the ability of the float/needle to stop a surge. The pressure in those tanks with AD-ed caps would be....terrific?

The parts manual excludes a view of and a callout of the three way selector though its escutcheon and stop plate are shown and called out. The four-way selector and its accompanying escutcheon are noted and called out in the manual on a diferent page than for the three way features. Someday, one of the members will run across a pre-four way parts book so we can find out what the part numbers of the selector on the early planes was.

**Serial 14005 and Subs 120/140's**

Starting with serial 14005, still with the fully vented caps, the fuel system selector had four positions, Left, Right, Both, and Off. Although it cannot be confirmed, it is often repeated that the four way selector and the tank-to-tank vent tube happened at the same time. Maybe.

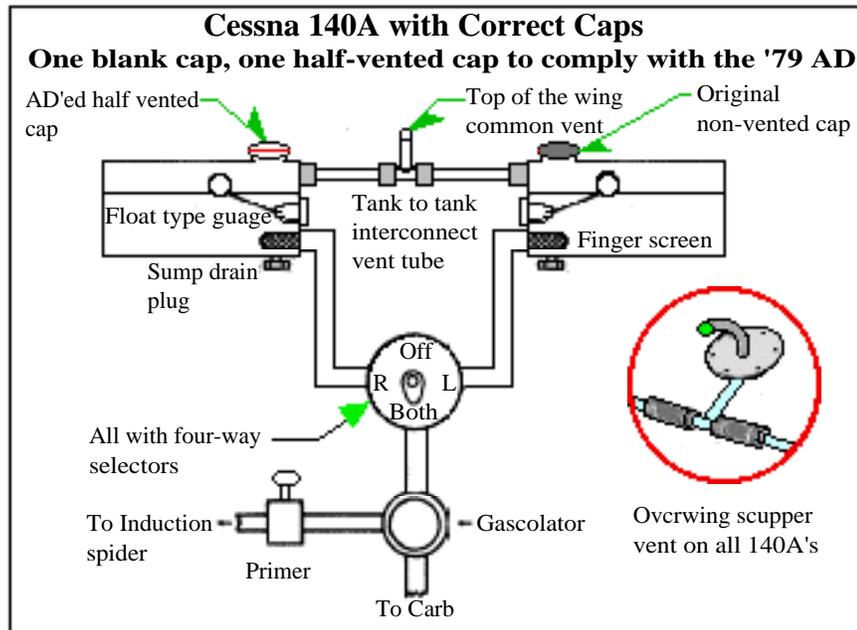


Note that if either of the caps becomes plugged, both tanks still have full venting because of the tank-to tank interconnect tube.. Again, if the error is made to put one of the half-vented caps on the plane, you have essentially created the plugged situation for that cap. If one puts two of the half-vented caps on the plane, then you have created a situation of allowing no venting until fuel usage has created a vacuum of a value to cause the weakest valve of the two caps to open. Many seem to believe that the valve, once opened, allows full venting, but that is never true. What is true is that with two of the half-vented caps installed, the tank is never free of a vacuum if fuel is being used and never free of pressure one way or the other when on the ground. One gets the same

results as for the earlier serialed planes with the half-vented caps.

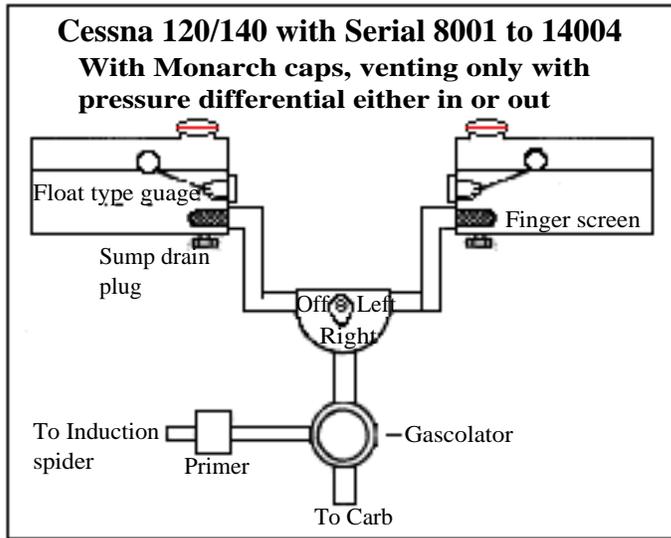
**The 140A:**

This figure shows the 140A tank system, with the four way selector, the tank-to-tank interconnect tube, the overwing scoop common vent, a single half-vented cap as mandated by the 1979 AD, and one original non-vented cap. Before the '79 AD added the half-vented cap, both caps were non-vented; they had to be or some the fuel of a full tank would have been vented overboard because of the ram pressure due to the overwing vent. No inlet pressure value for the AD'ed model caps has ever been published. They are half-vented which means they never let pressure out.



There is still confusion as to whether one or two half-vented caps are necessary to comply with the '79 AD on the A's. The correct answer is, one or two can be used. When using one non-vented cap and one half-vented cap, it makes no difference as to which side each is on.

## The Monarch Caps



The Monarch caps were presented as being approved for the 120/140 and 140A's. They offered the advantage of preventing rain water injection which was common for the original two-holed caps. The hazard they presented for the 120/140's was the same as for using the half-vented caps. The engine would quit on climbout on some planes. Moreover, unlike the Cessna AD'ed half-vented caps, they block outward venting only until the threshold of release of the two-way valve is reached. Fuel usage must create a vacuum in the tank of between 0.02 and 0.07 PSI for the Monarchs to allow air in.

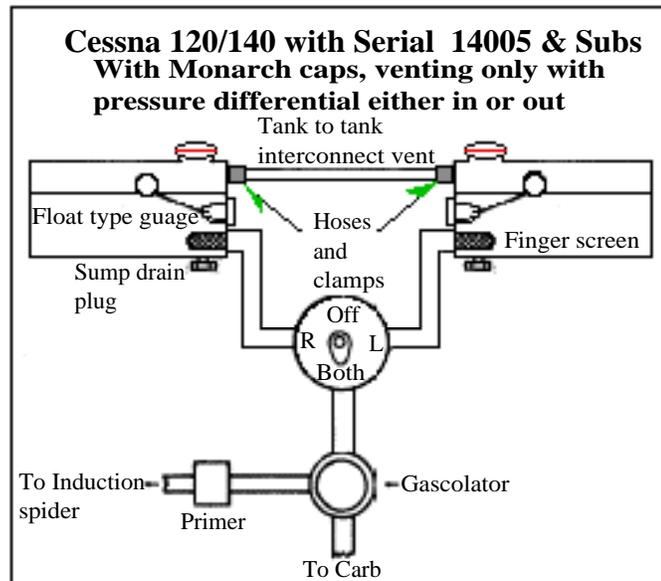
Expansion of fuel creates a pressure of as much as 1.5 PSI before the Monarch releases the pressure. The tank is about

20 X 29 inches for the top and bottom. With the maximum vacuum, that is a force of 42 lbs on the top or bottom. The force with the 1.5 PSI max pressure before relief would be 900 pounds on the top or bottom, causing flexing (tin-canning).

This last figure shows the same system for the 14005 and subs except with Monarch caps. The tank-to-tank vent and/or the Selector in BOTH means that both tanks always "see" the same pressure. With the Monarchs, the cap with the lower pressure differential requirement would be the one to open first, relieving both.

filed as Major 120/140 fuel sys & 140A system

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 may '05



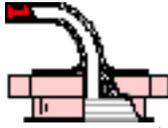
To see the full reports of the hazards of using either the half-vented caps or the Monarch caps, go to the reports at the FTP site: <http://members.aol.com/cougarnfw/>



The original two hole gas cap for the 120/140's

### Array of 120/140/140A Gas Caps

Free air/vapor passage with the original cap. The Monarch requires a pressure to open in or out.



Forward-facing cap cutaway (cute) not to be used on the 120/140's except with STC'ed Lycoming, causing problems with them



The Monarch cap

The 140A cap, shown incorrectly in the parts manual as the two-hole cap, actually had the two hole cap whose holes were filled with rivets as shown on the left. In the middle, the next generation, still with rivets in the holes but neater. On the right, the final cap with the indents of the spot welding barely visible through the paint and no rivets.



Because the A model has the open vent above the wing and a juncture which joins a tube to both tanks, the cap had to be a zero flow type in order for the ram pressure to not force fuel out of the caps.



The silicone valve, opens in but never out.



Overwing scupper vent joined to the tank-to-tank vent line

And then came reality, about thirty years later. The 1979 AD was issued to counter the fact that if the single top-of-the-wing vent was occluded with bugs or their nests or freezing rain, no fuel would go to the engine. The '79 AD mandated that at least one cap for the 140A be replaced with the half-vented cap shown here to allow vacuum relief if the common vent was plugged. The red silicone "valve" was designed to open and allow air in whenever the pressure of the vacuum was X (never stated and never tested since installation). The silicone valve would not allow any outward venting. Inadequately tested in real life, Cessna, the actual developer, and the FAA missed the fact that the silicone valve could adhere to its seat with such tenacity that it would sometimes not vent inwardly.

The consequence of using the half-vented cap on the 120-140's was sometimes severe, including loss of plane and other lesser ills, such as grossly expanded tanks when the expanding fuel and vapors in the tank could not get out. Although an intense effort was made in '91 to have the '79 AD revised to explicitly exclude the 120/140's, the appeal was denied by the FAA and the mandatory bulletin by Cessna was "sold" to the FAA and quickly disappeared, so the problem of this cap being put on the 120/140's is still evident in '05, often forced on the owner by the FAA sanctioned FBO's mechanic.

In early '05, the other brand of the '79 AD'ed caps were loaned and pictures taken.

They appear as at the right, and are marked as made by C.A.P. Note that they have the same silicone valve and are also half-vented. In '05, this brand is the type still being sold by Cessna for \$41, and is often available on ebay for a bit more.



The half-vented caps are sometimes misrepresented as correct for the 120/140's, but they are not and the Monarch cap, if used on the 120/140's, can also cause the engine to quit on climbout.

Filed as Gas cap array may '05

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See the full stories on the FTP site

<http://members.aol.com:/cougarnfw/>