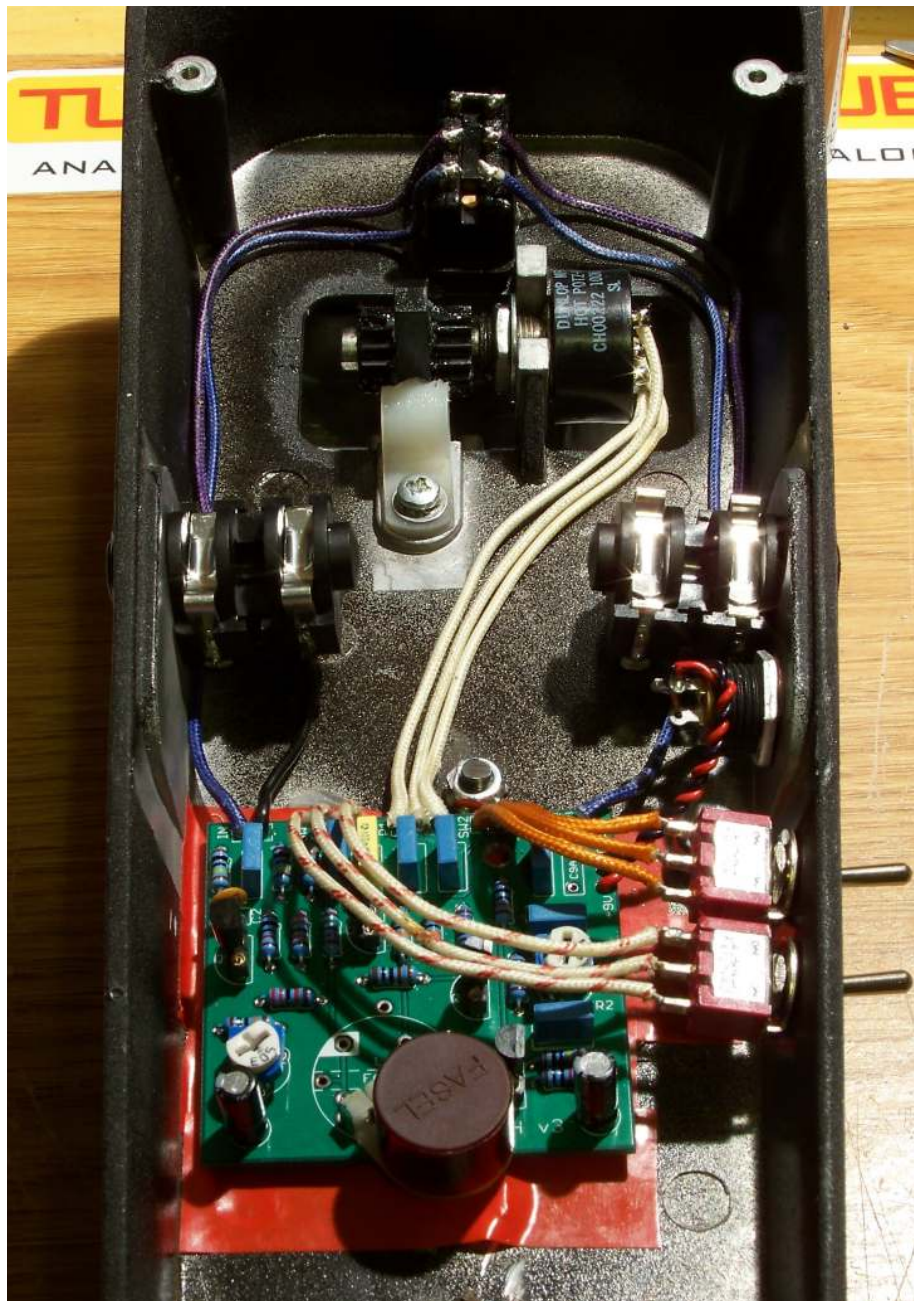


## MoWAH v3 Mod Doc

Those of you that have braved the "advanced" build of the MoWAH have probably noticed that it takes some finessing to get this circuit dialed in for peak performance. This is due to a combination of factors unique to a wah pedal. First, it is a mechanical pedal that requires adjustment of the mechanical motion of the pedal enclosure. Second, it is an active filter dependant upon several key components that are sensitive to even slight variations in value. After several months of playing with this circuit, researching the web, and helping out with build problems on the forum, at Barry's request I have put the following Mod Doc together to address common questions, problems, and (for the adventurous) different modifications that can be done.



## Sourcing Parts

The first question to address is sourcing parts. There are several great places to find Wah parts. As with anything, there is a trade off on quality and price, but if you are smart and patient, you can find all of these parts at reasonable prices.

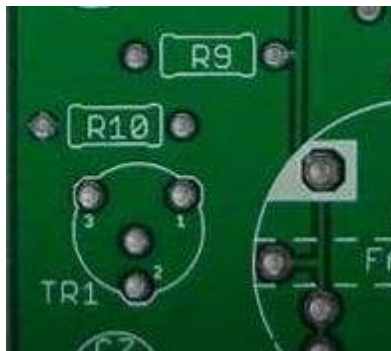
- Enclosure
  - Mammoth Electronics – many color options
  - Small Bear Electronics – only black is offered and must be put together.
  - Ebay – many cheap or broken wah pedals can be scavenged from Ebay for quite a bit less than just the pedal alone. BE CAREFUL to read the description and view the pictures so you know exactly what you are getting. Costs around \$25 - \$40 depending on condition of the pedal. If you get the circuit with the enclosure, you can also source parts (inductor, DPDT switch, jacks, etc.). May require some modification depending on the original configuration of the pedal.
  - DIY forums – every now and again, you may stumble onto a pedal for sale, or pedal lot on one of the many DIY forums.
- Inductor
  - Mammoth Electronics sells “Fasel” inductor. This is a great sounding inductor at a VERY reasonable price.
  - Small Bear Electronics – they offer the widest variety of inductors in one place that I have found. They even include some of the harder to find “boutique” varieties – stack of dimes, “halo” inductor, and even a DIY halo inductor kit for the very adventurous.
  - Ebay – can be a great source, but BE CAREFUL to read feedback. There are many selling “vintage” parts that are not (either maliciously or ignorantly).
  - Side Note: The inductor is a small piece of the wah puzzle. As with a lot of guitar toys, there is a legend that there are certain inductors that “make” the wah. School is still out for me on the impact of the inductor in the overall picture. However, I have built 3 of these circuits (to date) and used 2 Fasel's and a high end “halo” - I did not detect any difference in the sound (circuits were identical otherwise). If you choose to follow the hype just be prepared to pay for it. I have also included a link to the GeoFex site below where the inductor was researched – you decide!
- Potentiometer
  - Mammoth Electronics sells among others a great potentiometer, as well as, Dunlop Hot Potz, cheap imports, and some custom variations.

## Circuit Mods

The most common mods to this circuit pertain to the “Q” or sharpness of the filter response and the frequency response of the filter itself. I’ll address each individually, but understand that both are interactive in terms of your overall wah sound. That is one of the reasons the MoWAH was setup to easily modify both of these sections of the circuit. Below information should be taken as observations from one Wah builder, but by no means is it the final word on how to modify wah circuits.

### Adjusting the “Q”

The “Q” of a filter can be described as the sharpness of the frequency response. This can be changed very simply by adjusting the resistance in parallel with the inductor. Referencing the MoWAH schematic, this is TR1 and R9. A stock Crybaby has around 33k total resistance in this position, as a reference point. As you decrease resistance, the “Q” of the filter increases, causing a sharper sounding filter (which can be good or bad, depending on taste). As a starting point, I like the MoWah at R9 = 22k and TR1 at 50%. That equates to 47k, or slightly lower “Q” than a Crybaby. One popular mod here is to make TR1 an external potentiometer. 50k pots are easy to come by so replacing the trim-pot directly is very easy (simply follow the on-board lug labels for the potentiometer).



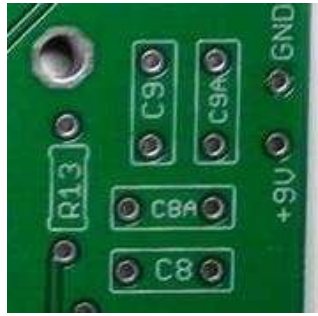
#### Troubleshooting tips

- If you experience a “popping” or “clanking” sound at the heel end of the sweep, TR1 can be used to dial back the “Q” a little.
- I have also found TR1 helpful in adjusting the toe end of the sweep from being too sharp.

### Adjusting the Frequency Response

Adjusting the frequency response of the wah is perhaps the most personal of all the modifications. You can go from a dark, brooding wah (a la Jerry Cantrell), to a bright, nasally wah (a la Kirk Hammett) all with a simple capacitor change. My personal preference is to install SW2 as a standard mod that will allow you to switch between two set ranges on the fly. The response can be generalized in the following way: increasing the value of C8 or C9 will shift the response lower and decreasing the value of C8 or C9 will shift the response higher. It's really that simple. However, tuning it to your taste, guitar, and rig can be another story. After several builds, I really like the recommended 6.8nF (6n8F) in C8. C9 I found to be very nice between 22nF (.022μF) and 33nF (.033μF). This is where the MoWAH board is very well designed. You can use the stock values as a starting point. Then adjust by adding

capacitors in the C8A and C9A positions. Adjust methodically to get the sound you want – I recommend increasing by 2nF or larger until you get it right.



The stock Crybaby circuit has a 10nF (.01 $\mu$ F) cap in this position. That may help you decide where to start. The GeoFex article below has a 6 position rotary switch mod suggested. That might be a little overkill in my opinion, but it demonstrates the myriad options with this part of the circuit.

### Gain and Transistor Mods

R.G. Keen over at GeoFex wrote a TREMENDOUS article on the technology of the wah (linked below) where I learned a lot of the information in this doc. Particularly the how and why questions are answered very well. I recommend reading it for all of the mods mentioned, but particularly for the adjustment of gain and bias.

If you like to experiment with transistors, then installing sockets is a MUST. I have built this circuit with MPSA18s, 2N5088s, 2N3094s, BC108s and BC109s. All sound good and don't stray too far from each other in terms of sound. Per R.G. Keen's article, Q2 is the transistor that makes a significant difference in tone because it provides the "gain" of the filter, where Q3 is simply acting as a buffer. So if you are going to invest in NOS transistors, focus on Q2 and maybe put a basic transistor in Q3. Q1 and Q4 won't have a tremendous impact on tone as they are simple input and output buffers respectively. I recommend leaving the buffers as is – they function great and in my testing, don't color the tone as some buffers are reputed to do. I recommend the MPF102s suggested in the build docs and if you want bonus points you can try a matching a set via the process outlined [here](#) (it may take quite a few FETs to get a matching pair though).

Back to Q2 and Q3. I found that depending on the transistor, I did need to adjust the "gain" of the filter slightly. This can be accomplished by changing R6. The recommended value to start is 220 $\Omega$ . I wouldn't recommend anything lower than that, but I have had good results up to 470 $\Omega$  (which I believe is the stock value in a Crybaby/Vox circuit). Be careful not to go too crazy because it also adjusts the bias point as well. And I would leave R5 alone (for all you transistor tinkerers...). We're talking about slight adjustments here to dial in the sound.

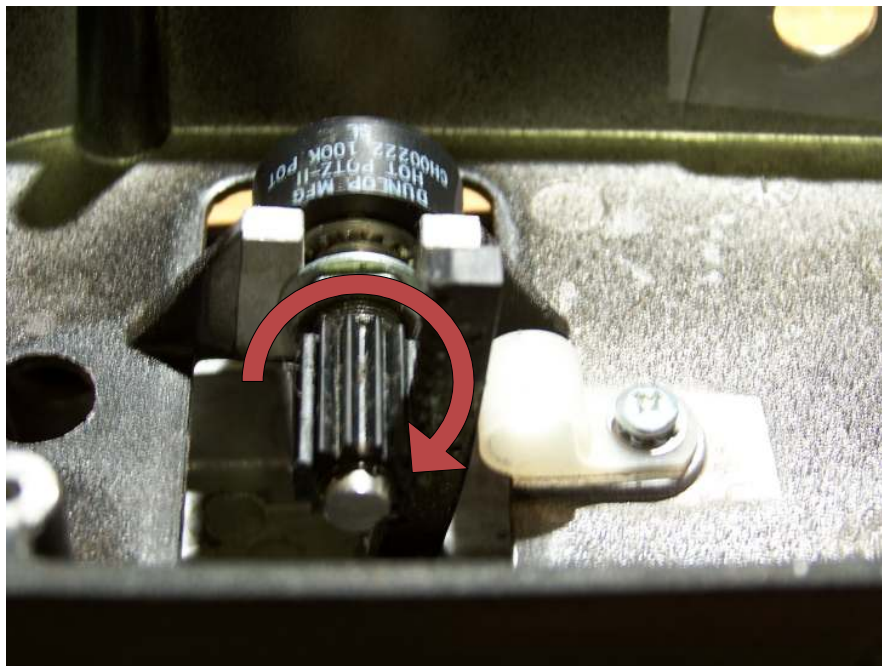
### Sweep, Pot Position, and Misc. Mods

The sound of a wah can be drastically altered by simple modification to the range of sweep of the pedal itself. This can be done by a number of ways all outlined here. The first and easiest, is to adjust the "bumpers". They can be removed entirely (although I don't recommend this route), shortened, or

lengthened to adjust the range from heel to toe. Keep in mind that you may need to adjust the height of your DPDT switch so that it can still be actuated by the toe. On a typical Crybaby/Vox enclosure, there are two small bumpers on the toe end and one large one on the heel end.



If you are satisfied with the mechanical range of the pedal, then you can adjust the range “electrically” by rotating the potentiometer gear by one or two notches. Rotating clockwise will shift the range toward the heel or bass end, and rotating counter-clockwise will shift toward the toe or treble end. In my experience, one or two notches can make a great difference. You will also find that it is possible to adjust too far toward the bass end where the pedal won't “wah”. In reality, you only use between 40%-60% of the total rotation anyway so play with it until you find the sweet spot.



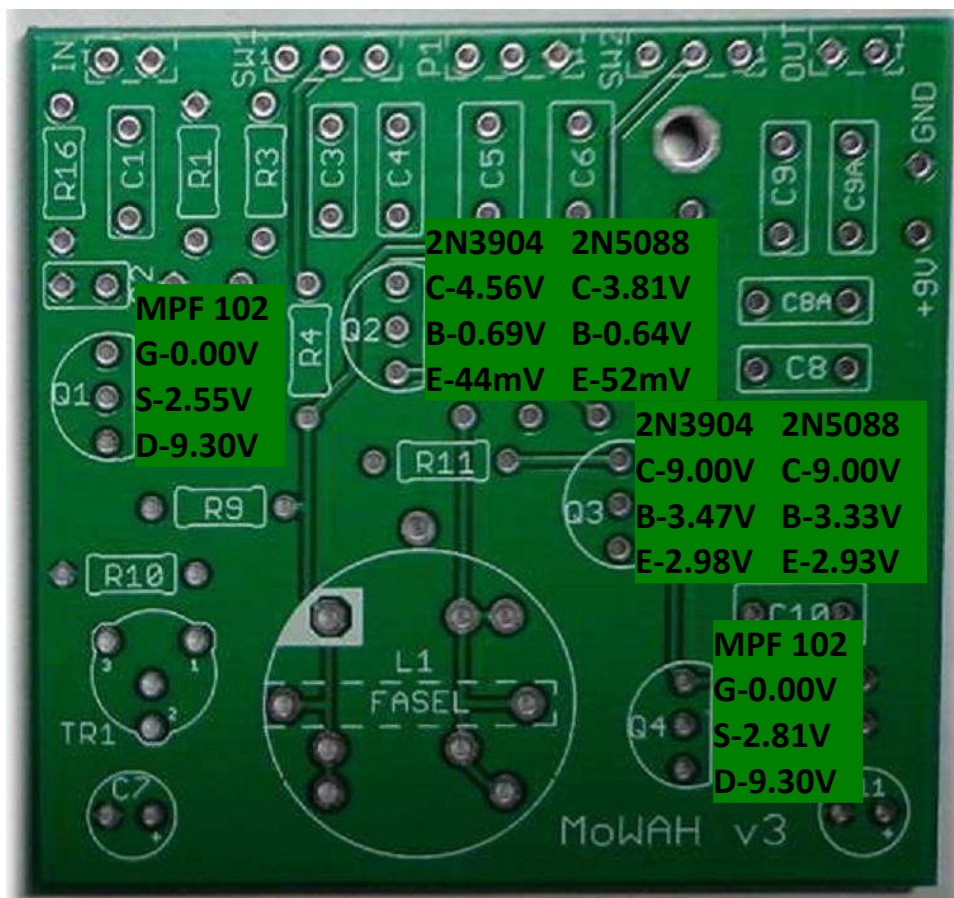
The sweep can also be affected by the pot taper. In simple terms, the taper is a description of how resistance changes as a function of the potentiometer rotation. You will notice some pots have a “quack” at the treble end and others seem “even” across the sweep. The McCon-O-Pot is one

example I have found that sounds great with a sweet quack at the toe end. You can use any taper pot (as long as the value is correct). However, you WILL notice a change in the feel of the wah. Don't skimp on this piece. As the build docs indicate, this is the first component likely to give you trouble.

You can also adjust the feel of the wah by lubricating the gear. There are several readily available silicon based lubricants for this purpose, many are available at hardware stores. This will not affect the sound, but will affect the smoothness of the operation of the footpedal.

### Voltage Readings

I measured my latest wah build transistor voltages for reference. I measured with a set of 2N5088s and 2N3094s to show some of the variation that you might experience. These are not “exact” values that you should shoot for when building. But they should be close. The voltages are labeled top to bottom to match the pinout of the listed transistors. Obviously if you choose a different transistor than what is recommended, make sure you verify the pinout is the same (or adjust orientation accordingly).



### Links

- [GuitarPCB MoWAH Schematic](#)
- [GeoFex Wah Tech Article](#)