5.4.8 DeArmond pickups

Harry DeArmond (Ohio) was one of the pickup-pioneers: as early as the 1930's he developed magnetic pickups and sold them via his business partner H. Rowe to many guitar manufacturers. Common were at that time flattop and archtop acoustic guitars which could be "electrified" with a pickup. If they sported a round soundhole, the pickup was mounted in there, if they had f-holes, a pickup as flat as possible had to be installed between top and strings (e.g. fitted to the pickguard or the end of the neck). DeArmond's **FHC** was attached to a rod running parallel to the strings, its position could be correspondingly adjusted between neck and bridge. A difficulty encountered with this retrofit of pickups related to the loudness of the individual strings. The "plectrum guitars" used back then did already use steel strings but he lower 4 strings (EADG) were wound with brass or bronze. Here, only the thin steel core is magnetically active and the voltage induced in a magnetic pickup is much lower than for the two solid top strings (chapter 3). DeArmond solved that problem with a very special magnet design for which he even obtained a patent: the bar magnet under the coil is not continuous but has a gap under the B-string. Above the coil two ferromagnetic metal strips focus the field (A, C, **Fig. 5.4.42)**; a metal bridge (B) attenuates the magnetic field further.

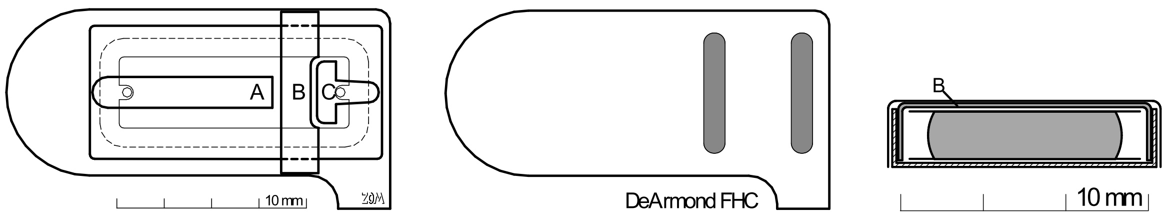


Fig. 5.4.42: DeArmond FHC (US-Patent 2,455,046).

The invention does meet its purpose: the B-string is picked up 8 dB weaker than the bass-strings, the high E-string features a 5 dB drop. The static flux density (measured 2 mm above the lid of the housing) is – at 17 mT – relatively weak; strong single coils easily reach triple this value. There is another difference in that the aperture of these "other" single coils is narrower (chapter 5.4.4). **Fig. 5.4.43** shows the aperture windows compared to the Stratocaster pickup. There is little effect of the extended width of the aperture of the B-string: the wave velocity of the latter is relatively high (chapter 5.4.4). However, for the bass strings there is a loss of brilliance. The dominant treble absorber is the ferromagnetic sheet mounted below the pickup: the eddy currents generated in it (chapter 5.9.2.4) have hat effect of a pronounced treble loss.

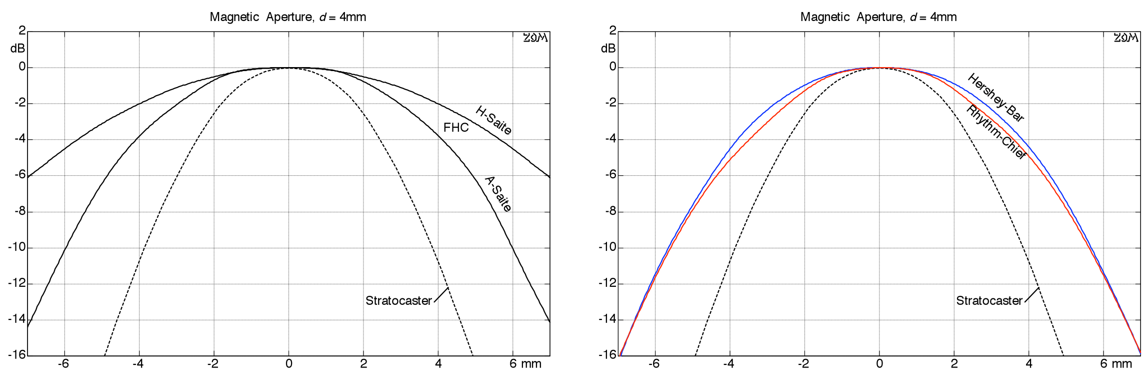


Fig. 5.4.43: Aperture window; DeArmond FHC (left), Rhythm-Chief and Hershey-Bar (right).

The relatively strong eddy-current losses also show up in the frequency response of the impedance (**Fig. 5.4.44**). The inductivity is rather strong but the resonance emphasis only weakly developed. The broken-line curve indicates that the (non-magnetic) cover of the pickup housing reduces the Q-factor, as well. For the impedance the effect is small but fort he transfer function strong. An even more dramatic treble loss results from loading the pickup with a potentiometer – back in the day this device often had only 50 kΩ which killed the treble completely: 8.2 H and 50 kΩ yields a 1-kHz-lowpass having its effect on top of the aperture- and eddy-current-losses (in Fig. 5.4.44 it is not even considered yet). Still: that's the "golden tone" for which these pickups are sought after and change hands for substantial amounts of money.

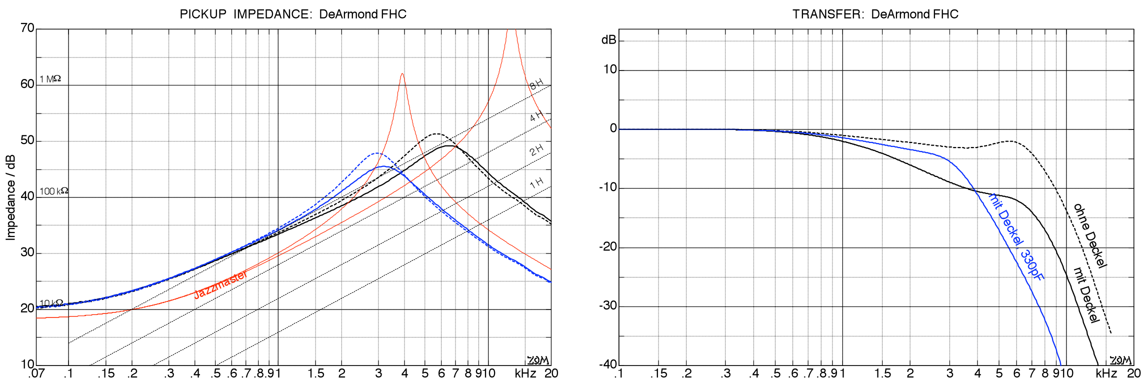


Fig. 5.4.44: Impedance. No load (black), w/load of 330pF (blue); Jazzmaster for comparison (red). The broken lines show the frequency response of the impedance as it is measured without pickup cover. The right part above shows the transfer measured with the laser vibrometer (chapter 5.10.5).

A further development based on the FHC is the **Rhythm-Chief**. Early variants were given a divided winding with a reduced number of turns below the B- and E-string to compensate for loudness as indicated above. The next step, the Rhythm-Chief 1100, features adjustable pole screws. Watch out: these work rather differently than e.g. in a P-90. The particularity starts with the magnet: for DeArmond this often is a plastic magnet (also called rubber magnet). Despite the name the magnetic active substance is a metal powder which is molded to shape using plastic or rubber as binder. In the RC-1100 the magnet consists of the whole (oblong) coil core and the screws are inserted <u>into</u> it. This is indeed **very unusual**, since the screws are directed in <u>parallel</u> to the magnet and short-circuit it partially. Two cases are shown in Fig. 5.4.45: if the screws are deeply inserted (second section of the figure from the right), the magnetic circuit is closed mainly via the screws and the external field is relatively small. Unscrewing the screws to a large extent (as shown in right-most section of the figure) renders them field-focusing and -amplifying. In the end the result matters, and indeed: yes – it works! And even with a little less treble loss than in the FHC. The RC-1100, as well, has the dampening effect of the eddy currents and also the non-negligible aperture dampening (Fig. 5.4.43). The connecting cord is fastened rather amateurishly and easily torn off – which the collectors are not too unhappy about since the collectors value of surviving specimens increases .... to presently approx. $ 1200. Trend: going up.

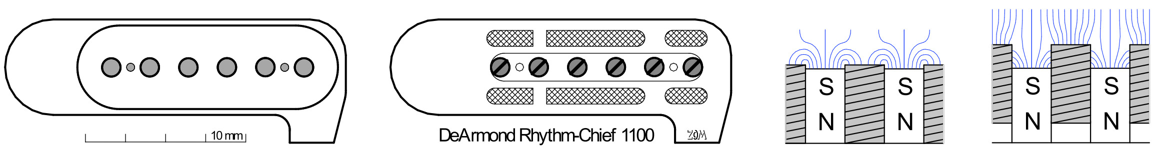


Fig. 5.4.45: DeArmond Rhythm-Chief 1100.

In **Fig. 5.4.46** the impedance frequency responses are shown. The "naked" coil with the plastic magnet inserted in it has a high Q-factor. Installing the 6 screws increases the inductivity (right section of the figure). An even bigger push towards more inductance is generated by the ferromagnetic bottom plate (left part of the figure), but this component also reduces the Q-factor by a considerable amount (eddy currents)

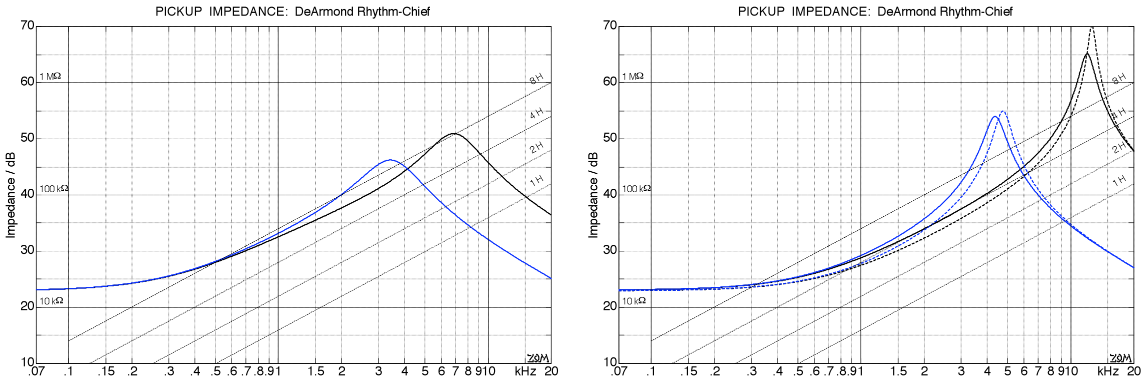
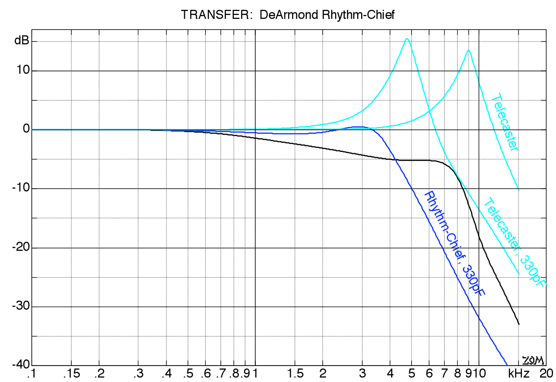
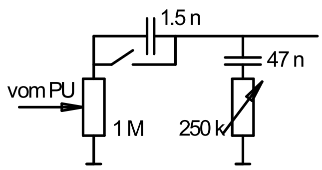


Fig. 5.4.46: impedance DeArmond Rhythm-Chief 1100. Left: original condition, w/out load and w/330 pF load, respectively. Right: coil w/out housing, w screws (———) and w/out screws (-----).

The Rhythm-Chief has directly attached to it a small **control unit** (volume and tone controls plus a lead/rhythm switch). In **Fig. 5.4.47**, the frequency response of the unloaded pickup is shown in black while the condition with a load C_{load} = 330pF is shown in blue. In contrast to the very low-impedance controls they used elsewhere, DeArmond suddenly switches to high values here aiding a better treble response – as long as one does not turn down the volume.





Circuitry of the DeArmond control unit

Fig. 5.4.47: transfer frequency response for the Rhythm-Chief 1100; Telecaster Bridge-pickup fro comparison.

A much simpler representative of the DeArmond pickup line is the so-called **Hershey-Bar** (named of course after the well known chocolate bar). Take a flat, rectangular plastic magnet with a coil wound around it, fix it to a ferromagnetic base plate, slam on a non-magnetic cover – done. Just 7 mm tall, no adjustment possibilities, no treble – perfect. O.k., not perfect for everybody but this pickup, as well, found its fans. The magnetic window is about as broad as the one of the Rhythm Chief (Fig. 5.4.43), and the flux density is (at 19 mT measured 2 mm from the pickup) about as weak as with the FHC, but the coil has either fewer turns or a bigger wire: the DC-resistance is only 3,8 kΩ versus 9.7 kΩ (FHC) and 14 kΩ (Rhythm-Chief), respectively. Interestingly, the Rhythm-Chief is the softest of the three: still about 2 dB more sensitive than the Strat pickup (used as reference, chapter. 5.4.5), but the Hershey-Bar is 4 dB more sensitive and the FHC even 9 dB. This again shows that the DC-resistance has little bearing on the transfer coefficient (see also Fig. 5.5.19).

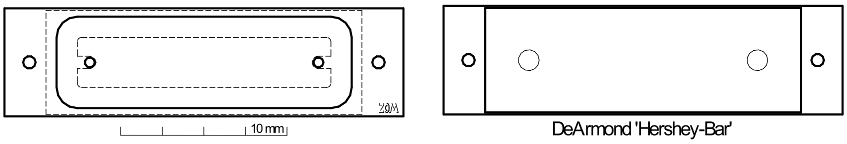


Fig. 5.4.48: DeArmond Hershey-Bar

Hershey-Bar-measurements are shown in **Fig. 5.4.49**. The original-accessory-volume-control has merely 50 kΩ and significantly cuts the treble. Those desiring more treble can switch to a 250-kΩ-pot without any issues.

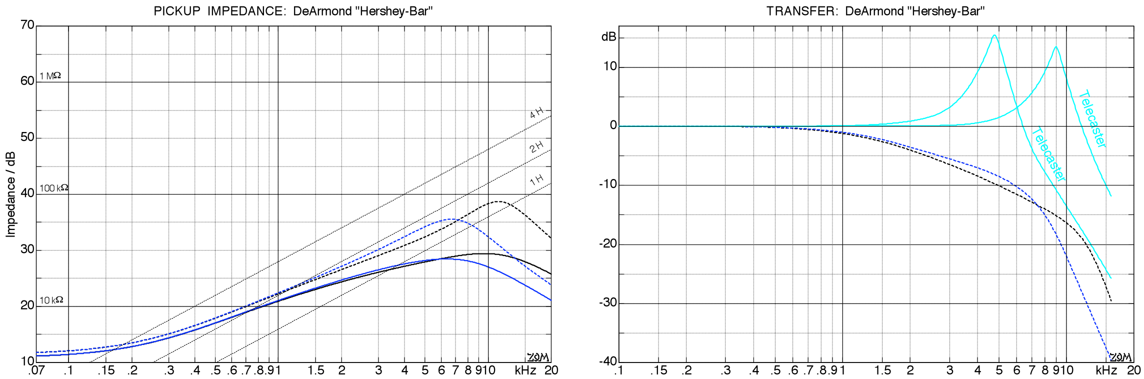


Fig. 5.4.49: DeArmond "Hershey-Bar". Left: impedance frequency response, w/out load and w/330 pF load. Loaded w/original 50-kΩ-potentiometer (———); w/out potentiometer (-----).
Right: transfer-frequency-response; Telecaster-bridge-pickup fro comparison (330 pF, 0 pF).

To **complement** the information about these rather special pickups: 1) designations such as FHC or Guitar-Mike are not unambiguous, they specify merely a group of similar but not identically constructed pickups 2) Such old pickups may have incurred shorts in the winding, or a torn off connecting wire. 3) Because the pickups were often defective, there are many that where repaired somehow but failed to regain the original state after the repair. 4) Some of the pickups are attached to very long cables, and the latter may have significant losses capacities (e.g. 250 pF/m). 5) The aperture attenuations measured via the laser-vibrometer are string dependent! 6) And just to mention it: enthusiasts willing to pay in excess of $ 1000 for a pickup might inspire obvious ideas ....

In closing here a look at the signal-to-hum ratios (chapter 5.7): FHC = 3 dB better than the Strat used as reference, Rhythm-Chief 1100 = 4 dB worse, Hershey-Bar = 2 dB worse.

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Fig. 5.4.50: DeArmond pickups: Rhythm-Chief and FHC.