TR7: The FASD, Part I

By Jim TenCate, Wayne Simpson

Introduction

In order to start from cold, an engine requires a richer than normal fuel/air mixture, and additional air to raise the idle speed during the first few minutes of operation. Conventional fixed venturi carburetors employ a "choke", a flap of metal that restricts the flow of air into the carb and creates a greater than normal atmospheric depression (vacuum) at the venturi, thereby drawing more fuel into the mixture to achieve a richer starting mix. A cam holds the throttle slightly open, admitting more air into the engine to speed up the idle during warm-up.

A variable venturi carb like the Stromberg CD cannot employ a conventional choke since by design it maintains the venturi at a constant depression. Early (1975-76 Federal) TR7s employed an operator controlled system that metered additional fuel into the mix and held the throttles slightly open. As the engine warmed, the operator would back off the "choke" (which wasn't really a choke) until it was fully off. How did these work? On the side of each carb was rotating disk with a series of increasingly larger holes to allow extra gasoline into the air/fuel stream entering the engine.

How well did the dual manual chokes on the early TR7s work? Comments from the early mailing list archives seem to suggest "not especially well". Jim had a 75 TR7 with dual manual chokes. He drove it pretty regularly in Michigan even in the bitter cold. The car could be made to start easily enough but getting it to warm up smoothly was always challenging. As the cables were pushed in to close the "chokes", the two carbs never seemed to balance very well and he admits he couldn't wait to push that choke knob all the way home to shut those dual "extra gas devices" off. Plus, it seems there was always crud accumulating in those little holes that had to be cleaned out periodically, gasoline wasn't as clean back then as it now.

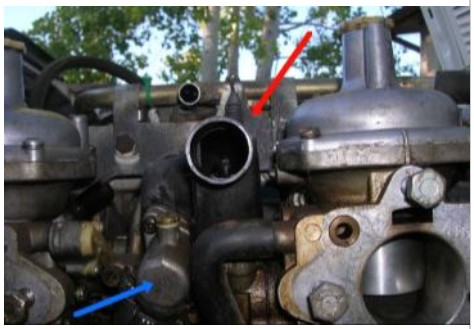
As the 1970s progressed, environmental regulations required that automobiles must proceed through the warm-up quickly and disengage their starting enrichment devices as soon as possible without the intervention of the operator. In other words, an automatic choke was required. In the TR8 and Spitfire models, Triumph used a water-heated "auto starter" that had also been employed in the TR7 California market single carb models. These were semi automatic in that they required the operator to "set" the choke by depressing the accelerator and "unset" it once the engine started, again by depressing the gas pedal.

In the TR7 however, they chose to adapt a device invented by Solex that was fully automated and required no input whatsoever from the driver. This was the Fully Automatic Starting Device, or FASD. In operation, the FASD would provide a burst of fuel to get the engine started, additional fuel to enrich the mixture, and additional air to raise the idle. As warm-up progressed, the FASD would reduce the added fuel and air it supplied until the engine reached a set temperature, at which point it would shut itself off. Federal TR7s from 1977 to 1980 and California models from 1977 to 1979 were equipped with the FASD.

Can we make an estimate of how many TR7s had FASDs? Sure. From Piggott's book for each year up to 1980 we get this many
TR7s: 14528+5517+16207+88+6199 = 42000 total export, but roughly 20% of US 1980 TR7s were FI and not carbureted so maybe around 40,000 TR7s may have had them! Of the 91 TR7s currently listed on Craigslist, *all* but 14 should have originally come with a FASD.

How Does The "Device" Work?

There are two answers to a question like this, (1) the general principle of operation or (2) the more specific "this valve closes off when this arm is pushed on by the plunger in this bulb". For now, we'll stick with a general description and save a more detailed description for the follow-up article. The FASD is really just a third carburetor attached to the front carb of a dual carb set. It gets its fuel supply from the front carb fuel bowl, its air supply from inside the air cleaner (via a black plastic snorkel—blue on later Rovers), and spews the air-fuel mixture it makes into an input port on the manifold where it feeds *all* 4 cylinders. The photo here was taken looking into the snorkel (red arrow) with the air cleaner removed.



It's worth noting that the FASD by itself can flow enough air/fuel mix to run the car pretty well even if the carbs are flowing next to nothing. Inside the FASD is *the* essential piece, a wax bulb (like in a thermostat) which, when warmed by coolant flowing through the housing (blue arrow on photo), pushes on a rod which closes off a fuel metering needle and airflow. You can just barely see the top of the rod inside the black snorkel in the photo. There is also a small cartridge heater which helps warm the FASD for better fuel atomization too, a two wire connection,

ground and hot. The FASD, once you manage to get it (and the carb set) off the car is simple to clean and rebuild. If you've ever taken apart and rebuilt a Holley or the like, the FASD is not a very big challenge. There's a gasket and a few O-rings and another gasket pair where it attaches to an adapter and carb. There are a set of detailed photos of one apart on the website if you'd like to see what you're getting into before you undertake to clean up one of these.

http://www.triumphwedgeowners.org/fasdphotos.html

You may be wondering if there's any discussion of it in the TR7 Repair Operations Manual or elsewhere. Actually, it's quite hard to find out anything at all about it anywhere. There is a brief mention of it in the Haynes Weber SU Z-S Carburetor manual (*Part 4 SU carbs Ch. 20, p. 20-15*) which tells you how to adjust the shut-off temperature. There's nothing there on how to rebuild it however.

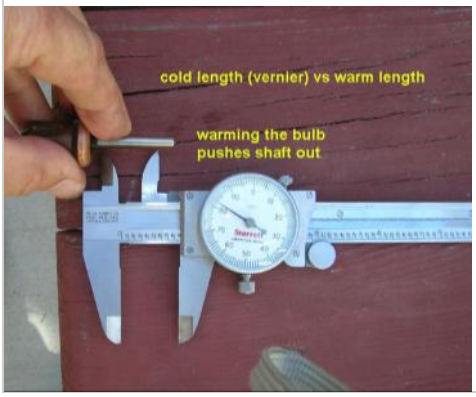
There have been a few articles written about the FASD and posted to the Internet and if you search long enough, you can also find some discussion about them on various forums. Our own Bruce Clough, in fact, is the author of one of the more widely cited articles and the xrocks.net link (below) has animated Bruce's drawings. The article and web animation are quite good for understanding the general principle of the thing except... there is a small problem. Although the general idea on what it does is correct, the wax bulb operation described in Bruce's article and the xrocks web animation is backwards. Check it out!

http://www.roversd1.nl/sd1web/fasd.html

http://www.buckeyetriumphs.org/newsletter/PDF_Files/Dec2000.pdf

http://www.xrocks.net/fasd.html

So, to set the record straight, the wax in the bulb *expands* as the coolant warms it and pushes the pin out, not contracts as shown in the article and web simulation. One of us was puzzled by that for long time when he had his apart. It all becomes clear once you know it works the other way. Here's a photo of the wax bulb and its plunger rod in operation, cold and hot.



For the anoraks amongst us, we've found that the US patents of "the device" are actually very detailed, especially if you want their theory of operation, how they work. Just look up US Patent number 3,967,610 (1974) with a CIP (continuation-in-part) Patent number 4,069,802 (1978) on patents.google.com for example. These two patents are perhaps the best and most detailed descriptions of how these work and include some beautifully hand-drawn illustrations for additional clarification.

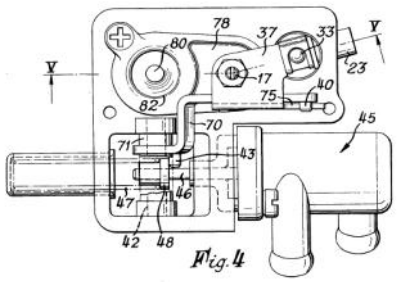


Fig. 4

What Goes Wrong?

In our experience and from our reading, the FASD (especially in neglected cars) gets gummed up and dirty and just needs to be cleaned to work correctly. Once cleaned, you should be able to poke your little finger in the snorkel and easily push the metering needle down and seat it on a cold car. Taking apart and cleaning a Holley is way more work and if you're comfortable doing that, cleaning up an FASD is much easier. The exploded/take apart views are shown on the website. A list of potential problems related to dirt and gummed up gas follows:

* We've read that occasionally the wax bulb goes bad but none of us has seen a bad wax bulb actually. Yes, sometimes the wax bulb rod is stuck and frees up when dunked in hot water for testing but that's not common from our reading. The rod on the wax bulb of one Jim built recently will actually pull *out* of the bulb if you tug on it hard enough but it works fine otherwise.

* Another problem is that the FASD metering needle gets stuck in its bore, especially true of cars that have been neglected for a while. The gasoline gets gummy and the metering needle slowly is glued in place with gum and varnish and it may take a great deal of work and cleaners and sprays to free that up.

* The coolant bleed screw on the top of the housing is important. Without a nice, bubble-free flow of coolant to heat the wax bulb, the FASD won't close off. That housing will simply collect all those bubbles and the resulting air pocket won't allow the wax bulb to get hot. That bleed screw is often corroded so when you have it apart, make sure the bleed screw is free so you can properly bleed the FASD coolant line when putting it back in operation.

* There is also a small cartridge heater at the bottom of the FASD (to aid in fuel atomization according to one source) and its electrical leads sometimes get pinched or broken so watch for that too.

FASD as an Indicator of Head Gasket Issues?

As mentioned above, in normal operation you have to be sure to bleed out all the air bubbles, otherwise the wax bulb won't be in contact with the coolant and won't close off the FASD and the car will continue to idle at around 1800 RPM or higher even once warm. If you're having trouble with air in your coolant, check your head gasket with a leak down tester! Jim spent maybe a month on and off trying to get an FASD on a TR7 to work correctly, only to learn the car had a head gasket problem! Joe Pawlak's daughter's Spider had a similar problem, with (probably) a small but inconsequential head gasket leak. In spite of Joe's best efforts, it gradually collected enough air to make the FASD stop shutting off. He was bleeding it every week or so to keep it working correctly. So, don't blame the FASD right away, think of it as early warning of head gasket issues.

What's to Come

Next issue we promise to write the article that now needs to be written, a full and detailed set of take-apart instructions. We hope this introduction has helped you understand them a bit better for now. Stay tuned!