Comment on the James-Baxandall tone control circuit

by «teemuk" on www.thegearpage.net

As mentioned earlier, Baxandall merely introduced a very well known passive tone control circuit in a far more superior active form and hence popularised the design in times to come. People commonly refer to the circuit using his name but if you want to be precise about it, Baxandall circuit is specifically the active circuit version. The passive circuit itself was made popular by a magazine article written by E. J. James. James' article was published in 1949 while Baxandall's article dates to 1952. However, the passive circuit was likely invented by a gentleman named Michael Volkoff even a decade earlier (circa 1938). James' influence was merely introducing the design to larger audience. On that note, Baxandall wasn't first one to invent the active tone control idea either. Infact, he was (like without knowing so) infringing Richard Burwen's pending patent that presented an almost identical circuit. Ironically, Burwen even wrote an article that described his invention in 1950 but the electronics magazine he sent it to never published it.

So in a nutshell... James=passive circuit, Baxandall=active circuit, and none of them being the original inventor of the aforementioned either.

That concludes our daily history lesson.

James, E. J. "Simple Tone Control Circuit: Bass and Treble, Cut and Lift," Wireless World, February 1948, p. 48-50
http://www.thermionic.info/james/James_SimpleToneControl.pdf
Baxandall, P. J. "Negative Feedback Tone Control," Wireless World, October 1952, pp. 402-405
http://www.thermionic.info/baxandall/Baxandall_NegativeFeedbackTone.pdf

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Comments and tests by hb9aik:

The above links contain the original articles published in Wireless World. The erratum included in the Baxandall article also covers the use of a treble pot without center tap, i.e. the two equal resistors to ground on both sides of the pot. The widely used «classical» circuit with an ECC83 is thus *almost* a true Baxandall tone control.

Why *almost*? In his circuit analysis of Fig. 7 Baxandall notes «… *since the source of input voltage is assumed to be of low impedance* ...». This is however not quite the case if – as is generally done - the first section of the ECC83 is configured as an amplifying stage with the signal taken from the plate. This will introduce a tilt in the flat part of the curves (measurements indicate about +2dB @ 200Hz to -1dB @ 1kHz). In a radio no serious problem but not perfect.

The solution to this – and this is not my invention – is to configure the input triode as a *cathode follower* to provide the low impedance source. Now the tilt disappears completely and the flat portion in the center of the frequency range is indeed flat as it is described by Baxandall to be. Such «Baxandall» PCBs are currently available from China, just make sure you'll get the version with the *cathode follower* as first stage (the other configuration is sold as well)!

Using a high slope pentode (such as the 6AH6) in the feedback stage does not noticeably change the frequency response of the network compared to the ECC83 configuration. The better distortion values discussed by Baxandall were not measured however, there still might be an advantage to be found there.
