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pickups .construction...

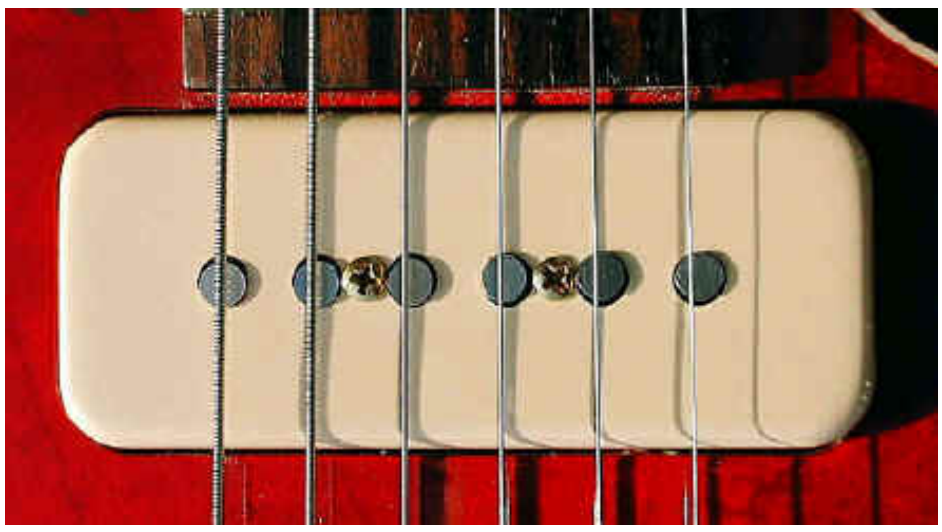
body | neck | circuit | pickups

to find out more about Blues90s (and their ancestors) check out these pages...

do they humbuck? | frequency response | how pickups work

Blues 90 pickups are based on Gibson P90 single coil pickups - continuing the same soap-bar appearance, but with a substantially modified interior. Blues 90s have -

- Alnico 5 magnets for pole pieces - rather than the steel or ceramic magnets (depending on which "authority" you are reading) used in many forms of P90 pickup (Alnico is a magnetic material made typically with Aluminium, Nickel and Cobolt - hence the name. Alnico 5 is a specific grade.)
- windings of 42 gauge, enameled, copper wire (with reportedly fewer windings than P90s)
- non-adjustable pole pieces which are all the same height - ie non-staggered and without individual screws



Blues 90 pickup

- As far as I can tell, the same pickup design is used in both the neck and bridge positions - although I have noticed recently that my neck pickup has R (for Rhythm?) marked on the base-plate and the bridge pickup is marked with a T (for Treble?). Does anyone out there have certain information about this? **Update** - see Pickup orientation below
- The pickups seem to be wax potted - traces of wax can be found on the pickup bobbins. Wax potting helps reduce pickup microphony (responding to audio signals, as opposed to changes in the magnetic field), which in turn reduces squeal (as opposed to more desirable forms of feedback - which occurs via string/body resonance).
- The pickups are mounted direct to the body via two gold-plated screws between pole-pieces 2 & 3 and 4 & 5. These screws allow the height of the pickups to be adjusted - the pickups are supported on springs threaded on to the mounting screws. The mounting screws fit into threaded metal bushes that are set into the body.
- The dummy-coil appears to be a Blues 90 pickup without the magnetic cores - which makes sense from an electronic point of view!
- **Pickup orientation** - the bridge pickup has its north magnetic pole upwards/towards the strings, and the neck pickup has its south magnetic pole upwards/towards the strings. This helps cancel hum when the pickups are selected together.

the dummy coil

check pickup detail by clicking the thumbnail below...

neck pickup with "bits"	neck pickup - underside	"naked" bridge p/u	bridge pickup - underside	the front pickup rout	both pickup routs
					

If you want to read about the history of P90 pickups go here...

Below is the text of a page from the Gibson website which I have edited a bit to get rid of obvious mistakes - read on...

"The main feature of the BluesHawk is that you can obtain a good single-coil, fast attack-type sound with hum-cancelling capability," Riboloff said, "With the hum-cancelling mechanism in place, it also makes the pickups more efficient and makes them more powerful."

The secret of Riboloff "Blues-90" pickup system is a dummy coil, placed away from the strings to cancel hum without interfering with the working pickups. He explained how the hum-cancelling mechanism works.

"The 'dummy' pickup is basically another pickup, but it doesn't have the magnetic core in it," Riboloff said. "It cancels out opposing sides of the A/C signal and provides a path for the other side of the signal to travel through to prevent the hum." - **the blueshawk** thinks this is a pretty inarticulate explanation of what is admittedly a difficult thing to explain. Riboloff notes that the idea of a dummy coil is not new, but his use of the technology is. "Dummy coils have been used in the past, but I've never seen it used in the manner that I used it in," he said. "It's wired into the circuit in a unique fashion to where it knows to get out of its own way when it's not needed."

"The user doesn't have to worry about turning it on or off; it automatically happens when he selects his pickups normal with the normal three-way pickup selector. When you are in the middle position, for example, the two normal pickups cancel each other out and the dummy coil is automatically inoperative. The pickups are 360 degrees out of phase with each other, which makes them actually in phase but opposite polarity. One pickup is picking up the top side of the sine wave and the other pickup is picking up the bottom half." - **the blueshawk** says - *this is the same principle at work in humbucking pickups.*

With magnets rather than screws for pickup poles, the Blues-90 pickup is obviously different from Gibson's traditional P-90 soap bar, but the differences go far deeper, Riboloff explained. "On a Blues-90, the core of the pickup is the actual magnet mode whereas on a P-90 pickup, the core is steel with the magnet placed beneath it, he said. "This, in effect, will give the Blues-90s a narrower, more precise magnetic path to pick the strings up with. The result is a faster attack. On a P-90, the steel tends to warm up the sound more and gives you a fatter sound. I was going for more of a brighter tone with a faster attack than a P-90. Also, to increase the high end of the pickup and get more of a traditional single coil sound, the coil of the Blues-90 pickup has fewer turns of the coil wire."

Riboloff went a step further by implementing a "Varitone" circuit similar to the one Gibson introduced in 1959 on the ES-345. By filtering out specific frequencies in it's five active settings, the Varitone gives the BluesHawk enough sounds to satisfy a session player. The end result is a fresh new sound. "It fills a whole new niche because it's not quite a "Fenderish" type instrument," Riboloff said. "It doesn't sound like a Les Paul either."

do they humbuck?

.pickups.construction...

Blues 90s, like their forebears the P90 pickup, are single coil pickups. However, they are never connected to the output of the guitar as straightforward single-coil pickups...

- When selected individually, the pickups are connected in series and "out-of-phase" with the dummy coil - an effective way of cancelling induced hum. The dummy coil is simply a Blues 90 pickup without its magnet and pole pieces.
- When the pickups are selected together they are connected in series (without the dummy coil) and "out-of-phase", but because the neck pickup has its south magnetic pole facing upwards and bridge pickup has its north magnetic pole facing upward, the signal is reinforced, and induced hum is cancelled.

So do the BluesHawk's pickups hum-buck? - well... yes and no.

The pickups are not humbuckers - but the guitar produces little or no hum in any pickup selector position.

However, what is less clear, is precisely what effect connecting the pickups in series with a dummy coil has - this arrangement certainly "bucks hum", but how far it takes them into the sonic territory of true humbuckers i.e. the treble roll-off, reduced attack and other timbral/envelope changes so apparent in humbuckers, is uncertain. The blueshawk's ears tell him that they have some of the characteristics of both types of pickups - but our perceptions are distorted by what we know, or think we know.

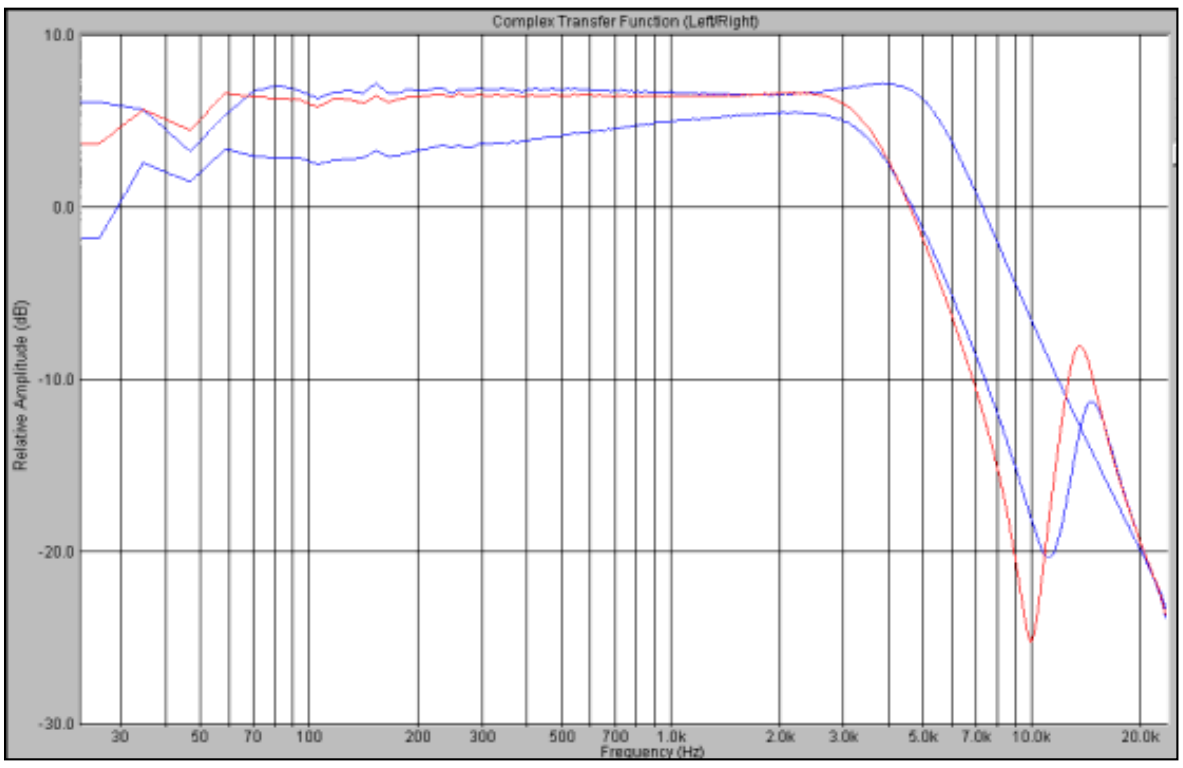
I have recently discovered some frequency response curves which show treble roll-off when Blues90s are combined with the dummy coil.

frequency response

.pickup.construction...

Thanks to Stephan Moeller for producing frequency response curves for the Blues90 pickup in a variety of settings.

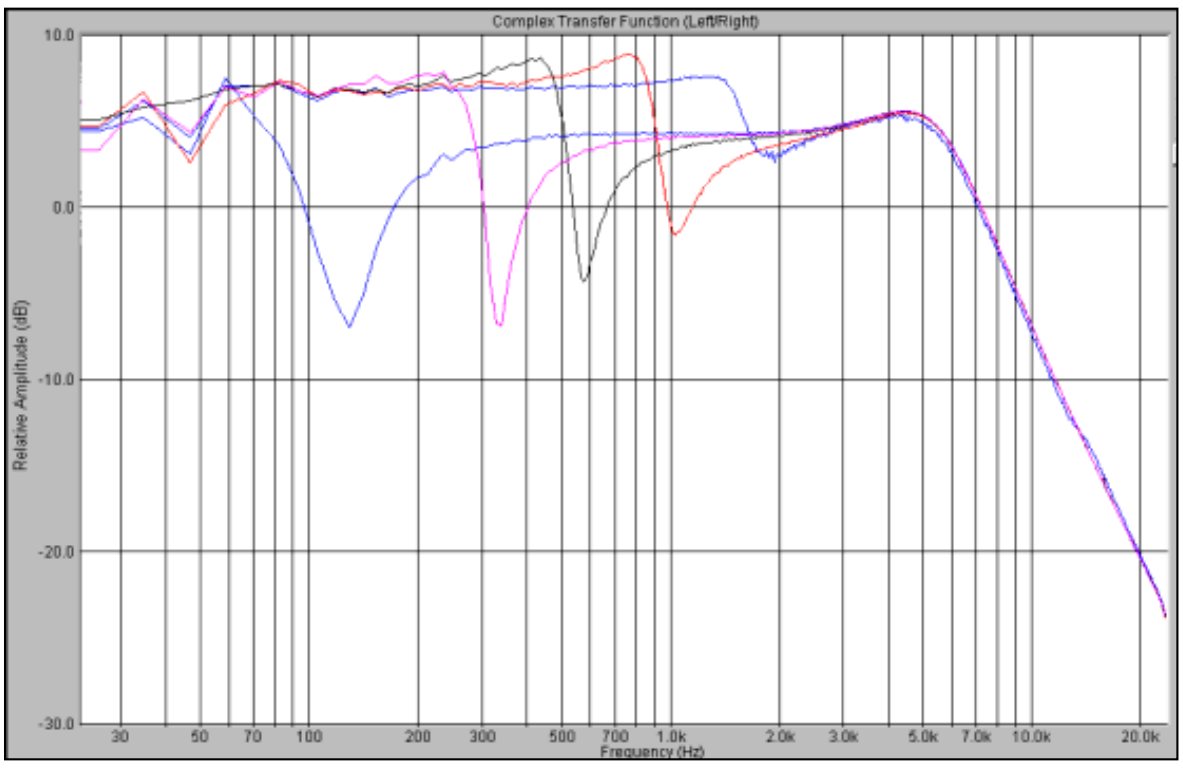
Blues90 pickup alone, in combination with another Blues90, and the dummy coil



Upper Blue curve = bridge pickup alone - this combination does not occur "naturally" in a BluesHawk
Red curve = bridge pickup & dummy coil connected in series
Lower Blue curve =bridge & neck pickups combined in series, with the treble bleed network (Gibson R-C decoupling) between the bridge and neck pickups

The Blues90 pickups used in the neck and bridge positions are identical, so the frequency response is the same for both pickups - it is the variation in position along the length of the strings that changes the tone of the different pickups.

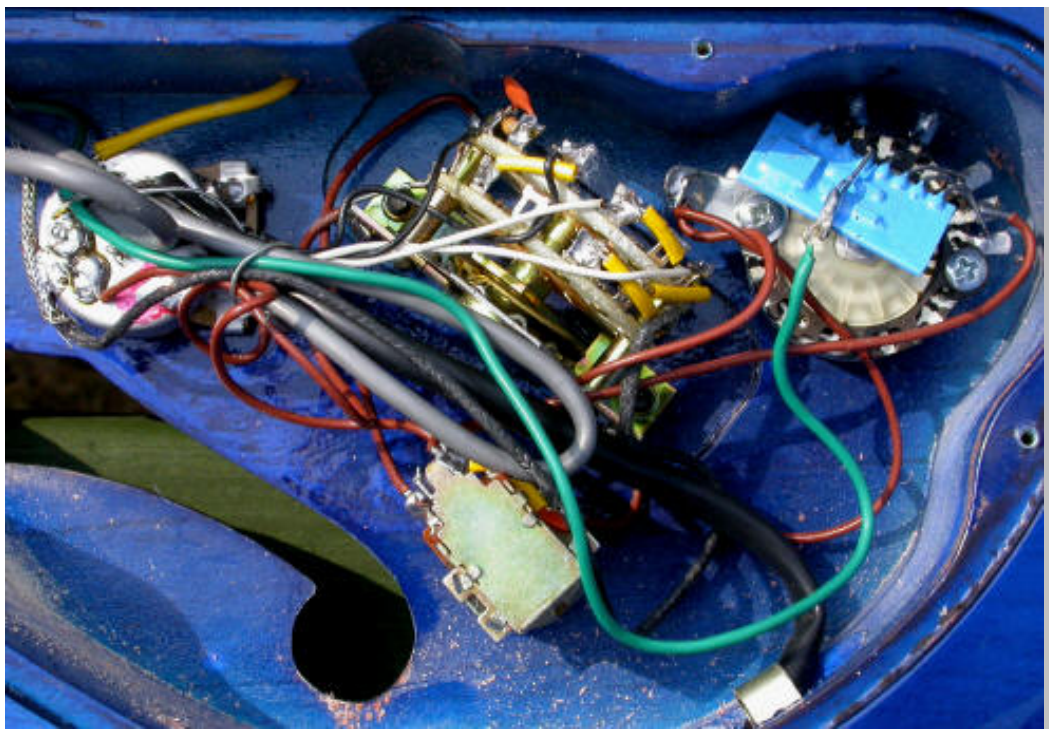
Blues90 pickup at Varitone settings 2-6 - remember setting 1 is the pickup alone, "untreated"



These curves accord very closely with Gibson's published performance figures for the Varitone circuit...

- Position 2 : -5dB at f0=1875 Hz
- Position 3 : -6dB at f0=1090 Hz
- Position 4 : -7dB at f0=650 Hz
- Position 5 : -10dB at f0=350 Hz
- Position 6 : -14dB at f0=130 Hz

circuit .construction...



inside the circuit cavity

How the circuit works

circuit diagram | wiring schematic | varitone **- check these as well**

What happens when you select differing pickup combinations

- **Neck position -** with the pickup selector set towards the neck
  - The neck pickup is selected.
  - The dummy coil is connected in series with the neck pickup.
  - The way the pickup and dummy coil are configured and connected means that hum is cancelled.
- **Middle position -** with the pickup selector set upright
  - The neck pickup is selected **with** the "treble bleed network"* in series with the pickups.
  - The bridge pickup is selected and connected in series with the neck pickup.
  - The way the pickups are configured and connected means that hum is cancelled.
- **Bridge position -** with the pickup selector set away the from the neck
  - The bridge pickup is selected.
  - The dummy coil is connected in series with the bridge pickup.
  - The way the pickup and dummy coil are configured and connected means that hum is cancelled.

the pickup switch

output jack socket, plate mounted on the bottom edge of the guitar

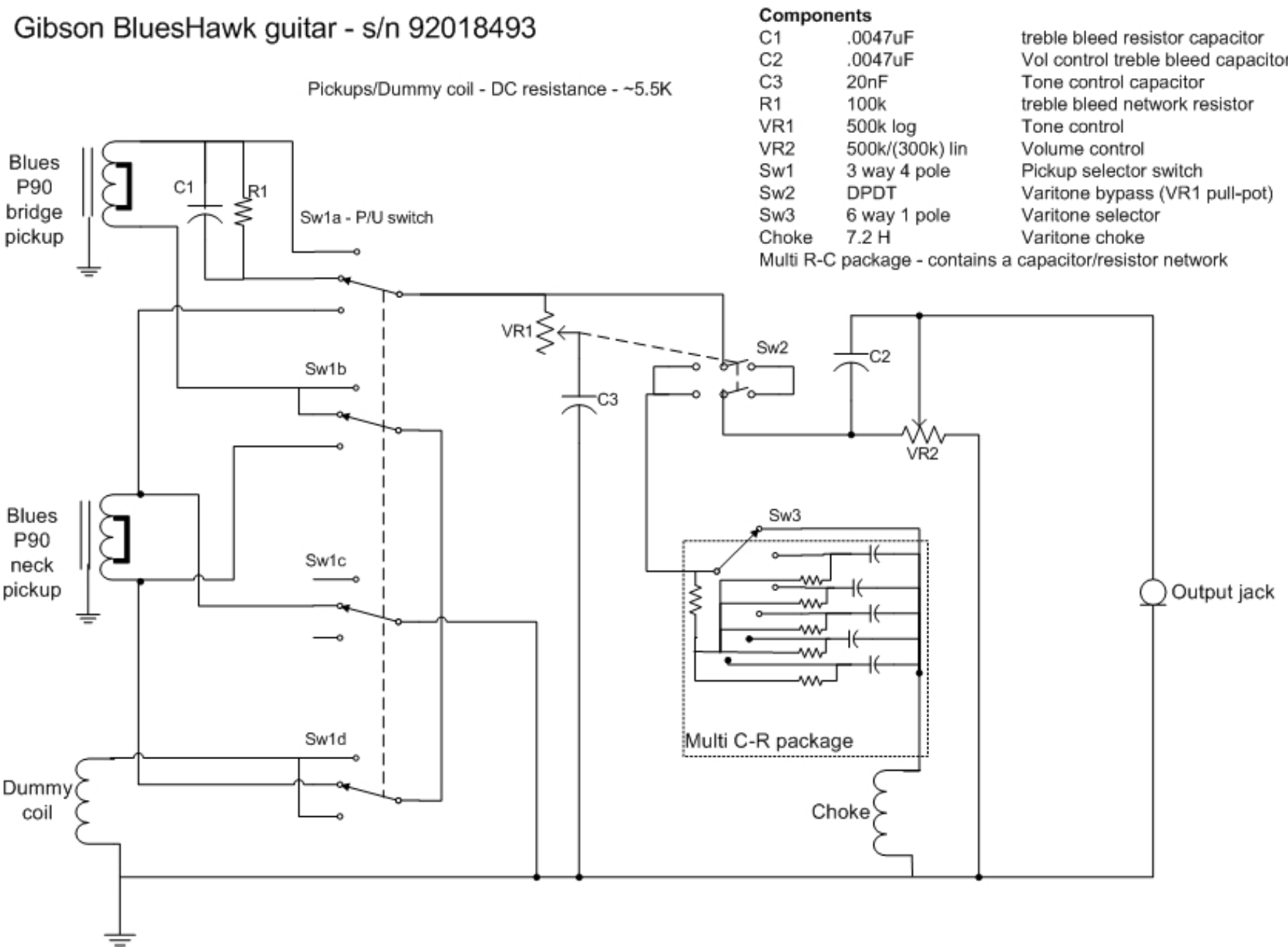
*** The "treble bleed network"** is a capacitor and resistor connected in parallel with each other, and in series with the pickups, when both pickups are selected. This gives the sound (in the words of Guitarist magazine's Dr Robert) "a more Strat-like twang".

circuit diagram

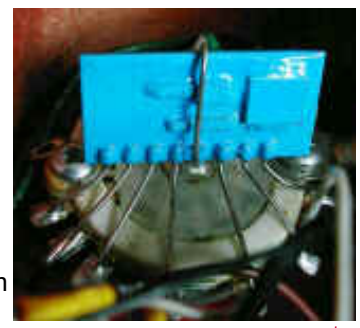
.circuit.construction...

I have worked out the following circuit diagram by examining my BluesHawk - I think it is right - but take care if you use it as a basis for modifying the circuit of your BluesHawk - particularly the Varitone circuit.

I have now obtained the official schematic from Gibson - I have made some minor corrections to my diagram...



The multi-capacitor/resistor package - contains the equivalent of five capacitors and six resistors. Varitone position 2 is routed via a .001uF cap, pos. 3 via a .003uF cap, pos. 4 via a .01uF cap, pos. 5 via a .03uF cap and pos. 6 via a .22uF cap. Series resistors are included to balance the circuit - the first switch position bypasses the varitone.



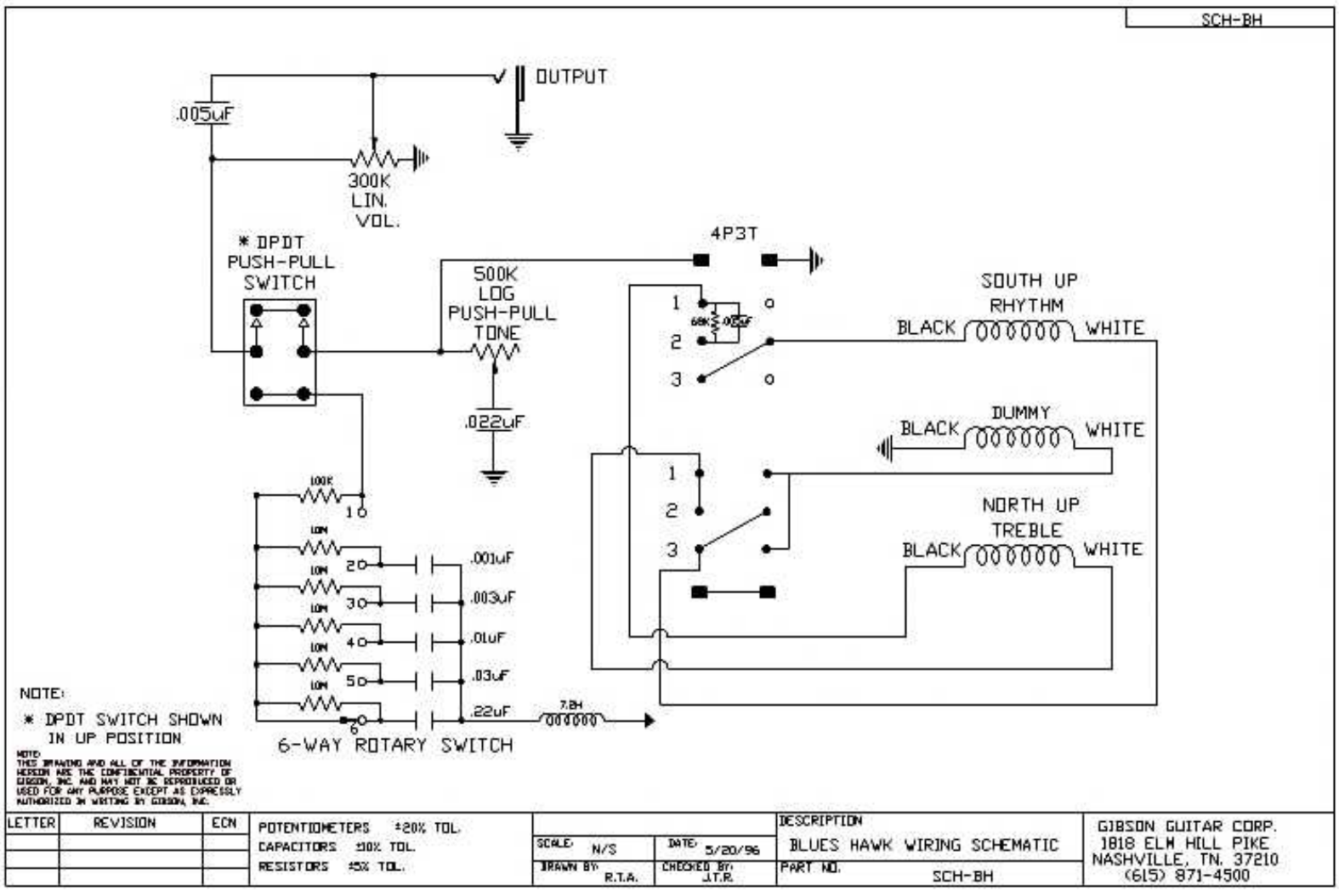
the multi-R-C package soldered to the varitone switch

official Gibson schematic

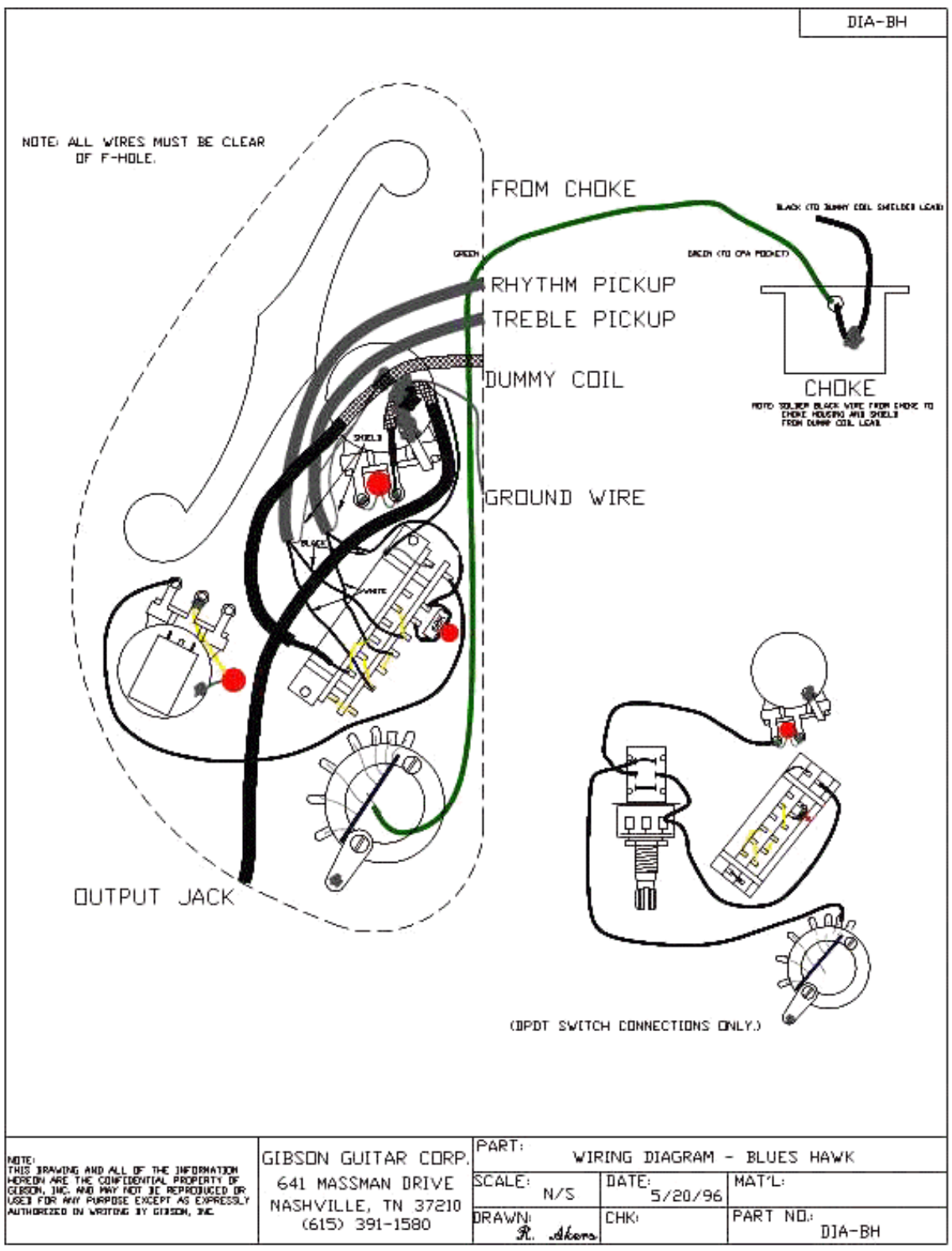
circuit diagram | wiring schematic | varitone

Well I got it almost right - here it is from the horse's mouth -

Get your own copy of the schematic as an Adobe Acrobat .pdf file here...



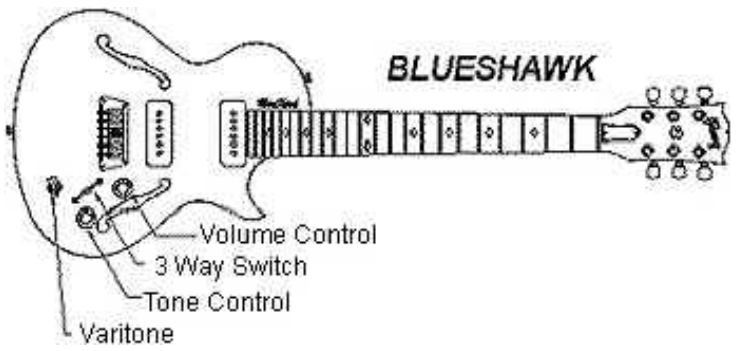
wiring schematic

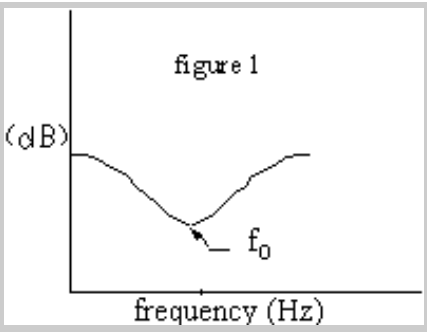


varitone

.circuit.construction...

The Varitone circuit is a "notch" filter that uses a range of capacitors to achieve a reduction in frequencies at set points within the BluesHawk's overall frequency spectrum. As the varitone control is rotated from position 1 to position 6 the centre frequency(f_0) of the filter shifts from higher to lower frequencies. Figure 1 below demonstrates the type of frequency response that is created by the varitone - see also frequency response curve.





The effect of the varitone circuit at different positions

- Position 1 : Bypass (no effect)
- Position 2 : -5dB at f_0=1875 Hz
- Position 3 : -6dB at f_0=1090 Hz
- Position 4 : -7dB at f_0=650 Hz
- Position 5 : -10dB at f_0=350 Hz
- Position 6 : -14dB at f_0=130 Hz

multi-capacitor package at the heart of the Varitone

Which Varitone position is which?

- position number 1 is the most anti-clockwise (looking at the front of the guitar) - number 6 is therefore the most clockwise position. In position 6 treble/highs are strongly emphasised. In position 1 the varitone gives you the basic pickup sound.

How many sounds does the BluesHawk have?

Eighteen - three pickup combinations times six varitone positions. Position 1 of the Varitone is the "vanilla flavoured" pickup sound - the same as with the tone knob out. Some people say 21, but they are assuming Varitone position 1 alters the sound of the pickups - it doesn't. If you are lucky you may get 6 additional sounds with your pickup selector halfway between the "neck" and "both" positions of the pickup selector.

What effect does the Varitone have on the sound of the BluesHawk?

- In position 1 - the most anti-clockwise position - you get the basic pickup sound.
- Positions 2, 3, and 4 give a range of sounds which are thicker/more "middley"/more like a humbucker?.
- Position 5 gives a more Strat-like sound (particularly with the neck pickup)
- Position 6 (the most clockwise) gives a "trebley" Telecaster-like sound.
- **Listen to the effect here...**

Push/Pull Tone Control -

- With the push/pull tone control in the IN position the varitone is operational.
- With the push/pull tone control in the OUT position the varitone is removed from the circuit.

Here's what Gibson said about the BluesHawk's Varitone

Gibson first introduced the Varitone six-way tone control in 1959 on the ES-345.
When JT Riboloff designed the BluesHawk in the 90's he included a Varitone circuit.
"The Varitone opened up the spectrum of the tone paths of that instrument quite a bit," Riboloff said. "The nice thing with the Varitone is the push/pull tone pot which bypasses the circuit. The Varitone selector is a rotary switch, and somebody might want to change his tone in the middle of the song, but he's also thinking about keeping his timing. He doesn't want to count how many times he's clicked his Varitone knob. What this allows him to do is, for example, leave the circuit in bypass and preset his Varitone at the beginning of the song. So if you want to locate position 5 on the Varitone, for example, preset the knob so that all you have to do is push that pot down."

- **If you want to get hold of a custom-made Varitone circuit check out - www.bigdguitars.com - I've recently fitted one of Big D's Varitone circuits to my Tokai Breezy Sound Tele - here are a few pictures**